# FRM 历年真题

## PRAT ONE Foundations of Risk Mangement

1. Question 5-13(2008)

   Portfolio Q has a beta of 0.7, an expected return of 12.8%, and an equity risk premium of 5.25%. The risk-free rate is 4.85%. Calculate Jensen's alpha measure for portfolio Q.

   A. 7.67%

   B. 2.70%

   C. 5.73%

   D. 4.27%

### Example 29.6: FRM Exam 2008—Question 5-13

d. The alpha is $(12.8\% - 4.85\%) - 0.7(5.25\%) = 4.27\%$.

2. Question 1-11(2009)

   Based on the risk assessment of the CRO, Bank United's CEO decided to make a large investment in a levered portfolio of CDOs. The CRO had estimated that the portfolio had a 1% chance of losing $1 billion or more over one year, a loss that would make the bank insolvent. At the end of the first year the portfolio has lost $2 billion and the bank was closed by regulators.Which of the following statements is correct?

   A. The outcome demonstrates a risk management failure because the bank did not eliminate the possiblity of financial distress.

   B. The outcome demonstrates a risk management failure because the fact that an extremly unlikely outcome occurred.

   C. The outcome demonstrates a risk management failure because the CRO failed to go to regulators to stop the shutdown.

   D. Based on the information provided, one cannot determine whether it was a risk management failure.

### Example 1.2: FRM Exam 2009—Question 1-11

d. It is the role of the CEO to decide on such investments, not the CRO. The CRO had correctly estimated that there was some chance of losing $1 billion or more. In addition, there is no information on the distribution beyond VAR. So, this could have been bad luck. A risk management failure could have occurred if the CRO had stated that this probability was zero.

3. Question 1-4(2009)

An analyst at CAPM Research Inc. is projecting a return of 21% on Portfolio A. The market risk premium is 11%, the volatility of the market portfolio is 14%, and the risk-free rate is 4.5%. Portfolio A has a beta of 1.5. According to the capital asset pricing model, which of the following statements is true?

A. The expected return of Portfolio A is greater than the expected return of the market portfolio.

B. The expected return of Portfolio A is less than the expected return of the market portfolio.

C. The return of Portfolio A has lower volatility than the market portfolio.

D. The expected return of Portfolio A is equal to the expected return of the market portfolio.

### Example 1.3: FRM Exam 2009—Question 1-4

a. According to the CAPM, the required return on Portfolio A is $R_F + \beta[E(R_M) - R_F] = 4.5 + 1.5[11] = 21\%$ indeed. Because the beta is greater than 1, it must be greater than the expected return on the market, which is 15.5%. Note that the question has a lot of extraneous information.

4. Question 1-6(2009)

Suppose Portfolio A has an expected return of 8%, volatility of 20%, and beta of 0.5. Suppose the market has an expected return of 10% and volatility of 25%. Finally, suppose the risk-free rate is 5%. What is Jensen's alpha for Portfolio A?

A. A.10.0%

B. B.1.0%

C. C.0.5%

D. D.15%

### Example 1.4: FRM Exam 2009—Question 1-6

c. This is the reverse problem. The CAPM return is $R_F + \beta[E(R_M) - R_F] = 5 + 0.5[10 - 5] = 7.5\%$. Hence the alpha is $8 - 7.5 = 0.5\%$.

5. Question 1-8(2009)

In perfect markets, risk management expenditures aimed at reducing a firm's diversifiable risk serve to

A. Market the firm more attractive to shareholders as long as costs of risk management are reasonable

B. Increase the firm's value by lowing its cost of equity

C. Decrease the firm's vaule whenever the costs of such risk management are

positive

D.        Has no impact on firm value

## Example 1.7: FRM Exam 2009—Question 1-8

c. In perfect markets, risk management actions that lower the firm's diversifiable risk should not affect its cost of capital, and hence will not increase value. Further, if these activities are costly, the firm value should decrease.

6.    Question 1-2(2009)

By reducing the risk of financial distress and bankreptcy, a firm's use of dervatives contracts to hedge its cash flow uncertainty will

A.        Lower its value due to the transaction costs of derivatives trading

B.        Enhance its value since investors cannot hedge such risks by themselves

C.        Have no impact on its value as investors can costlessly diversify this risk

D.    Have no impact as only systematic risks can be hedged with derivatives

## Example 1.8: FRM Exam 2009—Question 1-2

b. The cost of financial distress is a market imperfection, or deadweight cost. By hedging, firms will lower this cost, which should increase the economic value of the firm.

7.    Question- 132(2007)

Which of the following statements about the Sharpe ratio is *false*?

A.    The Sharpe ratio considers both the systematic and unsystematic risks of a portfolio.

B.    The Sharpe ratio is equal to the excess return of a portfolio over the risk-free rate divided by the total risk of the portfolio.

C.    The Sharpe ratio cannot be used to evaluate relative performance of undiversified portfolios.

D.    The Sharpe ratio is derived from the Capital Market Line.

**Example 16.5: FRM Exam 2007—Question 132**

c. The SR considers total risk, which includes systematic and unsystematic risks, so a. and b. are correct statements, and incorrect answers. Similarly, the SR is derived from the CML, which states that the market is mean-variance efficient and hence has the highest Sharpe ratio of any feasible portfolio. Finally, the SR can be used to evaluate undiversified portfolios, precisely because it includes idiosyncratic risk.

# Part Two  Quantitative Analysis

8. Question 2-3(2009)

An analyst gathered the following information about the return distributions for two portfolios during the same time period:

| Portfolio | Skewness | Kurtosis |
|-----------|----------|----------|
| A | -1.6 | 1.9 |
| B | 0.8 | 3.2 |

The analyst states that the distribution for Portfolio A is more peaked than a normal distribution and that the distribution for Portfolio B has a long tail on the left side of the distribution. Which of the following is correct?

A.  The analyst's assessment is correct

B.  The analyst's assessment is correct for Portfolio A and incorrect for Portfolio B

C.  The analyst's assessment is not correct for Portfolio A but is correct for Portfilio B

D.  The analyst's assessment is incorrect for both portfolios

## Example 2.1: FRM Exam 2009—Question 2-3

b. Portfolio A has a longer left tail, due to negative skewness. In addition, it has less kurtosis (1.9) than for a normal distribution, which implies that it is more peaked.

9. Question 2-18（2009）

Assume that a random variable follows a normal distribution with a mean of 80 and a standard deviation of 24. What percentage of this distribution is *not* between 32 and 116?

A.  4.56%

B.  8.96%

C.  13.36%

D.  18.15%

## Example 2.7: FRM Exam 2009—Question 2-18

b. First convert the cutoff points of 32 and 116 into standard normal deviates. The first is $z_1 = (32 - 80)/24 = -48/24 = -2$, and the second is $z_2 = (116 - 80)/24 = 36/24 = 1.5$. From normal tables, $P(Z > +1.5) = N(-1.5) = 0.0668$ and $P(Z < -2.0) = N(-2.0) = 0.0228$. Summing gives 8.96%.

10. Question 9(2009)

When testing a hypothesis, which of the following statements is *correct* when the level of

significance of the test is decreased?

A.    The likelihood of rejecting the null hypothesis when it is true decreases.

B.    The likelihood of making a type 1 error increases

C.    The null hypothesis is rejected more frequently, even when it is actually false

D.    The likelihood of making a type 2 error decreases

## Example 3.2: FRM Exam 2009—Question 9

a. The significance level is also the probability of making a type 1 error, or to reject the null hypothesis when true, which decreases. This is the opposite of answers b. and c., which are false. This leads to an increase in the likelihood of making a type 2 error, which is to accept a false hypothesis, so answer d. is false.

11.  Question 6(2009)

A population has a known mean of 1,000. Suppose 1,600 samples are randomly drawn (with replacement) from this population .The mean of the observed samples is 998.7, and the standard deviation of the observed sample is 100. What is the standard error of the sample mean?

A.    0.025

B.    0.25

C.    2.5

D.    25

## Example 3.3: FRM Exam 2009—Question 6

c. This is $\sigma/\sqrt{T}$, or $1,000/sqrt1,600 = 1,000/40 = 2.5$. Other numbers are irrelevant.

12.  Question 8(2009)

A portfolio manager is interested in the systematic risk of a stock portfolio, so he estimates the linear regression: $R_{Pt} - R_F = \alpha_P + \beta_P[R_{Mt} - R_F] + \varepsilon_{Pt}$ where $R_{Pt}$ is the return of the portfolio at time $t$, $R_{Mt}$ is the return of the market portfolio at time $t$, and $R_F$ is the risk-free rate, which is constract over time. Suppose that $\alpha$ =0.008, $\beta$ =0.977, $\sigma(R_P) = 0.167$, and $\sigma(R_M) = 0.156$.

What is the approximate coefficient of determination in this regression?

A.    0.913

B.    0.834

C.    0.977

D.    0.955

b. Using Equation (3.27), the $R$-squared is given by $\beta^2 \sigma_M^2 / \sigma_P^2 = 0.977^2 \times 0.156^2 / 0.167^2 = 0.83$.

13. Question 7(2009)

    You built linear regression model to analyze annual salaries for a developed country. You incorporated two independent variables, age and experience, into your model. Upon reading the regression results, you notice that the coefficient of experience is negative, which appears to be counterintuitive. In addition, you discover that the coefficients have low

    $t$-statistics but the regression model has a high $R^2$. What is the most likely cause of these

    results?
    A. Incorrect standard errors
    B. Heteroskedasticity
    C. Serial correlation
    D. Multicollinearity

**Example 3.8: FRM Exam 2009—Question 7**

d. Age and experience are likely to be highly correlated. Generally, multicollinearity manifests itself when standard errors for coefficients are high, even when the $R^2$ is high.

14. Question 14(2009)

    Suppose you simulate the price path of stock HHF using a geometric Brownian motion model with drift $\mu = 0$, volatility $\sigma = 0.14$, and time step $\Delta t = 0.01$. Let $S_t$ be the

    price of the stock at time $t$. If $S_0 = 100$, and the first two simulated (randomly selected)

    standard normal variables are $\varepsilon_1 = 0.263$ and $\varepsilon_2 = -0.475$, what is the simulated stock price

    after the second step?
    A. 96.79
    B. 99.79
    C. 99.97
    D. 99.70

**Example 4.1: FRM Exam 2009—Question 14**

d. The process for the stock prices has mean of zero and volatility of $\sigma \sqrt{\Delta t} = 0.14\sqrt{0.01} = 0.014$. Hence the first step is $S_1 = S_0(1 + 0.014 \times 0.263) = 100.37$. The second step is $S_2 = S_1(1 + 0.014 \times -0.475) = 99.70$.

15. Question 2-13(2009)

Suppose $\sigma_t^2$ is the estimated variance at time $t$ and $u_t$ is the realized return at $t$. Which of the following GARCH(1,1) models will take the longest time to revert to its mean?

A. $\sigma_t^2 = 0.04 + 0.02u_{t-1}^2 + 0.92\sigma_{t-1}^2$

B. $\sigma_t^2 = 0.02 + 0.04u_{t-1}^2 + 0.94\sigma_{t-1}^2$

C. $\sigma_t^2 = 0.03 + 0.02u_{t-1}^2 + 0.95\sigma_{t-1}^2$

D. $\sigma_t^2 = 0.03 + 0.03u_{t-1}^2 + 0.93\sigma_{t-1}^2$

## Example 5.6: FRM Exam 2009—Question 2-13

b. The persistence $(\alpha_1 + \beta)$ is, respectively, 0.94, 0.98, 0.97, and 0.96. Hence the model with the highest persistence will take the longest time to revert to the mean.

16. Question 2-17(2009)

Which of the following statements is *incorrect* regarding the volatility term structure predicted by a GARCH(1,1) model: $\sigma_t^2 = \omega + \alpha u_{t-1}^2 + \beta\sigma_{t-1}^2$, where $\alpha + \beta < 1$?

A. When the current volatility estimate is below the long-run average volatility, this GARCH model estimates an upward-sloping volatility term structure.

B. B.When the current volatility estimate is above the long-run average volatility, this GARCH model estimates a downward-sloping volatility term structure.

C. C.Assuming the long-run estimated variance remains unchanged as the GARCH parameters $\alpha$ and $\beta$ increase, the volatility term structure predicted by this GARCH model reverts to the long-run estimated variance more slowly.

D.  D.Assuming the long-run estimated variance remains unchanged as the GARCH parameters $\alpha$ and $\beta$ increase, the volatility term structure predicted by this GARCH model reverts to the long-run estimated variance faster.

## Example 5.9: FRM Exam 2009—Question 2-17

d. The GARCH model has mean reversion in the conditional volatility, so statements a. and b. are correct. When $\sigma_t$ is lower than the long-run average, the volatility structure goes up. Higher persistence $\alpha + \beta$ means that mean reversion is slower, so statement c. is correct.

17.  Question 2-16(2009)

Assume that an asset's daily return is normally distributed with zero mean. Suppose you have historical return data, $u_1, u_2, ..., u_m$ and that you want to use the maximum likelihood method to estimate the parameters of a EWMA volatility model. To do this, you define $v_i = \sigma_i^2$ as the variance estimated by the EWMA model on day $i$, so that the likelihood that these $m$ observations occurred is given by:

$$\prod_{i=1}^{m} [\frac{1}{\sqrt{2\pi v_i}} \exp[-u_i^2/(2v_i)]$$

. To maximize the likelihood that these $m$ observations occurred, you must:

A.  Find the value of $\lambda$ that minimizes: $\sum_{i=1}^{m}[-\ln(v_i) - u_i^2/(2v_i)]$

B.  Find the value of $\lambda$ that maximizes: $\sum_{i=1}^{m}[-\ln(v_i) - u_i^2/(2v_i)]$

C.  Find the value of $\lambda$ that minimizes: $-m\ln(v_i) - \sum_{i=1}^{m}[u_i^2/(2v_i)]$

D.  Find the value of $\lambda$ that maximizes: $-m\ln(v_i) - \sum_{i=1}^{m}[u_i^2/(2v_i)]$

**Example 5.14: FRM Exam 2009—Question 2-16**

b. The optimal parameter must maximize (not minimize) the likelihood function. Otherwise, the log-likelihood function is the log of the product, which is the sum of the logs. This gives, up to a constant, $\sum_{i=1}^{m}[-\ln(v_i) - u_i^2/(2v_i)]$, and there is no way to take the first term outside the summation because it depends on $i$. So, answers c. and d. are incorrect.

18. EXAMPLE 2.1: FRM EXAM 2000—QUESTION 81

    Which one of the following statements about the correlation coefficient is *false*?

    A. It always ranges from −1 to +1.
    B. A correlation coefficient of zero means that two random variables are independent.
    C. It is a measure of linear relationship between two random variables.
    D. It can be calculated by scaling the covariance between two random variables.

    Example 2.1: FRM Exam 2000—Question 81
    b. Correlation is a measure of linear association. Independence implies zero correlation, but the reverse is not always true.

19. EXAMPLE 2.2: FRM EXAM 2007—QUESTION 93

    The joint probability distribution of random variables $X$ and $Y$ is given by
    $f(x, y) = k \times x \times y$ for $x = 1, 2, 3$, $y = 1, 2, 3$, and $k$ is a positive constant.
    What is the probability that $X + Y$ will exceed 5?
    A. 1/9
    B. 1/4
    C. 1/36
    D. Cannot be determined

    Example 2.2: FRM Exam 2007—Question 93
    b. The function $x \times y$ is described in the following table. The sum of the entries is

20. The scaling factor $k$ must be such that the total probability is one. Therefore, we have $k = 1/36$. The table shows one instance where $x + y > 5$, which is $x = 3$, $y = 3$. The probability is $p = 9/36 = 1/4$.

| $x \times y$ | $x = 1\ 2\ 3$ |
|---|---|
| Y=1 | 123 |
| =2 | 246 |
| =3 | 369 |

EXAMPLE 2.3: FRM EXAM 2007—QUESTION 127

Suppose that A and B are random variables, each follows a standard normal distribution, and the covariance between A and B is 0.35. What is the variance of (3A+ 2B)?

A.  14.47

B.  17.20

C.  9.20

D.  15.10

Example 2.3: FRM Exam 2007—Question 127

b. The variance is V(3A+ 2B) = $3^2$V(A) + $2^2$V(B) + 2 ×3 2 Cov(A, B) = 9 1 +

4 1 + 12 × 0.35 = 17.2.

21. EXAMPLE 2.4: FRM EXAM 2002—QUESTION 70

Given that x and y are random variables, and a, b, c and d are constant, which one of the following definitions is *wrong*.

A.  E(ax + by + c) = aE(x) + bE(y) + c, if x and y are correlated.

B.  V(ax + by + c) = V(ax + by) + c, if x and y are correlated.

C.  Cov(ax + by, cx + dy) = acV(x) + bdV(y) + (ad + bc)Cov(x, y), if x and y are correlated.

D.  V(x − y) = V(x + y) = V(x) + V(y), if x and y are uncorrelated.

Example 2.4: FRM Exam 2002—Question 70

b. Statement a. is correct, as it is a linear operation. Statement c. is correct, as in Equation (2.32). Statement d. is correct, as the covariance term is zero if the variables are uncorrelated. Statement b. is false, as adding a constant c to a variable cannot change the variance. The constant drops out because it is also in the expectation

22. EXAMPLE 2.5: FRM EXAM 2002—QUESTION 119

The random variable X with density function f (x) = 1/(b− a) for a <x <b, and 0 otherwise, is said to have a uniform distribution over (a, b). Calculate its mean.

A.(a + b)/2

B. a − b/2

C. a + b/4

D. $a - b/4$

Example 2.5: FRM Exam 2002—Question 119

a. The mean is the center of the distribution, which is the average of $a$ and $b$.

23. EXAMPLE 2.6: FRM EXAM 2005—QUESTION 62

Let $Z$ be a standard normal random variable. An event $X$ is defined to happen if either $Z$ takes a value between −0.5 and +0.5 or $Z$ takes any value greater than 1.5. What is the probability of event $X$ happening if $N(0.5) = 0.6915$ and $N(-1.5) = 0.0668$, where $N(.)$ is the cumulative distribution function of a standard normal variable?

A.   0.2583

B.   0.3753

C.   0.4498

D.   0.7583

Example 2.6: FRM Exam 2005—Question 62

c. The event is the sum of the probabilities $P(-0.5 < Z < +0.5)$ and $P(Z > +1.5)$. Given the symmetry of the normal distribution, or that $N(d) = 1 - N(-d)$, this gives $P(-0.5 < Z < +0.5) = 2P(0 < Z < +0.5) = 2(P(Z < +0.5) - 0.5) = 2(N(0.5) - 0.5) = 2(0.6915 - 0.5) = 0.3830$ and $P(Z > +1.5) = N(-1.5) = 0.0668$. The sum is 0.4498.

24. EXAMPLE 2.7: FRM EXAM 2003—QUESTION 21

Which of the following statements about the normal distribution is *not* accurate?

A.   Kurtosis equals 3.

B.   Skewness equals 1.

C.   The entire distribution can be characterized by two moments, mean and variance.

D.   The normal density function has the following expression: $f(x)$

$$= \frac{1}{\sigma} \exp\left[ - \frac{1}{2\sigma^2}(x -) \right]$$

Example 2.7: FRM Exam 2003—Question 21

b. Skewness is 0, kurtosis 3, the entire distribution is described by $\mu$ and $\sigma$, and the p.d.f. is correct.

25. EXAMPLE 2.8: FRM EXAM 2006—QUESTION 11

Which type of distribution produces the lowest probability for a variable to exceed a specified extreme value which is greater than the mean, assuming the distributions all have the same mean and variance?

A. A leptokurtic distribution with a kurtosis of 4
B. A leptokurtic distribution with a kurtosis of 8
C. A normal distribution
D. A platykurtic distribution

Example 2.8: FRM Exam 2006—Question 11
d. A platykurtic distribution has kurtosis less than 3, less than the normal p.d.f. because all other answers have higher kurtosis, this produces the lowest extreme values.

26. EXAMPLE 2.9: FRM EXAM 1999—QUESTION 5
Which of the following statements best characterizes the relationship between the normal and lognormal distributions?
A. The lognormal distribution is the logarithm of the normal distribution.
B. If the natural log of the random variable $X$ is lognormally distributed, then $X$ is normally distributed.
C. If $X$ is lognormally distributed, then the natural log of $X$ is normally distributed.
D. The two distributions have nothing to do with one another.

Example 2.9: FRM Exam 1999—Question 5
c. $X$ is said to be lognormally distributed if its logarithm $Y = \ln(X)$ is normally distributed.

27. EXAMPLE 2.10: FRM EXAM 2007—QUESTION 21
The skew of a lognormal distribution is always
A. Positive
B. Negative
C. 0
D. 3

Example 2.10: FRM Exam 2007—Question 21
a. A lognormal distribution is skewed to the right. Intuitively, if this represents the distribution of prices, prices can fall at most by 100% but can increase by more than that.

28. EXAMPLE 2.11: FRM EXAM 2002—QUESTION 125
Consider a stock with an initial price of $100. Its price one year from now is given by $S = 100 \times \exp(r)$, where the rate of return $r$ is normally distributed with a mean of 0.1 and a standard deviation of 0.2. With 95% confidence, after rounding, $S$ will be between

A. $67.57 and $147.99

B. $70.80 and $149.20

C. $74.68 and $163.56

D. $102.18 and $119.53

Example 2.11: FRM Exam 2002—Question 125

c. Note that this is a two-tailed confidence band, so that $\alpha$ = 1.96. We find the extreme values from $100exp($\mu \pm \alpha\sigma$). The lower limit is then $V1$ = $100exp(0.10 − 1.96 × 0.2) = $100exp(−0.292) = $74.68. The upper limit is $V2$ = $100exp(0.10 + 1.96 × 0.2) = $100exp(0.492) = $163.56.

29. EXAMPLE 2.12: FRM EXAM 2000—QUESTION 128

For a lognormal variable $X$, we know that ln($X$) has a normal distribution with a mean of zero and a standard deviation of 0.5. What are the expected value and and the variance of $X$?

A. 1.025 and 0.187

B. 1.126 and 0.217

C. 1.133 and 0.365

D. 1.203 and 0.399

Example 2.12: FRM Exam 2000—Question 128

c. Using Equation (2.48), we have $E[X] = \exp[\mu+0.5\sigma2] = \exp[0+0.5 *0.52]$ =

1.1331. Assuming there is no error in the answers listed for the variance, it is sufficient to find the correct answer for the expected value.

30. EXAMPLE 2.13: FRM EXAM 2003—QUESTION 18

Which of the following statements is the most accurate about the relationship between a normal distribution and a Student's $t$-distribution that have the same mean and standard deviation?

A. They have the same skewness and the same kurtosis.

B. The Student's $t$-distribution has larger skewness and larger kurtosis.

C. The kurtosis of a Student's $t$-distribution converges to that of the normal distribution as the number of degrees of freedom increases.

D. The normal distribution is a good approximation for the Student's $t$distribution when the number of degrees of freedom is small.

Example 2.13: FRM Exam 2003—Question 18

c. The two distributions have the same skewness of zero but the Student's $t$ has higher kurtosis. As the number of degrees of freedom increases, the Student

converges to the normal, so c. is the correct answer.

31. EXAMPLE 2.14: FRM EXAM 2006—QUESTION 84
    On a multiple-choice exam with four choices for each of six questions, what is the probability that a student gets fewer than two questions correct simply by guessing?
    A. 0.46%
    B. 23.73%
    C. 35.60%
    D. 53.39%

    Example 2.14: FRM Exam 2006—Question 84
    d. We use the density given by Equation (2.56). The number of trials is $n = 6$. The probability of guessing correctly just by chance is $p = 1/4 = 0.25$. The probability of zero lucky guesses is $\binom{6}{0}0.25^0 0.75^6 = 0.75^6 = 0.17798$. The probability of one lucky guess is $\binom{6}{1}0.25^1 0.75^5 = 6* 0.25* 0.755 = 0.35596$. The sum is 0.5339.

    Note that the same analysis can be applied to the distribution of scores on the FRM examination with 140 questions. It would be virtually impossible to have a score of zero, assuming random guesses; this probability is $0.75140 = 3.2E - 18$ Also, the expected percentage score under random guesses is $p = 25\%$.

32. EXAMPLE 2.15: FRM EXAM 2004—QUESTION 60
    When can you use the normal distribution to approximate the Poisson distribution, assuming you have $n$ independent trials each with a probability of success of $p$
    A. When the mean of the Poisson distribution is very small
    B. When the variance of the Poisson distribution is very small
    C. When the number of observations is very large and the success rate is close to 1
    D. When the number of observations is very large and the success rate is close to 0

    Example 2.15: FRM Exam 2004—Question 60
    c. The normal approximation to the Poisson improves when the success rate, $\lambda$ is very high. Because this is also the mean and variance, answers a. and b. are wrong. In turn, the binomial density is well approximated by the Poisson density when $np = \lambda$ is large.

33. EXAMPLE 3.1: FRM EXAM 1999—QUESTION 4

A fundamental assumption of the random walk hypothesis of market returns is that returns from one time period to the next are statistically independent. This assumption implies

A. Returns from one time period to the next can never be equal.
B. Returns from one time period to the next are uncorrelated.
C. Knowledge of the returns from one time period does not help in predicting returns from the next time period.
D. Both b) and c) are true.

Example 3.1: FRM Exam 1999—Question 4

d. Efficient markets implies that the distribution of future returns does not depend on past returns. Hence, returns cannot be correlated. It could happen, however, that return distributions are independent, but that, just by chance, two successive returns are equal.

34. EXAMPLE 3.2: FRM EXAM 2002—QUESTION 3(modeling risk factors)

Consider a stock with daily returns that follow a random walk. The annualized volatility is 34%. Estimate the weekly volatility of this stock assuming that the year has 52 weeks.

A. 6.80%
B. 5.83%
C. 4.85%
D. 4.71%

Example 3.2: FRM Exam 2002—Question 3

d. Assuming a random walk, we can use the square root of time rule. The weekly volatility is then $34\% \times 1/\sqrt{52} = 4.71\%$.

35. EXAMPLE 3.3: FRM EXAM 2002—QUESTION 2(modeling risk factors)

Assume we calculate a one-week VAR for a natural gas position by rescaling the daily VAR using the square-root rule. Let us now assume that we determine the *true* gas price process to be mean-reverting and recalculate the VAR.

Which of the following statements is true?

A. The recalculated VAR will be less than the original VAR.
B. The recalculated VAR will be equal to the original VAR.
C. The recalculated VAR will be greater than the original VAR.

D. There is no necessary relation between the recalculated VAR and the original VAR.

Example 3.3: FRM Exam 2002—Question 2
a. With mean reversion, the volatility grows more slowly than the square root of time

36. EXAMPLE 3.4: FRM EXAM 2004—QUESTION 39(modeling risk factors)
Consider a portfolio with 40% invested in asset $X$ and 60% invested in asset $Y$. The mean and variance of return on $X$ are 0 and 25, respectively. The mean and variance of return on $Y$ are 1 and 121, respectively. The correlation coefficient between $X$ and $Y$ is 0.3. What is the nearest value for portfolio volatility?
A. 9.51
B. 8.60
C. 13.38
D. 7.45

Example 3.4: FRM Exam 2004—Question 39

d. The variance of the portfolio is given by $\sigma_p^2 = (0.4)^2 25 + 0.6^2 121$

$+2(0.4)(0.6)0.3\sqrt{25 \times 121} = 55.48$. Hence, the volatility is 7.45.

37. EXAMPLE 14.1: TIME SCALING
Consider a portfolio with a one-day VAR of $1 million. Assume that the market is trending with an autocorrelation of 0.1. Under this scenario, what would you expect the two-day VAR to be?
A. $2 million
B. $1.414 million
C. $1.483 million
D. $1.449 million

Example 14.1: Time Scaling
c. Knowing that the variance is $VAR$(2-day) $= VAR$(1-day)$[2+2\rho]$, we find

$VAR$(2-day) $= VAR$(1-day) $\sqrt{2 + 2\rho} = \$1\sqrt{2 + 0.2} = \$1.483$, assuming the same distribution for the different horizons.

38. EXAMPLE 14.2: FRM EXAM 2006—QUESTION 36
Which of the following GARCH models will take the shortest time to revert

to its long-run value?

A. $h_t = 0.05 + 0.03 \quad + 0.96 h_{t-1}$

B. $h_t = 0.03 + 0.02 \quad + 0.95 h_{t-1}$

C. $h_t = 0.02 + 0.01 \quad + 0.97 h_{t-1}$

D. $h_t = 0.01 + 0.01 \quad + 0.98 h_{t-1}$

Example 14.2: FRM Exam 2006—Question 36
b. The persistence parameter $\alpha_1 + \beta$ is, respectively, 0.99, 0.97, 0.98, 0.99. Model b. has the lowest parameter and hence will revert the fastest to the mean.

39. EXAMPLE 14.3: FRM EXAM 2006—QUESTION 132
   Assume you are using a GARCH model to forecast volatility that you use to calculate the one-day VAR. If volatility is mean reverting, what can you say about the $T$-day VAR?

   A.   It is less than the    × one-day VAR.

   B.   It is equal to    × one-day VAR.

   C.   It is greater than the    × one-day VAR.

   D.   It could be greater or less than the    × one-day VAR.

   Example 14.3: FRM Exam 2006—Question 132
   d. If the initial volatility were equal to the long-run volatility, then the $T$-day VAR could be computed using the square root of time rule, assuming normal distributions. If the starting volatility were higher, then the $T$-day VAR should be

   less than the $\sqrt{T}$× one-day VAR. Conversely if the starting volatility were lower

   than the long-run value. However, the question does not indicate the starting point. Hence, answer d. is correct.

40. EXAMPLE 14.4: FRM EXAM 2007—QUESTION 34
   A risk manager estimates daily variance $h_t$ using a GARCH model on daily

   returns $r_t$: $h_t = \alpha_0 + \alpha_1 r_{t-1}^2 + \beta h_{t-1}$, with $\alpha_0 = 0.005$, $\alpha_1 = 0.04$, $\beta = 0.94$.

The long-run *annualized* volatility is approximately

A. 13.54%

B. 7.94%

C. 72.72%

D. 25.00%

Example 14.4: FRM Exam 2007—Question 34

b. The long-run mean variance is h = α0/(1 − α1 − β) = 0.006/(1 − 0.04 − 0.94) = 0.25. Taking the square root, this gives 0.5 for daily volatility. Multiplying

by $\sqrt{252}$, we have an annualized volatility of 7.937%.

41. EXAMPLE 14.5: FRM EXAM 2002—QUESTION 13

The GARCH model is useful for simulating asset returns. Which of the following statements about this model is false?

A. The Exponentially Weighted Moving Average (EWMA) approach of RiskMetrics is a particular case of a GARCH process.

B. The GARCH allows for time-varying volatility.

C. The GARCH can produce fat tails in the return distribution.

D. The GARCH imposes a positive conditional mean return.

Example 14.5: FRM Exam 2002—Question 13

d. The GARCH model allows for time variation in volatility and includes the EWMAmodel as a special case. It can also induce fat tails in the return distribution, but says nothing about the mean, so answer d. is false

42. EXAMPLE 14.6: FRM EXAM 2007—QUESTION 46

A bank uses the Exponentially Weighted Moving Average (EWMA) technique with $\lambda$ of 0.9 to model the daily volatility of a security. The current estimate of the daily volatility is 1.5%. The closing price of the security is USD 20 yesterday and USD 18 today. Using continuously compounded returns, what is the updated estimate of the volatility?

A. 3.62%

B. 1.31%

C. 2.96%

D. 5.44%

Example 14.6: FRM Exam 2007—Question 46

a. The log return is ln(18/20) = −10.54%. The new variance forecasts is $h = 0.90 \times (1.5^2) + (1 − 0.90) \times 10.54^2 = 0.001313$, or taking the square root,

3.62%

43. EXAMPLE 14.7: FRM EXAM 2006—QUESTION 40
Using a daily RiskMetrics EWMA model with a decay factor $\lambda = 0.95$ to
develop a forecast of the conditional variance, which weight will be applied
to the return that is four days old?
A. 0.000
B. 0.043
C. 0.048
D. 0.950

Example 14.7: FRM Exam 2006—Question 40
b. The weight of the last day is (1 − 0.95) = 0.050. For the day before, this is
0.05 × 0.95, and for four days ago, $0.05 \times 0.95^3 = 0.04287$.

44. Question 1-8 (2008)
Which of the following four statements on models for estimating volatility is *incorrect*?
A. In the EWMA model, some positive weight is assigned to the long-run average variance
rate.
B. In the EWMA model, the weights assigned to observations decrease exponentially as
the observations become older.
C. In the GARCH(1,1) model, a positive weight is estimated for the long-run average
variance rate.
D. In the GARCH(1,1) model, the weights estimated for observations decrease
exponentially as the observations become older.

### Example 5.13: FRM Exam 2008—Question 1-8

a. The GARCH model has a finite unconditional variance, so statement c. is
correct. In contrast, because $\alpha_1 + \beta$ sum to 1, the EWMA model has undefined
long-run average variance. In both models weights decline exponentially with
time.

45. EXAMPLE 14.8: EFFECT OF WEIGHTS ON OBSERVATIONS
Until January 1999 the historical volatility for the Brazilian real versus the
U.S. dollar had been very small for several years. On January 13, Brazil abandoned
the defense of the currency peg. Using the data from the close of business
on January 13, which of the following methods for calculating volatility
would have shown the greatest jump in measured historical volatility?
A. 250 day equal weight
B. Exponentially weighted with a daily decay factor of 0.94
C. 60 day equal weight

D. All of the above

Example 14.8: Effect of Weights on Observations
b. The EWMA model puts a weight of 0.06 on the latest observation, which is higher than the weight of (1/60) = 0.0167 for the 60-day MA and (1/250) = 0.004 for the 250-day MA.

46. EXAMPLE 14.9: FRM EXAM 2006—QUESTION 29
    Risk-neutral default probability and real-world (or physical) default probability are used in the analysis of credit risk. Which one of the following statements on their uses is correct?
    A. Real-world default probability should be used in scenario analyses of potential future losses from defaults, and real-world default probability should also be used in valuing credit derivatives.
    B. Real-world default probability should be used in scenario analyses of potential future losses from defaults, but risk-neutral default probability should be used in valuing credit derivatives.
    C. Risk-neutral default probability should be used in scenario analyses of potential future losses from defaults, and risk-neutral default probability should be used in valuing credit derivatives.
    D. Risk-neutral default probability should be used in scenario analyses of potential future losses from defaults, but real-world default probability should be used in valuing credit derivatives.
    Example 14.9: FRM Exam 2007—Question 29
    b. Real-world probabilities should be used for risk management, or to devise scenarios. In contrast, risk-neutral probabilities should be used to price assets, such as credit derivatives.

47. EXAMPLE 3.5: FRM EXAM 2007—QUESTION 137
    What does a hypothesis test at the 5% significance level mean?
    A. P(not reject H0 | H0 is true) = 0.05
    B. P(not reject H0 | H0 is false) = 0.05
    C. P(reject H0 | H0 is true) = 0.05
    D. P(reject H0 | H0 is false) = 0.05

    Example 3.5: FRM Exam 2007—Question 137
    c. The significance level is the probability of committing a type 1 error, or rejecting a correct model. This is also P(reject H0 | H0 is true). On the other hand, the type 2 error rate is P(not reject H0 | H0 is false).

48. EXAMPLE 3.6: FRM EXAM 2007—QUESTION 2

Which of the following statements regarding hypothesis testing is *incorrect*?

A. Type II error refers to the failure to reject the null hypothesis when it isactually false.

B. Hypothesis testing is used to make inferences about the parameters of agiven population on the basis of statistics computed for a sample that isdrawn from that population.

C. All else being equal, the decrease in the chance of making a type I errorcomes at the cost of increasing the probability of making a type II error.

D. The p-value decision rule is to reject the null hypothesis if the p-value isgreater than the significance level.

Example 3.6: FRM Exam 2007—Question 2

d. We would reject the null if the observed p-value is *lower* (not greater) than the significance level.

49. EXAMPLE 3.7: FRM EXAM 2004—QUESTION 4

Consider the following linear regression model: $Y = a + b X + e$. Suppose $a = 0.05$, $b = 1.2$, SD($Y$) = 0.26, SD($e$) = 0.1, what is the correlation between $X$ and $Y$?

A. 0.923

B. 0.852

C. 0.701

D. 0.462

Example 3.7: FRM Exam 2004—Question 4

a. We can find the volatility of $X$ from the variance decomposition, Equation (3.37). This gives $V(x) = [V(y) - V(e)]/\beta^2 = [0.262 - 0.10^2]/1.2^2 = 0.04$. Then SD($X$) = 0.2, and $\rho = \beta$SD($X$)/SD($Y$) = 1.20.2/0.26 = 0.923.

50. EXAMPLE 3.8: FRM EXAM 2007—QUESTION 22

Consider two stocks, A and B. Assume their annual returns are jointly normally distributed, the marginal distribution of each stock has mean 2% and standard deviation 10%, and the correlation is 0.9. What is the expected annual return of stock A if the annual return of stock B is 3%?

A. 2%

B. 2.9%

C. 4.7%

D. 1.1%

Example 3.8: FRM Exam 2007—Question 22

b. The information in this question can be used to construct a regression model of A on B. We have $RA = 2\% + 0.9(10\%/10\%)(RB - 2\%) + \varepsilon$. Next, replacing $RB$ by 3% gives $\hat{RA}$ = 2% + 0.9(3% − 2%) = 2.9%.

51. EXAMPLE 3.9: FRM EXAM 2004—QUESTION 23

Which of the following statements about the linear regression of the return of a portfolio over the return of its benchmark presented below are correct?

| Portfolio parameter | Value |
|---|---|
| Beta | 1.25 |
| Alpha | 0.26 |
| Coefficient of determination | 0.66 |
| Standard deviation of error | 2.42 |

I. The correlation is 0.71.

II. 34% of the variation in the portfolio return is explained by variation in the benchmark return.

III. The portfolio is the dependent variable.

IV. For an estimated portfolio return of 12%, the confidence interval at 95% is (7.16% to −16.84%).

A. II and IV

B. III and IV

C. I, II, and III

D. II, III, and IV

Example 3.9: FRM Exam 2004—Question 23

b. The correlation is given by $\sqrt{0.66}$ = 0.81, so I. is incorrect. Next, 66% of the variation in $Y$ is explained by the benchmark, so answer II. is incorrect. The portfolio return is indeed the dependent variable $Y$, so answer III. is correct. Finally, to find the 95% two-tailed confidence interval, we use $\alpha$ from a normal distribution, which covers 95% within plus or minus 1.96, close to 2.00. The interval is then $y − 2SD(e), y + 2SD(e)$, or (7.16 − 16.84). So answers III. and IV. are correct.

52. EXAMPLE 3.10: FRM EXAM 2004—QUESTION 59

Which of the following statements regarding linear regression is *false*?

A. Heteroskedasticity occurs when the variance of residuals is not the sameacross all observations in the sample.

B. Unconditional heteroskedasticity leads to inefficient estimates, whereasconditional heteroskedasticity can lead to problems with both inferenceand estimation.

C. Serial correlation occurs when the residual terms are correlated witheach other.

D. Multicollinearity occurs when a high correlation exists between oramong two or more of the independent variables in a multiple regression.

Example 3.10: FRM Exam 2004—Question 59

b. Heteroskedasticity indeed occurs when the variance of the residuals is not

constant, so a. is correct. This leads to inefficient estimates but otherwise does not cause problems with inference and estimation. Statements c. and d. are correct.

53. EXAMPLE 3.11: FRM EXAM 1999—QUESTION 2
    Under what circumstances could the explanatory power of regression analysis be overstated?
    A.  The explanatory variables are not correlated with one another.
    B.  The variance of the error term decreases as the value of the dependentvariable increases.
    C.  The error term is normally distributed.
    D.  An important explanatory variable is omitted that influences the explanatory variables included, and the dependent variable.

    Example 3.11: FRM Exam 1999—Question 2
    d. If the true regression includes a third variable $z$ that influences both $y$ and $x$, the error term will not be conditionally independent of $x$, which violates one of the assumptions of the OLS model. This will artificially increase the explanatory power of the regression. Intuitively, the variable $x$ will appear to explain more of the variation in $y$ simply because it is correlated with $z$.

54. EXAMPLE 4.1: FRM EXAM 2003—QUESTION 40
    In the geometric Brownian motion process for a variable $S$,
    I. $S$ is normally distributed.
    II. $d\ln(S)$ is normally distributed.
    III. $dS/S$ is normally distributed.
    IV. $S$ is lognormally distributed.
    A.  I only
    B.  II, III, and IV
    C.  IV only
    D.  III and IV

    Example 4.1: FRM Exam 2003—Question 40
    b. Both $dS/S$ or $d\ln(S)$ are normally distributed. As a result, $S$ is lognormally distributed. The only incorrect answer is I.

55. EXAMPLE 4.2: FRM EXAM 2002—QUESTION 126
    Consider that a stock price $S$ that follows a geometric Brownian motion
    $dS= aSdt+ bSdz,$ with $b$ strictly positive. Which of the following statements is *false*?
    A.  If the drift $a$ is positive, the price one year from now will be abovetoday's price.

B. The instantaneous rate of return on the stock follows a normal distribution.

C. The stock price *S* follows a lognormal distribution.

D. This model does not impose mean reversion.

Example 4.2: FRM Exam 2002—Question 126

a. All the statements are correct except a., which is too strong. The expected price is higher than today's price but certainly not the price in all states of the world.

56. EXAMPLE 4.3: FRM EXAM 1999—QUESTION 25

The Vasicek model defines a risk-neutral process for *r* which is $dr = a(b - r)dt + \sigma dz$, where *a*, *b*, and $\sigma$ are constant, and *r* represents the rate of interest. From this equation we can conclude that the model is a

A. Monte Carlo-type model

B. Single-factor term-structure model

C. Two-factor term-structure model

D. Decision tree model

Example 4.3: FRM Exam 1999—Question 25

b. This model postulates only one source of risk in the fixed-income market. This is a single-factor term-structure model.

57. EXAMPLE 4.4: FRM EXAM 1999—QUESTION 26

The term $a(b - r)$ in the previous question represents which term?

A. Gamma

B. Stochastic

C. Reversion

D. Vega

Example 4.4: FRM Exam 1999—Question 26

b. This represents the expected return with mean reversion.

58. EXAMPLE 4.5: FRM EXAM 2000—QUESTION 118

Which group of term-structure models do the Ho-Lee, Hull-White, and Heath, Jarrow, and Morton models belong to?

A. No-arbitrage models

B. Two-factor models

C. Lognormal models

D. Deterministic models

Example 4.5: FRM Exam 2000—Question 118

a. These are no-arbitrage models of the term structure, implemented as either

one-factor or two-factor models.

59. EXAMPLE 4.6: FRM EXAM 2000—QUESTION 119
A plausible stochastic process for the short-term rate is often considered to be one where the rate is pulled back to some long-run average level. Which one of the following term-structure models does *not* include this characteristic?
A. The Vasicek model
B. The Ho-Lee model
C. The Hull-White model
D. The Cox-Ingersoll-Ross model

Example 4.6: FRM Exam 2000—Question 119
b. Both the Vasicek and CIR models are one-factor equilibrium models with mean reversion. The Hull-White model is a no-arbitrage model with mean reversion. The Ho and Lee model is an early no-arbitrage model without mean-reversion.

60. EXAMPLE 4.7: FRM EXAM 2005—QUESTION 67
Which of the following statements about Monte Carlo simulation is *false*?
A. Monte Carlo simulation can be used with a lognormal distribution.
B. Monte Carlo simulation can generate distributions for portfolios that contain only linear positions.
C. One drawback of Monte Carlo simulation is that it is computationally very intensive.
D. Assuming the underlying process is normal, the standard error resulting from Monte Carlo simulation is inversely related to the square root of the number of trials.

Example 4.7: FRM Exam 2005—Question 67
b. MC simulations do account for options. The first step is to simulate the process of the risk factor. The second step prices the option, which properly accounts for non-linearity.

61. EXAMPLE 4.8: FRM EXAM 2007—QUESTION 66
A risk manager has been requested to provide some indication of accuracy of a Monte Carlo simulation. Using 1,000 replications of a normally distributed variable $S$, the relative error in the one-day 99% VAR is 5%. Under these conditions,
A. Using 1,000 replications of a long option position on $S$ should create a larger relative error.
B. Using 10,000 replications should create a larger relative error.
C. Using another set of 1,000 replications will create an exact measure of 5.0% for relative

error.

D. Using 1,000 replications of a short option position on *S* should create alarger relative error.

Example 4.8: FRM Exam 2007—Question 66

d. Short option positions have long left tails, which makes it more difficult to estimate a left-tailed quantile precisely. Accuracy with independent draws increases with the square root of *K*. Thus increasing the number of replications should shrink the standard error, so answer b. is incorrect.

62. EXAMPLE 4.9: SAMPLING VARIATION

The measurement error in VAR, due to sampling variation, should be greater with

A. More observations and a high confidence level (e.g., 99%)
B. Fewer observations and a high confidence level
C. More observations and a low confidence level (e.g., 95%)
D. Fewer observations and a low confidence level

Example 4.9: Sampling Variation

b. Sampling variability (or imprecision) increases with (1) fewer observations and (2) greater confidence levels. To show (1), we can refer to the formula for the precision of the sample mean, which varies inversely with the square root of the number of data points. A similar reasoning applies to (2). A greater confidence level involves fewer observations in the left tails, from which VAR is computed.

63. EXAMPLE 4.10: FRM EXAM 2007—QUESTION 28

Let *N* be an $n \times 1$ vector of independent draws from a standard normal distribution, and let *V* be a covariance matrix of market time-series data. Then, if *L* is a diagonal matrix of the eigenvalues of *V*, *E* is a matrix of the eigenvectors of *V*, and $C\_C$ is the Cholesky factorization of *V*, which of the following would generate a normally distributed random vector with mean zero and covariance matrix *V* to be used in a Monte Carlo simulation?

A. $N\ C'C\ N'$
B. $N\ C'$
C. $E'LE$
D. Cannot be determined from data given

Example 4.10: FRM Exam 2007—Question 28

b. In the notation of the text, *N* is the vector of i.i.d. random variables $\eta$ and $CC' = T''$. The transformed variable is $T\eta$, or $C'N$, or its transpose.

64. EXAMPLE 4.11: FRM EXAM 2006—QUESTION 82

Consider a stock that pays no dividends, has a volatility of 25% pa and anexpected return of

13% pa. The current stock price is $S0 = \$30$. This impliesthe model $St+1 = St(1 + 0.13\Delta t + 0.25\sqrt{\Delta t}\varepsilon)$, where _ is a standard normalrandom variable. To implement this simulation, you generate a path of thestock price by starting at $t = 0$, generating a sample for $\varepsilon$, updating the stockprice according to the model, incrementing $t$ by 1 and repeating this processuntil the end of the horizon is reached. Which of the following strategies for generating a sample for $\varepsilon$ will implement this simulation properly?

A. Generate a sample for    by using the inverse of the standard normal cumulative distribution of a sample value drawn from a uniform distribution between 0 and 1.

B. Generate a sample for $\varepsilon$ by sampling from a normal distribution with mean 0.13 and standard deviation 0.25.

C. Generate a sample for   by using the inverse of the standard normal cumulative distribution of a sample value drawn from a uniform distribution between 0 and 1. Use Cholesky decomposition to correlate thissample with the sample from the previous time interval.

D. Generate a sample for    by sampling from a normal distribution with mean 0.13 and standard deviation 0.25. Use Cholesky decomposition to correlate this sample with the sample from the previous time interval.

Example 4.11: FRM Exam 2006—Question 82

a. The variable $\varepsilon$ should have a standard normal distribution, i.e., with mean zero and unit standard deviation. Answer b. is incorrect because $\varepsilon$ is transformed afterward to the desired mean and standard deviation. The Cholesky decomposition is not applied here because the sequence of random variables has no serial correlation.

65. EXAMPLE 4.12: FRM EXAM 2006—QUESTION 83
Continuing with the previous question, you have implemented the simulation process discussed above using a time interval $\Delta t = 0.001$, and you are analyzing the following stock price path generated by your implementation.

| T | St−1 | $\varepsilon$ | $\Delta S$ |
|---|---|---|---|
| 0 | 30.00 | 0.0930 | 0.03 |
| 1 | 30.03 | 0.8493 | 0.21 |
| 2 | 30.23 | 0.9617 | 0.23 |
| 3 | 30.47 | 0.2460 | 0.06 |

| | | | |
|---|---|---|---|
| 4 | 30.53 | 0.4769 | 0.12 |
| 5 | 30.65 | 0.7141 | 0.18 |

Given this sample, which of the following simulation steps most likely contains an error.

A. Calculation to update the stock price

*B.* Generation of random sample value for _

C. Calculation of the change in stock price during each period

D. None of the above

Example 4.12: FRM Exam 2006—Question 83

b. The random variable ∈should have a standard normal distribution, which

means that it should have negative as well as positive values, which should average close to zero. This is not the case here. This is probably a uniform variable instead.

# Part Three    Financial markets and products

66. Question 4-9(2009)

Lisa Smith, the treasurer of Bank AAA, has $100 million to invest for one year. She has identified three alternative one-year certificates of deposit (CDs), with different compounding periods and annual rates. CD1: monthly, 7.82%; CD2: quarterly, 8.00%; CD3: semiannually, 8.05%; and CD4: continuous, 7.95%. Which CD has the highest effective annual rate (EAR)?

A. CD1

B. CD2

C. CD3

D. CD4

## Example 6.2: FRM Exam 2009—Question 4-9

d. A dollar initially invested will grow to (CD1) $(1 + 7.82\%/12)^{12} = 1.08107$, (CD2) $(1 + 8.00\%/4)^4 = 1.08243$, (CD3) $(1 + 8.05\%/2)^2 = 1.08212$, (CD4) $\exp(7.95\%) = 1.08275$. Hence, CD4 gives the highest final amount and EAR.

67. Question 4-8(2009)

A five-year corporate bond paying an annual coupon of 8% is sold at a price reflecting a yield to maturity of 6%. One year passes and the interest rates remain unchanged. Assuming a flat term structure and holding all other factors constant, the bond's price during this period will have

A. Increased

B. Decreased

C. Remained constant

D. Cannot be determined with the data given

**Example 6.4: FRM Exam 2009—Question 4-8**

b. Because the coupon is greater than the yield, the bond must be selling at a premium, or current price greater than the face value. If yields do not change, the bond price will converge to the face value. Given that it starts higher, it must decrease.

68. Question 4-15(2009)

A portfolio manager uses her valuation model to estimate the value of a bond portfolio at USD 125.482 million. The term structure is flat. Using the same model, she estimates that the value of the portfolio would increase to USD 127.723 million if all interest rates fell by 30bp and would decrease to USD 122.164 million if all interest rates rose by 30bp. Using these estimates, the effective duration of the bond portfolio is closest to:

A. 8.38

B. 16.76

C. 7.38

D. 14.77

**Example 6.7: FRM Exam 2009—Question 4-15**

c. By Equation (6.20), effective duration is $D^E = \frac{[P_- - P_+]}{(2P_0 \Delta y)} = \frac{[127.723 - 122.164]}{(125.482 \times 0.6\%)} = 7.38$.

69. Question 3-8(2009)

According to an in-house research report, it is expected that USDJPY (quoted as JPY/USD) will trade near 97 at the end of March. Frankie Shiller, the investment director of a house fund, decides to use an option strategy to capture this opportunity. The current level of the USDJPY exchange rate is 97 on February 28. Accordingly, which of the following strategies would be the most appropriate for the largest profit while the potential loss is limited?

A. Long a call option on USDJPY and long a put option on USDJPY with the same strike price of USDJPY 97 and expiration date

B. Long a call option on USDJPY with strike price of USDJPY 97 and short a call option on USDJPY with strike price of USDJPY 99 and the same expiration date

C. Short a call option on USDJPY and long a put option on USDJPY with the same strike

price of USDJPY 97 and expiration date

D. Long a call option with strike price of USDJPY 96, long a call option with strike price of USDJPY 98, and sell two call options with strike price of USDJPY 97, all of them with the same expiration date

## Example 8.9: FRM Exam 2009—Question 3-8

d. The best strategy among these is a long butterfly, which benefits if the spot stays at the current level. Answer a. is a long straddle, which is incorrect because this will lose money if the spot rate does not move. Answer b. is a bull spread, which is incorrect because it assumes the spot price will go up. Answer c. is the same as a short spot position, which is also incorrect.

70. Question 4-16(2009)

From the time of issuance until the bond matures, which of the following bonds is most likely to exhibit negative convexity?

- A. A puttable bond
- B. A callable bond
- C. An option-free bond selling at a discount
- D. A zero-coupon bond

## Example 9.4: FRM Exam 2009—Question 4-16

b. A callable bond is short an option, which creates negative convexity for some levels of interest rates. Regular bonds, as in answers c. and d., have positive convexity, as well as puttable bonds.

71. Question 4-12(2009)

Your boss wants to devise a fixed-income strategy such that there is no reinvestment risk over five years. Reinvestment risk will not occur if:

I. Interest rates remain constant over the time period the bonds are held.
II. The bonds purchased are callable.
III. The bonds purchased are issued at par.
IV. Only zero-coupon bonds with a five-year maturity are purchased.

A. I only
B. I and II only
C. III only
D. I and IV

d. Reinvestment risk occurs when the intermediate coupon payments have to be reinvested at a rate that differs from the initial rate. This does not happen if interest rates stay constant, or with zero-coupon bonds. Callable bonds can be called early, which creates even more reinvestment risk for the principal.

72. Question 4-11(2009)

    Consider a bond with par value of EUR 1,000 and maturity in three years, and that pays a coupon of 5% annually. The spot rate curve is as follows: 1-year, 6%; 2-year, 7%; and 3-year, 8%. The value of the bond is closest to:

    A.   904
    B.   924
    C.   930
    D.   950

**Example 9.6: FRM Exam 2009—Question 4-11**

b. The price is $50/(1+6\%) + 50/(1+7\%)^2 + 1{,}050/(1+8\%)^3 = 924.36$.

73. Question 3-24(2009)

    The term structure of swap rates is: 1-year, 2.50%; 2-year, 3.00%; 3-year, 3.50%; 4-year, 4.00%; 5-year, 4.50%. The two-year forward swap rate starting in three years is closest to

    A.   3.50%
    B.   4.50%
    C.   5.51%
    D.   6.02%

**Example 9.8: FRM Exam 2009—Question 3-24**

d. We compute first the accrual of a dollar over three and five years. For $T = 3$, this is $(1 + 3.50\%)^3 = 1.10872$. For $T = 5$, this is $(1 + 4.50\%)^5 = 1.24618$. This

74. Queston 3-11(2009)

The yield curve is upward sloping. You have a short T-bond futures position. The following bonds are eligible for delivery:

| Bond | A | B | C |
|---|---|---|---|
| Spot price | 102-14/32 | 106-19/32 | 98-12/32 |
| Coupon | 4% | 5% | 3% |
| Conversion factor | 0.98 | 1.03 | 0.952 |

The futures price is 103-17/32 and the maturity date of the contract is September 1. The bonds pay their coupon semiannually on June 30 and December 31. The cheapest to deliver bond is:

A. Bond A

B. Bond B

C. Bond C

D. Insufficient information

## Example 10.4: FRM Exam 2009—Question 3-11

b. The cost of delivering each bond is the price divided by the conversion factor. This gives, respectively, $(102 + 14/32)/0.98 = 104.53$, 103.49, and 103.55. Hence the CTD is bond B. All other information is superfluous.

75. Question 3-23(2009)

Which of the following statements related to forward and futures prices is *true?*

A. If the forward price does not equal the futures price, arbitragers will exploit this arbitrage opportunity.
B. The level of interest rates determines whether the forward price is higher or lower than the futures price.
C. The volatility of interest rates determines whether the forward price is higher or lower than the futures price.
D. Whether the forward price will be higher or lower than the futures price depends on correlation between interest rate and futures price.

## Example 10.5: FRM Exam 2009—Question 3-23

d. Forward rates may not equal futures rates due to the correlation between the interest rate, or reinvestment rate, and the futures contract profit. As seen in Equation (10.4), the volatility determines the size of the bias but not the direction.

76. Question 3-4(2009)

    A bank entered into a three-year interest rate swap for a notional amount of USD 250 million, paying a fixed rate of 7.5% and receiving LIBOR annually. Just after the payment was made at the end of the first year, the continuously compounded spot one-year and two-year LIBOR rates are 8% and 8.5%, respectively. The value of the swap at that time is closest to

    A. USD 14 million
    B. USD -6 million
    C. USD -14 million
    D.  USD 6 million

### Example 10.9: FRM Exam 2009—Question 3-4

d. This question differs from the previous one, which gave the swap rate. Here, we have the spot rates for maturities of one and two years. The coupon is 7.5. The net present value (NPV) of the payments is then $V = \$18.75\exp(-1 \times 8\%) + (\$250 + \$18.75)\exp(-2 \times 8.5\%) = \$244$ million. Right after the reset, the value of the FRN is $250 million, leading to a gain of $6 million. This is a gain because the bank must pay a fixed rate but current rates are higher.

77. Question 2-24(2009)

    The yield curve is upward sloping and a portfolio manager has a long position in 10-year Treasury notes funded through overnight repurchase agreements. The risk manager is concerned with the risk that market rates may increase further and reduce the market value of the position. What hedge could be put on to reduce the position's exposure to rising rates?

    A. Enter into a 10-year pay-fixed and receive-floating interest rate swap.
    B. Enter into a 10-year receive-fixed and pay-floating interest rate swap.
    C. Establish a long position in 10-year Treasury note futures.
    D.  Buy a call option on 10-year Treasury note futures.

### Example 10.15: FRM Exam 2009—Question 2-24

a. The bond position has positive duration. Entering a pay-fixed swap gains if rates go up; this negative duration can provide a hedge against the original position. Answer b. is thus incorrect. Answer c. is the same as the original position and is not a hedge. In answer d., a call on futures would not create a profit if rates go up, in which case the futures would go down. Buying a put would be a correct answer.

78. Question 3-1(2009)

A stock index is valued at USD 750 and pays a continuous dividend at the rate of 2% per annum. The six-month futures contract on that index is trading at USD 757. The risk-free rate is 3.50% continuously compounded. There are no transaction costs or taxes. Is the futures contract priced so that there is an arbitrage opportunity? If yes, which of the following numbers comes closest to the arbitrage profit you could realize by taking a position in one futures contract?

    A.   $4.18
    B.   $1.35
    C.   $12.60
    D.   There is no arbitrage opportunity.

## Example 11.2: FRM Exam 2009—Question 3-1

b. The fair forward price is $F = Se^{-y\tau}/e^{-r\tau} = 750\exp(-0.02 \times 6/12)/\exp(-0.035 \times 6/12) = 750 \times 0.9905/0.9827 = 755.65$. The actual price is 757.00. Hence buying at the cheap price and selling at the forward price gives a profit of $1.35.

79. Question 3-19(2009)

Bonumeur SA is a French company that produces strollers for children and is specialized in strollers for twins and triplets for the EU market. The company buys the wheels of the strollers on the U.S. market. Invoices are paid in USD. What is Bonumeur's currency risk and how can the company hedge its exposure?

    A.   EUR depreciating against USD; selling EUR against buying USD forward
    B.   EUR depreciating against USD; selling USD against buying EUR forward
    C.   EUR appreciating against USD; selling EUR against buying USD forward
    D.   EUR appreciating against USD; selling USD against buying EUR forward

## Example 11.4: FRM Exam 2009—Question 3-19

a. Because the company has revenues fixed in EUR and some costs in USD, it would be hurt if the USD appreciated. So, the risk is that of a depreciation of the

EUR against the USD. This can be hedged by buying the USD forward, which will lock in the EUR payment even if the USD appreciates.

80. Question 2-1.1-48(2002)

An investor buys a Treasury bill maturing in 1 month for $987. On the maturity date the investor collects $1,000. Calculate effective annual rate (EAR).

    A.   17.0%
    B.   15.8%

C. 13.0%
**D.** 11.6%

### Example 1.1: FRM Exam 2002—Question 48

a. The EAR is defined by $FV/PV = (1 + EAR)T$. So EAR = $(FV/PV)1/T - 1$.
Here, $T = 1/12$. So, EAR = $(1,000/987)12 - 1 = 17.0\%$.

81. Question 2-1.3-75(2006)
A zero-coupon bond with a maturity of 10 years has an annual effective yield of 10%. What is the closest value for its modified duration?
A. 9
B. 10
C. 99
D. 100

### Example 1.3: FRM Exam 2006—Question 75

a. Without doing any computation, the Macaulay duration must be 10 years because this is a zero-coupon bond. With annual compounding, modified duration is

$D* = 10/(1 + 10\%)$, or close to 9 years.

82. Question 2-1.2-51(2002)
Consider a savings account that pays an annual interest rate of 8%. Calculate the amount of time it would take to double your money. Round to the nearest year.
A. 7 years
B. 8 years
C. 9 years
D. 10 years`

### Example 1.2: FRM Exam 2002—Question 51

c. The time $T$ relates the current and future values such that $FV/PV = 2 = (1 + 8\%)T$. Taking logs of both sides, this gives $T = \ln(2)/\ln(1.08) = 9.006$.

83. Question 2-1.4-115(2007)
A portfolio manager has a bond position worth USD 100 million. The position has a modified duration of eight years and a convexity of 150 years. Assume that the term structure is flat. By how much does the value of the position change if interest rates increase by 25 basis points?

A.   USD −2,046,875

B.   USD −2,187,500

C.   USD −1,953,125

D.   USD −1,906,250

**Example 1.4: FRM Exam 2007—Question 115**

c. The change in price is given by $\_P = -[D^* \times P](\Delta y) + \frac{1}{2}[C \times P](\Delta y^2)$

$= -[8 \times 100](0.0025) + 0.5[150 \times 100](0.0025)2 = -2.000000 + 0.046875$

$= -1.953125.$

84. Question 2-1.5-55 (2007)

Consider the following three methods of estimating the profit and loss (P&L) of a bullet bond: full repricing, duration (PV01), and duration plus convexity. Rank the methods to estimate the P&L impact of a large negative yield shock from the lowest to the highest.

A.   Duration, duration plus convexity, full repricing

B.   Duration, full repricing, duration plus convexity

C.   Duration plus convexity, duration, full repricing

D.   Full repricing, duration plus convexity, duration

**Example 1.5: FRM Exam 2007—Question 55**

a. When yields drop, the duration approximation gives the smallest price increase, so the answer must be either a. or b. Figure 1.2 shows that the full repricing curve for decreases in yields is slightly higher than the duration and convexity approximation. Alternatively, differentiating Equation 1.18 once more give a negative term for the third-order derivative. Combined with $\delta y3$, which is negative, the third-order term must be positive.

85. Question 2-1.6-13(2003)

Suppose the face value of a three-year option-free bond is USD 1,000 and the annual coupon is 10%. The current yield to maturity is 5%. What is the modified duration of this bond?

A.   2.62

B.   2.85

C.   3.00

D.   2.75

**Example 1.6: FRM Exam 2003—Question 13**

d. As in Table 1.2, we lay out the cash flows and find

| Period T | Payment Yield Ct y | | PV=Ct/$(1+y)^t$ tPVt | |
|---|---|---|---|---|
| 1 | 100 | 5.0 | 95.24 | 95.24 |
| 2 | 100 | 5.0 | 90.71 181.41 | |
| 3 | 1100 | 5.0 | 950.22 2850.66 | |
| | | | | |
| Sum | | | 1136.16 3127.31 | |

Duration is then 2.75, and modified duration 2.62

86. Question 2-1.7-118(2002)

A Treasury bond has a coupon rate of 6% per annum (the coupons are paid semiannually) and a semiannually compounded yield of 4% per annum. The bond matures in 18 months and the next coupon will be paid 6 months from now. Which number below is closest to the bond's Macaulay duration?

A. 1.023 years

B. 1.457 years

C. 1.500 years

D. 2.915 years

**Example 1.7: FRM Exam 2002—Question 118**

b. For coupon-paying bonds, Macaulay duration is slightly less than the maturity, which is 1.5 year here. So, b. would be a good guess. Otherwise, we can compute duration exactly.

87. Question 2-1.8-48(2002)

A and B are two perpetual bonds, that is, their maturities are infinite. A has a coupon of 4% and B has a coupon of 8%. Assuming that both are trading at the same yield, what can be said about the duration of these bonds?

A. The duration of A is greater than the duration of B.

B. The duration of A is less than the duration of B.

C. A and B both have the same duration.

D. None of the above.

**Example 1.8: Duration and Coupon**

c. Going back to the duration equation for the consol, Equation (1.27), we see that it does not depend on the coupon but only on the yield. Hence, the durations must be the same. The price of bond A, however, must be half that of bond B.

88. Question 2-1.9(2002)

A manager wants to swap a bond for a bond with the same price but higher duration. Which of the following bond characteristics would be associated

with a higher duration?

I. A higher coupon rate

II. More frequent coupon payments

III. A longer term to maturity

IV. A lower yield

A.   I, II, and III

B.   II, III, and IV

C.   III and IV

D.   I and II

### Example 1.9: FRM Exam 2004—Question 16

c. Higher duration is associated with physical characteristics that push payments into the future, i.e., longer term, lower coupons, and less frequent coupon payments,as well as lower yields, which increase the relative weight of payments in the future.

89. Question 2-1.10-104(2001)

When the maturity of a plain coupon bond increases, its duration increases

A.   Indefinitely and regularly

B.   Up to a certain level

C.   Indefinitely and progressively

D.   In a way dependent on the bond being priced above or below par

### Example 1.10: FRM Exam 2001—Question 104

b. With a fixed coupon, the duration goes up to the level of a consol with the same coupon. See Figure 1.7.

90. Question 2-1.11-106(200)

Consider the following bonds:

| Bond Number | Maturity(yrs) | CouponRate | Frequency | Yield(Annual) |
|---|---|---|---|---|
| 1 | 10 | 6% | 1 | 6% |
| 2 | 10 | 6% | 2 | 6% |
| 3 | 10 | 0% | 1 | 6% |
| 4 | 10 | 6% | 1 | 5% |
| 5 | 9 | 6% | 1 | 6% |

How would you rank the bonds from the shortest to longest duration?

A.   5-2-1-4-3

B. 1-2-3-4-5

C. 5-4-3-1-2

D. 2-4-5-1-3

**Example 1.11: FRM Exam 2000—Question 106**

a. The nine-year bond (number 5) has shorter duration because the maturity is shortest, at nine years, among comparable bonds. Next, we have to decide between bonds 1 and 2, which only differ in the payment frequency. The semiannual bond (number 2) has a first payment in six months and has shorter duration than the annual bond. Next, we have to decide between bonds 1 and 4, which only differ in the yield. With lower yield, the cash flows further in the future have a higher weight, so that bond 4 has greater duration. Finally, the zero-coupon bond has the longest duration. So, the order is 5-2-1-4-3.

91. Question 2-1.12-110(2000)

Which of the following statements are true?

I. The convexity of a 10-year zero-coupon bond is higher than the convexity of a 10-year, 6% bond.

II. The convexity of a 10-year zero-coupon bond is higher than the convexity of a 6% bond with a duration of 10 years.

III. Convexity grows proportionately with the maturity of the bond.

IV. Convexity is always positive for all types of bonds.

V. Convexity is always positive for "straight" bonds.

A. I only

B. I and II only

C. I and V only

D. II, III, and V only

**Example 1.12: FRM Exam 2000—Question 110**

c. Because convexity is proportional to the square of time to payment, the convexity of a bond is mainly driven by the cash flows far into the future. Answer I. is correct because the 10-year zero has only one cash flow, whereas the coupon bond has several others that reduce convexity. Answer II. is false because the 6% bond with 10-year duration must have cash flows much further into the future, say in 30 years, which will create greater convexity. Answer III. is false because convexity grows with the square of time. Answer IV. is false because some bonds, for example MBSs or callable bonds, can have negative convexity. Answer V. is correct because convexity must be positive for coupon-paying bonds.

92. Question 2-1.13-57(2002)

A bond portfolio has the following composition:

**1.** Portfolio A: price $90,000, modified duration 2.5, long position in8 bonds

**2.** Portfolio B: price $110,000, modified duration 3, short position in6 bonds

**3.** Portfolio C: price $120,000, modified duration 3.3, long position in12 bonds

All interest rates are 10%. If the rates rise by 25 basis points, then the bond portfolio value will

A. Decrease by $11,430

B. Decrease by $21,330

C. Decrease by $12,573

D. Decrease by $23,463

### Example 1.13: FRM Exam 2002—Question 57

a. The portfolio dollar duration is $P = \sum x_i \quad P_i$

$= +8 \times 2.5 \times \$90,000 - 6 \times 3.0 \times \$110,000 + 12 \times 3.3 \times \$120,000$
$= \$4,572,000.$ The change in portfolio

value is then $-(D*P)(\_y) = -\$4,572,000 \times 0.0025 = -\$11,430.$

93. Question 2-1.14-61(2006)

Consider the following portfolio of bonds (par amounts are in millions ofUSD).

**Bond Price Par amount held Modified Duration**

A 101.43 3 2.36

B 84.89 5 4.13

C 121.87 8 6.27

What is the value of the portfolio's DV01 (dollar value of 1 basis point)?

A.  8,019

B.  8,294

C.  8,584

D.  8,813

### Example 1.14: FRM Exam 2006—Question 61

c. First, the market value of each bond is obtained by multiplying the par amount

by the ratio of the market price divided by 100. Next, this is multiplied by $D*$

to get the dollar duration DD. Summing, this gives $85.841 million. We multiply by 1,000,000 to get dollar amounts and by 0.0001 to get the DV01, which gives $8,584.

| Bond | Price Par Mktvalue $D*$DD |
|------|------|
| A | 101.43 3 3.043 2.36 7.181 |

| | | |
|---|---|---|
| B | 84.89 5 4.245 4.13 15.530 | |
| C | 121.87 8 9.750 6.27 61.130 | |
| Sum | 8 | 85.841 |

94. Question 2-33(2008)

Which of the following statements is *correct* regarding the effects of interest rate shift on fixed-income portfolios with similar durations?

A. A barbell portfolio has greater convexity than a bullet portfolio because convexity increases linearly with maturity.

B. A barbell portfolio has greater convexity than a bullet portfolio because convexity increases with the square of maturity.

C. A barbell portfolio has lower convexity than a bullet portfolio because convexity increases linearly with maturity.

D. A barbell portfolio has lower convexity than a bullet portfolio because convexity increases with the square of maturity.

## Example 6.17: FRM Exam 2008—Question 2-33

b. The statement compares two portfolios with the same duration. A barbell portfolio consists of a combination of short-term and long-term bonds. A bullet portfolio has only medium-term bonds. Because convexity is a quadratic function of time to wait for the payments, the long-term bonds create a large contribution to the convexity of the barbell portfolio, which must be higher than that of the bullet portfolio.

95. Question 2-15(2008)

The one-year U.S. dollar interest rate is 2.75% and one-year Canadian dollar interest rate is 4.25%. The current USD/CAD spot exchange rate is 1.0221-1.0225. Calculate the one-year USD/CAD forward rate. Assume annual compounding.

A. 1.0076

B. 1.0074

C. 1.0075

D. 1.03722

## Example 7.3: FRM Exam 2008—Question 2-15

a. The spot price is the middle rate of $1.0223. Using annual (not continuous) compounding, the forward price is $F = S(1+r)/(1+R^*) = 1.0223(1.0275)/(1.0425) = 1.0076$.

96. Question 2-10(2008)

The current price of stock ABC is $42 and the call option with a strike at $44 is trading at $3. Expiration is in one year. The corresponding put is priced at $2. Which of the following trading strategies will result in arbitrage profits? Assume that the risk-free rate is 10% and that the risk-free bond can be shorted costlessly. There are no transaction costs.

A. Long position in both the call option and the stock, and short position in the put option and risk-free bond

B. Long position in both the call option and the put option, and short position in the stock and risk-free bond

C. Long position in both the call option and the risk-free bond, and short position in the stock and the put option

D. Long position in both the put option and the risk-free bond, and short position in the stock and the call option

## Example 8.3: FRM Exam 2008—Question 2-10

c. Answers a. and b. have payoffs that depend on the stock price and therefore cannot create arbitrage profits. Put-call parity says that $c - p = 3 - 2 = \$1$ should equal $S - Ke^{-r\tau} = 42 - 44 \times 0.9048 = \$2.19$. The call option is cheap. Therefore buy the call and hedge it by selling the stock, for the upside. The benefit from selling the stock if $S$ goes down is offset by selling a put.

97. Question 2-6(2008)

Which two of the following four statements are correct about the early exercise of American options on non-dividend-paying stocks?

I. It is never optimal to exercise an American call option early.

II. It can be optimal to exercise an American put option early.

III. It can be optimal to exercise an American call option early.

IV. It is never optimal to exercise an American put option early.

A. I and II

B. I and IV

C. II and III

D. III and IV

## Example 8.12: FRM Exam 2008—Question 2-6

a. If the stock does not pay a dividend, the value of the American call option alive is always higher than if exercised (basically because there is no dividend to capture).

Hence, it never pays to exercise a call early. On the other hand, exercising an American put early may be rational because it is better to receive the strike price now than later, with positive interest rates.

98. EXAMPLE 5.2: FRM EXAM 2005—QUESTION 16

Suppose that U.S. interest rates rise from 3% to 4% this year. The spot exchange rate quotes at 112.5 JPY/USD and the forward rate for a one-year contract is at 110.5. What is the Japanese interest rate?

A.   1.81%

B.   2.15%

C.   3.84%

D.   5.88%

Example 5.2: FRM Exam 2005—Question 16

b. As is the convention in the currency markets, the exchange rate is defined as the yen price of the dollar, which is the foreign currency. The foreign currency interest rate is the latest U.S. dollar rate, or 4%. Assuming discrete compounding, the

Introduction to Derivatives 125

pricing formula for forward contracts is $F$ ($JPY$ /$USD$)/$(1 + rT) = S(JPY /$

$USD)/(1+r*T)$. Therefore, $(1+rT)=(F/S)(1+r*T)=(110.5/112.5)(1.04)=$

1.0215, and $r$ = 2.15%. Using continuous compounding gives a similar result. Another approach would consider the forward discount on the dollar, which is $(F − S)/S$ = −1.8%. Thus, the dollar is 1.8% cheaper forward than spot, which must mean that the Japanese interest rate must be approximately 1.8% lower than the U.S. interest rate.

99. EXAMPLE 5.3: FRM EXAM 2002—QUESTION 56

Consider a forward contract on a stock market index. Identify the *false* statement. Everything else being constant,

A.   The forward price depends directly upon the level of the stock market index.

B.   The forward price will fall if underlying stocks increase the level of dividend payments over the life of the contract.

C.   The forward price will rise if time to maturity is increased.

D.   The forward price will fall if the interest rate is raised.

Example 5.3: FRM Exam 2002—Question 56

d. Defining the dividend yield as $q$, the forward price depends on the cash price according to $F \exp(−rT) = S \exp(−qT)$. This can also be written as $F = S \exp[+(r − q)T]$. Generally, $r > q$. Statement a. is correct: $F$ depends directly on $S$. Statement b. is also correct, as higher $q$ decreases the term between brackets and hence $F$. Statement c. is correct because the term $r − q$ is positive, leading to a larger term in brackets as the time to maturity $T$ increases. Statement d.

is false, as increasing *r* makes the forward contract more attractive, or increases *F* .

100. EXAMPLE 5.4: FRM EXAM 2007—QUESTION 119

A three-month futures contract on an equity index is currently priced at USD 1,000. The underlying index stocks are valued at USD 990 and pay dividends at a continuously compounded rate of 2%. The current continuously compounded risk-free rate is 4%. The potential arbitrage profit per contract, given this set of data, is closest to

A.   USD 10.00

B.   USD 7.50

C.   USD 5.00

D.   USD 1.50

Example 5.4: FRM Exam 2007—Question 119

c. The fair value of the futures contract is given by $F = S \exp(-r * T)/\exp(-rT) =$

$990 \exp(-0.02 \times 3/12) \exp(-0.04 \times 3/12) = 994.96$. Hence, the actual futures price is too high by $(1,000 - 995) = 5$.

101. EXAMPLE 5.5: FRM EXAM 2004—QUESTION 38

An investor enters into a short position in a gold futures contract at USD 294.20. Each futures contract controls 100 troy ounces. The initial margin is USD 3,200, and the maintenance margin is USD 2,900. At the end of the first day, the futures price drops to USD 286.6. Which of the following is the amount of the variation margin at the end of the first day?

A.   0

B.   USD 34

C.   USD 334

D.   USD 760

Example 5.5: FRM Exam 2004—Question 38

a. This is a tricky question. Because the investor is short and the price fell, the position creates a profit and there is no variation margin.On the other hand, for the long the loss is $760, which would bring the equityto 3,200 − 760 = 2,440. Because this is below the maintenance margin of 2,900,an additional payment of $760 is required to bring back the equity to the initialmargin.

102. EXAMPLE 5.6: FRM EXAM 2004—QUESTION 66

Which one of the following statements is incorrect regarding the margining of exchange-traded futures contracts?

A.   Day trades and spread transactions require lower margin levels.

B.  If an investor fails to deposit variation margin in a timely manner the positions may be liquidated by the carrying broker.
C.  Initial margin is the amount of money that must be deposited when a futures contract is opened.
D.  A margin call will be issued only if the investor's margin account balance becomes negative.

Example 5.6: FRM Exam 2004—Question 66
d. All the statements are correct, except d. If the margin account balance falls below the maintenance margin (not zero), a margin call will be issued.


103. EXAMPLE 6.1: FRM EXAM 2007—QUESTION 84(option markets)
According to put–call parity, buying a put option on a stock is equivalent to
A.  Buying a call option and buying the stock with funds borrowed at the risk-free rate
B.  Selling a call option and buying the stock with funds borrowed at the risk-free rate
C.  Buying a call option, selling the stock, and investing the proceeds at the risk-free rate
D.  Selling a call option, selling the stock, and investing the proceeds at the risk-free rate

Example 6.1: FRM Exam 2007—Question 84
c. Buying a put creates a gain if the stock price falls, which is similar to selling the stock on the downside. On the upside, the loss is capped by buying a call.


104. EXAMPLE 6.2: FRM EXAM 2005—QUESTION 72
A one-year European put option on a non-dividend-paying stock with strike at EUR 25 currently trades at EUR 3.19. The current stock price is EUR 23 and its annual volatility is 30%. The annual risk-free interest rate is 5%. What is the price of a European call option on the same stock with the same parameters as that of the above put option? Assume continuous compounding.
A.  EUR 1.19
B.  EUR 3.97
C.  EUR 2.41
D.  Cannot be determined with the data provided

Example 6.2: FRM Exam 2005—Question 72

c. By put–call parity, $c = p + S e^{-r'\tau} - K e^{-r\tau} = 3.19 + 23 - 25\exp(-0.05 \times 1) =$

$3.19 - 0.78 = 2.409$. Note that the volatility information is not useful.

105. EXAMPLE 6.3: FRM EXAM 2002—QUESTION 25

The price of a non-dividend-paying stock is $20. A six-month European call option with a strike price of $18 sells for $4. A European put option on the same stock, with the same strike price and maturity, sells for $1.47. The continuously compounded risk-free interest rate is 6% per annum. Are these three securities (the stock and the two options) consistently priced?

A. No, there is an arbitrage opportunity worth $2.00.

B. No, there is an arbitrage opportunity worth $2.53.

C. No, there is an arbitrage opportunity worth $14.00.

D. Yes.

Example 6.3: FRM Exam 2002—Question 25

d. Put–call parity applies to these European options. With no dividend, the relationship is $c - p = S - K \exp(-r\tau)$. The first term is $c - p = \$4 - \$1.47 = \$2.53$. The second term is $S - K \exp(-r\tau) = \$20 - \$18\exp[-6\%(6/12)] = \$2.53$. Because the two numbers are the same, there is no arbitrage opportunity.

106. EXAMPLE 6.4: FRM EXAM 2006—QUESTION 74

Jeff is an arbitrage trader, who wants to calculate the implied dividend yield on a stock while looking at the over-the-counter price of a five-year European put and call on that stock. He has the following data: $S = \$85$, $K = \$90$, $r = 5\%$, $c = \$10$, $p = \$15$. What is the continuous implied dividend yield of that stock?

A. 2.48%

B. 4.69%

C. 5.34%

D. 7.71%

Example 6.4: FRM Exam 2006—Question 74

c. By put–call parity, $c - p = Se^{-r^*\tau} - Ke^{-r\tau}$

. Therefore, $Se^{-r^*\tau} = c - p + Ke^{-r\tau} = (10 - 15 + 90\exp(0.05 \times 5) = 65.09$. The dividend yield is then $y = -(1/T)\ln(65.09/85) = 5.337\%$.

107. EXAMPLE 6.5: FRM EXAM 2001—QUESTION 90

Which of the following is the riskiest form of speculation using option contracts?

A. Setting up a spread using call options

B. Buying put options
C. Writing naked call options
D. Writing naked put options

Example 6.5: FRM Exam 2001—Question 90
c. Long positions in options can lose at worst the premium, so b. is wrong. Spreads involve long and short positions in options and have limited downside loss, so a. is wrong. Writing options exposes the seller to very large losses. In the case of puts, the worst loss is the strike price $K$, if the asset price goes to zero. In the case of calls, however, the worst loss is in theory unlimited because there is a small probability of a huge increase in $S$. Between c. and d., c. is the better answer.

108. EXAMPLE 6.6: FRM EXAM 2007—QUESTION 103
An investor sells a June 2008 call of ABC Limited with a strike price of USD 45 for USD 3 and buys a June 2008 call of ABC Limited with a strike price of USD 40 for USD 5. What is the name of this strategy and the maximum profit and loss the investor could incur?
A. Bear spread, maximum loss USD 2, maximum profit USD 3
B. Bull spread, maximum loss Unlimited, maximum profit USD 3
C. Bear spread, maximum loss USD 2, maximum profit unlimited
D. Bull spread, maximum loss USD 2, maximum profit USD 3

Example 6.6: FRM Exam 2007—Question 103
d. This position is graphed in Figure 6.6. It benefits from an increase in the price between 40 and 45, so it is a bull spread. The worst loss occurs below $K1 = 40$, when none of the options is exercised and the net lost premium is 5 – 3 = 2. The maximum profit occurs above $K2 = 45$, when the two options are exercised, for a net profit of $5 minus the lost premium, which gives $3.

109. EXAMPLE 6.7: FRM EXAM 2006—QUESTION 45
A portfolio manager wants to hedge his bond portfolio against changes in interest rates. He intends to buy a put option with a strike price below the portfolio's current price in order to protect against rising interest rates. He also wants to sell a call option with a strike price above the portfolio's current price in order to reduce the cost of buying the put option. What strategy is the manager using?
A. Bear spread
B. Strangle
C. Collar
D. Straddle

Example 6.7: FRM Exam 2006—Question 45

c. The manager is long a portfolio, which is protected by buying a put with low strike price and selling a call with higher strike price. This locks in a range of profits and losses and is a collar. If the strike prices were the same, the hedge would be perfect.

110. EXAMPLE 6.8: FRM EXAM 2002—QUESTION 42

Consider a bearish option strategy of buying one $50 strike put for $7, selling two $42 strike puts for $4 each, and buying one $37 put for $2. All options have the same maturity. Calculate the final profit (P/L) per share of the strategy if the underlying is trading at $33 at expiration.

A.   $1 per share
B.   $2 per share
C.   $3 per share
D.   $4 per share

Example 6.8: FRM Exam 2002—Question 42

b. Because the final price is below the lowest of the three strike prices, all the puts will be exercised. The final payoff is ($50 − $33) − 2($42 − $33) + ($37 − $33) = $17 − $18 + $4 = $3. From this, we have to deduct the up-front cost, which is −$7 + 2($4) − $2 = −$1. The total profit is then, ignoring the time value of money, $3 − $1 = $2 per share.

111. EXAMPLE 6.9: FRM EXAM 2003—QUESTION 72

Which of the following regarding option strategies is/are *not* correct?
I. A long strangle involves buying a call and a put with equal strike prices.
II. A *short* bull spread involves selling a call at lower strike price and buying another call at higher strike price.
III. Vertical spreads are formed by options with different maturities.
IV. A long butterfly spread is formed by buying two options at two different strike prices and selling another two options at the same strike price.

A.   I only
B.   I and III only
C.   I and II only
D.   III and IV only

Example 6.9: FRM Exam 2003—Question 72

b. A strangle involves two different strike prices, so I. is incorrect. A long bull spread involves buying a call and selling a call with $K1 < K2$; the short position is inverted, so that II. is correct. Options with different maturities are called horizontal spreads, so answer III. is incorrect. A long butterfly spread indeed involves options with three strike prices, so IV. is correct. Hence, I. and III. are incorrect, and answer b. is the (correct) solution.

112. EXAMPLE 6.10: FRM EXAM 2002—QUESTION 50

Given strictly positive interest rates, the best way to close out a long American call option position early (option written on a stock that pays no dividends) would be to

A. Exercise the call
B. Sell the call
C. Deliver the call
D. Do none of the above

Example 6.10: FRM Exam 2002—Question 50

b. When there is no dividend, there is never any reason to exercise an American call early. Instead, the option should be sold to another party.

113. EXAMPLE 6.11: FRM EXAM 2005—QUESTION 15

You have been asked to verify the pricing of a two-year European call option with a strike price of USD 45. You know that the initial stock price is USD 50, and the continuous risk-free rate is 3%. To verify the possible price range of this call, you consider using price bounds. What is the difference between the upper and lower bounds for that European call?

A. 0.00
B. 7.62
C. 42.38
D. 45.00

Example 6.11: FRM Exam 2005—Question 15

d. The upper bound is $S = 50$. The lower bound is $c \geq S - Ke^{-rT} = 50 - 45\exp(-0.03 \times 2) = 42.379$.

114. EXAMPLE 6.12: FRM EXAM 2005—QUESTION 40

Which of the following statements is *wrong*?

A. The Black–Scholes formula holds only in a risk-neutral world.
B. The futures price of a stock depends on the risk-free rate.
C. An American put option is generally priced higher than a similar Europeanput option.
D. Binomial trees can be used to price American options

Example 6.12: FRM Exam 2005—Question 40

a. The BS formula relies on a method called risk-neutral valuation but does apply to the real world. Otherwise, it would be useless.

115. EXAMPLE 6.13: FRM EXAM 2001—QUESTION 91

Using the Black–Scholes model, calculate the value of a European call option given the following information: Spot rate = 100; Strike price = 110; Riskfree rate = 10%; Time to expiry = 0.5 years; $N(d1) = 0.457185$; $N(d2) = 0.374163$.

A. $10.90
B. $9.51
C. $6.57
D. $4.92

Example 6.13: FRM Exam 2001—Question 91

c. We use Equation (6.14) assuming there is no income payment on the asset. This gives $c = SN(d1) - K \exp(-r\tau)N(d2) = 100 \times 0.457185 - 110 \exp(-0.1 \times 0.5) \times 0.374163 = \$6.568$.

116. EXAMPLE 6.14: PROBABILITY OF EXERCISE

In the Black–Scholes expression for a European call option the term used to compute option probability of exercise is

A. $d1$
B. $d2$
C. $N(d1)$
D. $N(d2)$

Example 6.14: Probability of Exercise

d. This is the term multiplying the present value of the strike price, by Equation(6.17).

117. EXAMPLE 6.15: FRM EXAM 2003—QUESTION 34

Which of the following options is strongly path-dependent?

A. An Asian option
B. A binary option
C. An American option
D. A European call option

Example 6.15: FRM Exam 2003—Question 34

a. The payoff of an Asian option depends on the average value of $S$ and thereforeis path-dependent.

118. EXAMPLE 6.16: FRM EXAM 2006—QUESTION 59

All else being equal, which of the following options would cost more than plain-vanilla options that are currently at-the-money?

I. Lookback options

II. Barrier options

III. Asian options

IV. Chooser option

A.   I only

B.   I and IV

C.   II and III

D.   I, III, and IV


Example 6.16: FRM Exam 2006—Question 59

b. Lookback options use the maximum stock price over the period, which must be more than the value at the end. Hence, they must be more valuable than regular European options. Chooser options involve an additional choice during the life of the option, and as a result are more valuable than regular options. Asian options involve the average, which is less volatile than the final price, so must be less expensive than regular options. Finally, barrier options can be structured so that the sum of two barrier options is equal to a regular option. Because each premium is positive, a barrier option must be less valuable than regular options.


119. EXAMPLE 6.17: FRM EXAM 2002—QUESTION 19

Of the following options, which one does *not* benefit from an increase in the stock price when the current stock price is $100 and the barrier has not yet been crossed:

A.   A down-and-out call with out barrier at $90 and strike at $110

B.   A down-and-in call with in barrier at $90 and strike at $110

C.   An up-and-in put with barrier at $110 and strike at $100

D.   An up-and-in call with barrier at $110 and strike at $100


Example 6.17: FRM Exam 2002—Question 19

b. A down-and-out call where the barrier has not been touched is still alive and hence benefits from an increase in $S$, so a. is incorrect. A down-and-in call only comes alive when the barrier is touched, so an increase in $S$ brings it away from the barrier. This is not favorable, so b. is correct. An up-and-in put would benefit from an increase in $S$ as this brings it closer to the barrier of $110, so c. is not correct. Finally, an up-and-in call would also benefit if $S$ gets closer to the barrier.


120. EXAMPLE 6.18: FRM EXAM 2006—QUESTION 86

Which of the following statements about American options is *incorrect*?

A.   American options can be exercised at any time until maturity.

B.   American options are always worth at least as much as European options.

C.   American options can easily be valued with Monte Carlo simulation.

D.   American options can be valued with binomial trees.

Example 6.18: FRM Exam 2006—Question 86

c. This statement is incorrect because Monte Carlo simulations are strictly backward-looking, and cannot take into account optimal future exercise, which a binomial tree can do

121. EXAMPLE 7.1: FRM EXAM 2003—QUESTION 95(Fixed-Income Securities)

With any other factors remaining unchanged, which of the following statements regarding bonds is *not* valid?

A.   The price of a callable bond increases when interest rates increase.

B.   Issuance of a callable bond is equivalent to a short position in a straight bond plus a long call option on the bond price.

C.   The put feature in a puttable bond lowers its yield compared with the yield of an equivalent straight bond.

D.   The price of an inverse floater decreases as interest rates increase..

Example 7.1: FRM Exam 2003—Question 95

a. Answer b. is valid because a short position in a callable bond is the same as a short position in a straight bond plus a long position in a call. (The issuer can call the bond back.) Answer c. is valid because a put is favorable for the investor, so lowers the yield. Answer d. is valid because an inverse floater has high duration.

122. EXAMPLE 7.2: CALLABLE BOND DURATION

A 10-year zero-coupon bond is callable annually at par (its face value) starting at the beginning of year six. Assume a flat yield curve of 10%. What is the bond duration?

A.   5 years

B.   7.5 years

C.   10 years

D.   Cannot be determined based on the data given

Example 7.2: Callable Bond Duration

c. Because this is a zero-coupon bond, it will always trade below par, and the call should never be exercised. Hence, its duration is the maturity, 10 years.

123. EXAMPLE 7.3: DURATION OF FLOATERS

A money markets desk holds a floating-rate note with an eight-year maturity. The interest rate is floating at three-month LIBOR rate, reset quarterly. The next reset is in one week. What is the approximate duration of the floatingrate

note?

A. 8 years

B. 4 years

C. 3 months

D. 1 week

Example 7.3: Duration of Floaters

d. Duration is not related to maturity when coupons are not fixed over the life of the investment. We know that at the next reset, the coupon on the FRN will be set at the prevailing rate. Hence, the market value of the note will be equal to par at that time. The duration or price risk is only related to the time to the next reset, which is one week here.

124. EXAMPLE 7.4: FRM EXAM 2007—QUESTION 32

The price of a three-year zero-coupon government bond is 85.16. The price of a similar four-year bond is 79.81. What is the one-year implied forward rate from year 3 to year 4?

A. 5.4%

B. 5.5%

C. 5.8%

D. 6.7%

Example 7.4: FRM Exam 2007—Question 32

d. The forward rate can be inferred from $P4 = P3/(1 + F3,4)$, or $(1 + R4)^4 = (1 + R3)^3(1 + F3,4)$. Solving, this gives $F3,4 = (85.16/79.81) - 1 = 0.067$.

125. EXAMPLE 7.5: FRM EXAM 1999—QUESTION 1

Suppose that the yield curve is upward sloping. Which of the following statements is *true*?

A. The forward rate yield curve is above the zero-coupon yield curve, which is above the coupon-bearing bond yield curve.

B. The forward rate yield curve is above the coupon-bearing bond yield curve, which is above the zero-coupon yield curve.

C. The coupon-bearing bond yield curve is above the zero-coupon yield curve, which is above the forward rate yield curve.

D. The coupon-bearing bond yield curve is above the forward rate yield curve, which is above the zero-coupon yield curve.

Example 7.5: FRM Exam 1999—Question 1

a. See Figures 7.3 and 7.4. The coupon yield curve is an average of the spot, zerocoupon curve, hence has to lie below the spot curve when it is upward-sloping. The forward curve can be interpreted as the spot curve plus the slope of the

spot curve. If the latter is upward-sloping, the forward curve has to be above the spot curve.

126. EXAMPLE 7.6: FRM EXAM 2004—QUESTION 61

According to the pure expectations hypothesis, which of the following statements is *correct* concerning the expectations of market participants in an upward-sloping yield curve environment?

A.   Interest rates will increase and the yield curve will flatten.
B.   Interest rates will increase and the yield curve will steepen.
C.   Interest rates will decrease and the yield curve will flatten.
D.   Interest rates will decrease and the yield curve will steepen.

Example 7.6: FRM Exam 2004—Question 61
a. An upward-sloping term structure implies forward rates higher than spot rates, or that short-term rates will increase. Because short-term rates increase more than long-term rates, this implies a flattening of the yield curve.

127. EXAMPLE 11.2: FRM EXAM 2007—QUESTION 50

A portfolio consists of two zero coupon bonds, each with a current value of $10. The first bond has a modified duration of one year and the second has a modified duration of nine years. The yield curve is flat, and all yields are 5%. Assume all moves of the yield curve are parallel shifts. Given that the daily volatility of the yield is 1%, which of the following is the best estimate of the portfolio daily VAR at the 95% confidence level?

A.   USD 1.65
B.   USD 2.33
C.   USD 1.16
D.   USD 0.82

Example 11.2: FRM Exam 2007—Question 50
a. The dollar duration of the portfolio is $1 \times \$10 + 9 \times \$10 = \$100$. Multiplied by 0.01 and 1.65, this gives $1.65.

128. EXAMPLE 11.4: FRM EXAM 2002—QUESTION 128

During 2002, an Argentinean pension fund with 80% of its assets in dollardenominated debt lost more than 40% of its value. Which of the followingreasons could explain all of the 40% loss:

A.   The assets were invested in a diversified portfolio of AAA firms in theU.S.
B.   The assets invested in local currency in Argentina lost all their value and the value of the dollar-denominated assets stayed constant.
C.   The dollar-denominated assets were invested in U.S. Treasury debt, but

the fund had bought credit protection on sovereign debt from Argentina.

D.  The fund had invested 80% of its funds in dollar-denominated sovereign debt from Argentina.

Example 11.4: FRM Exam 2002—Question 128

d. In 2001, Argentina defaulted on its debt, both in the local currency and in dollars. Answer a. is wrong because a diversified portfolio could not have lost so much. The funds were invested at 80% in dollar-denominated assets, so b. is wrong. Even a total wipeout of the local-currency portion could not explain a loss of 40% on the portfolio. If the fund had bought credit protection, it would have not lost as much, so c. is wrong. The fund must have had credit exposure to Argentina, so answer d. is correct.

129. Question 2-41(2008)

Which of the following would not cause an upward-sloping yield curve?

A.  An investor preference for short-term instruments
B.  An expected decline in interest rates
C.  An improving credit risk outlook
D.  An expected increase in the inflation rate

## Example 9.13: FRM Exam 2008—Question 2-41

b. An upward-sloping yield curve could be explained by a preference for short-term maturities (answer a.), which requires a higher long-term yield, so answer a. is not the correct choice. An upward-sloping yield curve could also be explained by expectations of higher interest rates or higher inflation (d.). Finally, improving credit conditions (c.) would reduce the cumulative probability of default and thus flatten the term structure. Only an expected decline in interest rates (b.) would *not* cause an upward-sloping yield curve.

130. EXAMPLE 8.1: FRM EXAM 2002—QUESTION 27(Fixed-Income Derivatives)

A long position in a FRA 2 × 5 is equivalent to the following positions in thespot market:

A.  Borrowing in two months to finance a five-month investment
B.  Borrowing in five months to finance a two-month investment
C.  Borrowing half a loan amount at two months and the remainder at fivemonths
D.  Borrowing in two months to finance a three-month investment

Example 8.1: FRM Exam 2002—Question 27

b. An FRA defined as $t1 \times t2$ involves a forward rate starting at time $t1$ and ending at time $t2$. The buyer of this FRA locks in a borrowing rate for months 3 to 5. This is equivalent to borrowing for five months and reinvesting the funds for the first two months.

131. EXAMPLE 8.2: FRM EXAM 2005—QUESTION 57

ABC, Inc., entered a forward rate agreement (FRA) to receive a rate of 3.75% with continuous compounding on a principal of USD 1 million between the end of year 1 and the end of year 2. The zero rates are 3.25% and 3.50% for one and two years. What is the value of the FRA when the deal is just entered?

A. USD 35,629

B. USD 34,965

C. USD 664

D. USD 0

Example 8.2: FRM Exam 2005—Question 57

d. The market-implied forward rate is given by $\exp(-R2 \times 2) = \exp(-R1 \times 1 - F1,2 \times 1)$, or $F1,2 = 2 \times 3.50 - 1 \times 3.25 = 3.75\%$. Given that this is exactly equal to the quoted rate, the value must be zero. If instead this rate was 3.50%, for example, the value would be $V = \$1,000,000 \times (3.75\% - 3.50\%) \times (2 - 1) \exp(-3.50\% \times 2) = 2,331$.

132. EXAMPLE 8.3: FRM EXAM 2001—QUESTION 70

Consider the buyer of a 6 × 9 FRA. The contract rate is 6.35% on a notional amount of $10 million. Calculate the settlement amount of the *seller* if the settlement rate is 6.85%. Assume a 30/360 day count basis.

A. −12,500

B. −12,290

C. +12,500

D. +12,290

Example 8.3: FRM Exam 2001—Question 70

b. The seller of an FRA agrees to receive fixed. Since rates are now higher than the contract rate, this contract must show a loss for the seller. The loss is $10,000,000 × (6.85% − 6.35%) × (90/360) = $12,500 when paid in arrears, i.e., in nine months. On the settlement date, i.e., brought forward by three months, the loss is $12,500/(1 + 6.85% × 0.25) = $12,290.

133. EXAMPLE 8.4: FRM EXAM 2005—QUESTION 49

John H., a portfolio manager, is shorting a U.S. Treasury bond futures contract and has decided to deliver. The quoted futures price is USD 95.5.

Among the four deliverable bonds, which is the cheapest-to-deliver?

| Bond | A | B | C | D |
|------|---|---|---|---|
| Quote | 125.69 90.31 87.6 128.56 | | | |

| Conversion Factor | 1.1979 0.8109 0.8352 1.2249 |
|---|---|

A. Bond A
B. Bond B
C. Bond C
D. Bond D

Example 8.4: FRM Exam 2005—Question 49
c. Compute the ratio of the price to the CF. This gives, respectively, 125.69/1.1979
= 11.29, then 12.87, 8.09, and 11.58. Hence, bond C is the cheapest-to-deliver.

134. EXAMPLE 8.5: FRM EXAM 2007—QUESTION 80
Consider an FRA (forward rate agreement) with the same maturity and
compounding frequency as a Eurodollar futures contract. The FRA has a
LIBOR underlying. Which of the following statements are true about the
relationship between the forward rate and the futures rate?
A. The forward rate is normally higher than the futures rate.
B. They have no fixed relationship.
C. The forward rate is normally lower than the futures rate.
D. They should be exactly the same.

Example 8.5: FRM Exam 2007—Question 80
c. Equation (8.4) shows that the futures rate exceeds the forward rate.

135. EXAMPLE 8.6: FRM EXAM 2005—QUESTION 51
You are given the following information about an interest rate swap: twoyear
term, semiannual payment, fixed rate = 6%, floating rate = LIBOR +
50 basis points, notional USD 10 million. Calculate the net coupon exchange
for the first period if LIBOR is 5% at the beginning of the period and 5.5%
at the end of the period.
A. Fixed-rate payer pays USD 0
B. Fixed-rate payer pays USD 25,000
C. Fixed-rate payer pays USD 50,000
D. Fixed-rate payer receives USD 25,000

Example 8.6: FRM Exam 2005—Question 51
b. The floating leg uses LIBOR at the beginning of the period, plus 50bp, or 5.5%.
The payment is given by $10,000,000 × (0.06 – 0.055) × 0.5 = $25,000.

136. EXAMPLE 8.7: FRM EXAM 2000—QUESTION 55
Bank One enters into a five-year swap contract with Mervin Co. to pay
LIBOR in return for a fixed 8% rate on a principal of $100 million. Two
years from now, the market rate on three-year swaps at LIBOR is 7%. At this

time Mervin Co. declares bankruptcy and defaults on its swap obligation.
Assume that the net payment is made only at the end of each year for the
swap contract period. What is the market value of the loss incurred by Bank
One as a result of the default?
A. $1.927 million
B. $2.245 million
C. $2.624 million
D. $3.011 million

Example 8.7: FRM Exam 2000—Question 55
c. Using Equation (8.9) for three remaining periods, we have the discounted value
of the net interest payment, or $(8\% - 7\%)\$100m = \$1m$, discounted at 7%, which
is $934,579 + $873,439 + $816,298 = $2,624,316.

137. EXAMPLE 8.8: FRM EXAM 2002—QUESTION 22
An interest rate cap runs for 12 months based on three-month Libor with a
strike price of 4%. Which of the following is generally *true*?
A. The cap consists of three caplet options with maturities of three months, the first one
starting today based on three-month LIBOR set in advance and paid in arrears.
B. The cap consists of four caplets starting today, based on LIBOR set in advance and paid
in arrears.
C. The implied volatility of each caplet will be identical no matter how the yield curve
moves.
D. Rate caps have only a single option based on the maturity of the structure.

Example 8.8: FRM Exam 2002—Question 22
a. Interest rate caps involve multiple options, or caplets. The first one has terms
that are set in three months. It locks in $Max[R(t + 3) - 4\%, 0]$. Payment occurs in
arrears in six months. The second one is a function of $Max[R(t + 6) - 4\%, 0]$. The
third is a function of $Max[R(t + 9) - 4\%, 0]$ and is paid at $t + 12$. The sequence
then stops because the cap has a term of 12 months only. This means there are
three caplets.

138. EXAMPLE 8.9: FRM EXAM 2004—QUESTION 10
The payoff to a swap where the investor receives fixed and pays floating can
be replicated by all of the following *except*
A. A short position in a portfolio of FRAs
B. A long position in a fixed rate bond and a short position in a floating rate bond
C. A short position in an interest rate cap and a long position in a floor
D. A long position in a floating rate note and a short position in a floor

Example 8.9: FRM Exam 2004—Question 10
d. A receive-fixed swap position is equivalent to being long a fixed-rate bond, or

being short a portfolio of FRAs (which gain if rates go down), or selling a cap and buying a floor with the same strike price (which gains if rates go up). A short position in a floor does not generate a gain if rates drop. It is asymmetric anyway.

139. EXAMPLE 8.10: FRM EXAM 2003—QUESTION 27

A portfolio management firm manages the fixed-rate corporate bond portfolio owned by a defined-benefit pension fund. The duration of the bond portfolio is five years; the duration of the pension fund's liabilities is seven years. Assume that the fund sponsor strongly believes that rates will decline over the next six months and is concerned about the duration mismatch between portfolio assets and pension liabilities. Which of the following strategies would be the best way to eliminate the duration mismatch?

A. Enter into a swap transaction in which the firm pays fixed and receivesfloating.

B. Enter into a swap transaction in which the firm receives fixed and paysfloating.

C. Purchase an interest rate cap expiring in six months

D. Sell Eurodollar futures contracts.

Example 8.10: FRM Exam 2003—Question 27

b. The manager should increase the duration of assets, or buy coupon-paying bonds. This can be achieved by entering a receive-fixed swap, so b. is correct and a. is wrong. Buying a cap will not provide protection if rates drop. Selling Eurodollar futures will lose money if rates drop.

140. EXAMPLE 8.11: FRM EXAM 2003—QUESTION 56

As your company's risk manager, you are looking for protection against adverse interest rate changes in five years. Using Black's model for options on futures to price a European swap option (swaption) which gives the option holder the right to cancel a seven-year swap after five years, which of the following would you use in the model?

A. The two-year forward par swap rate starting in five years time

B. The five-year forward par swap rate starting in two years time

C. The two-year par swap rate

D. The five-year par swap rate

Example 8.11: FRM Exam 2003—Question 56

a. The forward rate should start at the beginning of the option in five years, with a maturity equal to the duration of the option, or two years.

141. EXAMPLE 8.12: FRM EXAM 2007—QUESTION 95

To hedge against future, unanticipated, and significant increases in borrowing rates, which of the following alternatives offers the greatest flexibility for the

borrower?

A. Interest rate collar
B. Fixed for floating swap
C. Call swaption
D. Interest rate floor

Example 8.12: FRM Exam 2007—Question 95

c. A swaption gives the borrower the flexibility to lock in a low rate. On the other hand, a regular swap does not offer flexibility as an option. A collar fixes a range of rates, but not much flexibility. A floor involves protection if rates go down, not up. (Note that buying a cap would have been another good choice.)

142. EXAMPLE 9.4: FRM EXAM 2000—QUESTION 12(Equity,Currency,and Commodity Markets)
Suppose the price for a six-month S&P index futures contract is 552.3. If the risk-free interest rate is 7.5% per year and the dividend yield on the stock index is 4.2% per year, and the market is complete and there is no arbitrage, what is the price of the index today?

A. 543.26
B. 552.11
C. 555.78
D. 560.02

Example 9.4: FRM Exam 2000—Question 12

a. This is the cash-and-carry relationship, solved for $S$. We have $Se^{-y\tau} = Fe^{-r\tau}$, or $S = 552.3 \times \exp(-7.5/200)/\exp(-4.2/200) = 543.26$. We verify that the forward price is greater than the spot price since the dividend yield is less than the risk-free rate.

143. The current spot CHF/USD rate is 1.3680CHF. The three-month USD interest rate is 1.05%, the three-month Swiss interest rate is 0.35%, both continuously compounded and per annum. A currency trader notices that the three-month forward price is USD 0.7350. In order to arbitrage, the trader should

A. Borrow CHF, buy USD spot, go long Swiss franc forward
B. Borrow CHF, sell Swiss franc spot, go short Swiss franc forward
C. Borrow USD, buy Swiss franc spot, go short Swiss franc forward
D. Borrow USD, sell USD spot, go long Swiss franc forward

Example 9.5: FRM Exam 2003—Question 2

c. For consistency, translate the spot rate in dollars, $S = 0.7310$. The CHF interest rate is lower than the USD rate, so the CHF must be selling at a forward

premium. The fair forward price is $F = S \exp((r - r^*)\tau) = 0.7310 \exp((0.0105 - 0.0035) \, 0.25) = 0.7323$. Because this is less than the observed price of 0.7350, we sell at the expensive forward price and borrow USD, buy CHF spot, invest in CHF. At maturity, we liquidate the CHF investment to satisfy the forward sale into dollars, repay the loan, and make a tidy profit.

144. EXAMPLE 9.6: FRM EXAM 2004—QUESTION 54

Which of the following statements is correct when comparing the differencesbetween an interest rate swap and a currency swap?

A. At maturity, there is no exchange of principal between the counterpartiesin interest rate swaps and there is an exchange of principal in currencyswaps.

B. At maturity, there is no exchange of principal between the counterpartiesin currency swaps and there is an exchange of principle in interest rateswaps.

C. The counterparties in a interest rate swap need to consider fluctuationsin exchange rates, while currency swap counterparties are only exposedto fluctuations in interest rates.

D. Currency swap counterparties are exposed to less counterparty creditrisk due to the offsetting effect of currency and interest rate risk in thetransaction.

Example 9.6: FRM Exam 2004—Question 54
a. Because payments on currency swaps are in different currencies, they cannot be netted.

145. EXAMPLE 9.7: FRM EXAM 2006—QUESTION 88

You have entered into a currency swap in which you receive 4%pa in yen and pay 6%pa in dollars once a year. The principals are 1,000 million yen and 10 million dollars. The swap will last for another two years, and the current exchange rate is 115 yen/$. The annualized spot rates (with continuous compounding) are 2.00% and 2.50% in yen for one- and twoyear maturities, and 4.50% and 4.75% in dollars. What is the value of the swap to you in million dollars?

A. −1.270

B. −0.447

C. 0.447

D. 1.270

Example 9.7: FRM Exam 2006—Question 88
a. The net present values of the payoffs in two currencies are described in the next table. As a result, the value of the currency swap is given by the dollar value of

a long position in the yen bond minus a position in the dollar bond, or (1/115)
1,000(102.85/100) − 10(102.13/100) = $8.943 − $10.213 = −$1.270.

| t | Yen | USD |
| --- | --- | --- |
| | Rate CF NPV | Rate CF NPV |
| 1 | 2.00% 4 3.92 | 4.50% 6 5.74 |
| 2 | 2.50% 104 98.93 | 4.75% 106 96.39 |
| sum | 102.85 | 102.13 |

146. EXAMPLE 9.8: FRM EXAM 2007—QUESTION 87
    Your company is expecting a major export order from a London-based
    client. The receivables under the contract are to be billed in GBP, while your
    reporting currency is USD. Since the order is a large sum, your company does
    not want to bear the exchange risk and wishes to hedge it using derivatives.
    To minimize the cost of hedging, which of the following is the most suitable
    contract?
    A.   A chooser option for GBP/USD pair
    B.   A currency swap where you pay fixed in USD and receive floating in GBP
    C.   A barrier put option to sell GBP against USD
    D.   An Asian call option on GBP against USD

    Example 9.8: FRM Exam 2007—Question 87
    c. A cross-currency swap is inappropriate because there is no stream of payment
    but just one. Also, one would want to pay GBP, not receive it. An Asian option
    is generally cheap, but this should be a put option, not a call. Among the two
    remaining choices, the chooser option is more expensive because it involves a call
    and put.

147. Question 2-30(2008)
    If the lease rate of commodity A is less than the risk-free rate, what is the market structure
    of commodity A?
    A.   Backwardation
    B.   Contango
    C.   Flat
    D.   Inversion

### Example 11.8: FRM Exam 2008—Question 2-30

b. If the lease rate is, for example, zero, the futures price must be greater than the
spot price, which describes a contango.

148. EXAMPLE 9.9: FRM EXAM 2007—QUESTION 29

On January 1, a risk manager observes that the one-year continuously compoundedinterest rate is 5% and storage costs of a commodity product A isUSD 0.05 per quarter (payable at each quarter end). He further observes thefollowing forward prices for product A: March, 5.35; June, 5.90; September,5.30; December, 5.22. Given the following explanation of supply anddemand for this product, how would you best describe its forward pricecurve from June to December?

A.  Backwardation as the supply of product A is expected to decline aftersummer
B.  Contango as the supply of product A is expected to decline after summer
C.  Contango as there is excess demand for product A in early summer
D.  Backwardation as there is excess demand for product A in early summer

Example 9.9: FRM Exam 2007—Question 29
d. From June to December, prices go down, which is backwardation. June prices are abnormally high because of excess demand, which pushes prices up.


149. EXAMPLE 9.10: FRM EXAM 2007—QUESTION 30

Continuing with the previous question, what is the annualized rate of return earned on a cash-and-carry trade entered into in March and closed out inJune?

A.  9.8%
B.  8.9%
C.  39.1%
D.  35.7%

Example 9.10: FRM Exam 2007—Question 30
d. The trade involves now going long a March contract and short a June contract. In practice, this means taking delivery of the commodity and holding it for three months until resale in June. The final payout is 5.90 – 0.05 on a base of 5.35. This gives an annualized rate of return of $r = 4 \ln(5.85/5.35) = 35.7\%$.


150. EXAMPLE 9.11: FRM EXAM 2004—QUESTION 5

Which of the following causes led MGRM into severe financial distress?
I. There was a mismatch of cash flows from hedge and physical transactions.
II. MGRM failed to consider hedging market risk from fixed price physical sales contracts.
III. MGRM held a great percentage of the total open interest on the NYMEX.
IV. The futures market went from backwardation to contango.

A.  I and III
B.  I and IV
C.  I, III, and IV
D.  II, III and IV

Example 9.11: FRM Exam 2003—Question 5

c.MGRMdid consider hedging itsOTCcontracts with futures but was hit with liquidity
risk as the long futures positions lost money due to the move into contango.
In addition, the positions were very large, which led to losses on the unwinding
of the hedges.

151. Question 4-16(2008)

In late 1993, MGRM reported losses of about $1.3 billion in connection with the
implementation of a hedging strategy in the oil futures market. In 1992, the company had
begun a new strategy to sell petroleum to independent retailers at fixed prices above the
prevailing market price for periods of up to 10 years. At the same time, MGRM implemented
a hedging strategy using a large number of short-term derivative contracts such as swaps
and futures on crude oil. This led to a timing (maturity) mismatch between the short-term
hedges and the long-term liability. Unfortunately, the company suffered significant losses
with its hedging strategy when oil market conditions abruptly changed to:

A.   Contango, which occurs when the futures price is above the spot price
B.   Contango, which occurs when the futures price is below the spot price
C.   Normal backwardation, which occurs when the futures price is above the spot price
D.   Normal backwardation, which occurs when the futures price is below the spot price

**Example 11.11: FRM Exam 2008—Question 4-16**

a. MGRM had purchased oil in short-term futures market as a hedge against
the long-term sales. The long futures positions lost money due to the move into
contango, which involves the spot price falling below longer-term prices.

152. EXAMPLE 11.5: FRM EXAM 2006—QUESTION 115

Assume the risk-free rate is 5% per annum, the cost of storing oil for a year
is 1% per annum, the convenience yield for owning oil for a year is 2%
per annum, and the current price of oil is USD 50 per barrel. All rates are
continuously compounded. What is the forward price of oil in a year?

A.   USD 49.01
B.   USD 52.04
C.   USD 47.56
D.   USD 49.50

Example 11.5: FRM Exam 2006—Question 115

b. Using $Fte^{-r\tau} = Ste^{-y\tau}$, we have $F = S \exp(-(y - c)\tau + r\tau) = 50 \exp(-(0.02 -$

$0.01) + 0.05) = 52.04$.

153. EXAMPLE 11.6: FRM EXAM 2006—QUESTION 138

Imagine a stack-and-roll hedge of monthly commodity deliveries that you continue for the next five years. Assume the hedge ratio is adjusted to take into effect the mistiming of cash flows but is not adjusted for the basis risk of the hedge. In which of the following situations is your calendar basis risk likely to be greatest?

A. Stack-and-roll in the front month in oil futures
B. Stack-and-roll in the 12-month contract in natural gas futures
C. Stack-and-roll in the three-year contract in gold futures
D. All four situations will have the same basis risk

Example 11.6: FRM Exam 2006—Question 138

a. For gold, forward rates closely follow spot rates, so there is little basis risk. For oil and natural gas, there is most movement at the short end of the term structure of futures prices. So using short maturities, or the front month, has the greatest basis risk.

# Part Four    Valuation and Risk Models

154. EXAMPLE 10.1: FRM EXAM 2005—QUESTION 32    (Introduction to Risk Models)

Which of the following statements about trader limits are *correct*?

I. Stop-loss limits are useful if markets are trending.

II. Exposure limits do not allow for diversification.

III. VAR limits are not susceptible to arbitrage.

IV. Stop-loss limits are effective in preventing losses.

A. I and II
B. III and IV
C. I and III
D. II and IV

Example 10.1: FRM Exam 2005—Question 32

a. Stop-loss limits cut down the positions after a loss is incurred, which is useful if market are trending. Exposure limits do not allow for diversification because correlations are not considered. VAR limits can be arbitraged, especially with weak VAR models. Finally, stop-loss limits are put in place after losses are incurred, so cannot prevent losses. As a result, statement I. and II. are correct.

155. EXAMPLE 10.2: FRM EXAM 2005—QUESTION 43

The 10-Q report of ABC Bank states that the monthly VAR of ABC Bank isUSD 10 million at 95% confidence level. What is the proper interpretationof this statement?

A. If we collect 100 monthly gain/loss data of ABC Bank, we will alwayssee five months with losses larger than $10m.

B. There is a 95% probability that the bank will lose less than $10m overa month.

C. There is a 5% probability that the bank will gain less than $10m eachmonth.

D. There is a 5% probability that the bank will lose less than $10m over amonth.

Example 10.2: FRM Exam 2005—Question 43

b. VAR is the worst loss, such that there is a 95% probability that the losses will be less severe. Alternatively, there is a 5% probability that the loss will be worse. So b. is correct. Answer d. says "lose less" and therefore is incorrect.

156. EXAMPLE 10.5: FRM EXAM 2003—QUESTION 5

Given the following 30 ordered percentage returns of an asset, calculatethe VAR and expected shortfall at a 90% confidence level: −16,−14,−10,−7,−7,−5,−4,−4,−4,−3,−1,−1, 0, 0, 0, 1, 2, 2, 4, 6, 7, 8, 9, 11,12, 12, 14, 18, 21, 23.

A. VAR (90%) = 10, expected shortfall = 14

B. VAR (90%) = 10, expected shortfall = 15

C. VAR (90%) = 14, expected shortfall = 15

D. VAR (90%) = 18, expected shortfall = 22

Example 10.5: FRM Exam 2003—Question 5

b. The 10% lower cutoff point is the third lowest observation, which is VAR = 10. The expected shortfall is then the average of the observations in the tails, which is 15.

157. Question 4-4(2009) ( VALUATION AND RISK MODELS)

Worse-than-VAR scenarios are defined as scenarios that lead to losses in the extreme left tail of the return distribution equal to or exceeding VAR at a given level of confidence. Which of the following statements is an accurate description of VAR?

A. VAR is the average of the worse-than-VAR scenario returns.

B. VAR is the standard deviation of the worse-than-VAR scenario returns.

C. VAR is the most pessimistic scenario return (maximum loss) from the worse-than-VAR scenarios.

D. VAR is the most optimistic scenario return (minimum loss) from the worse-than-VAR scenarios.

158. Question 2-2(2008)

Assume that the P&L distribution of a liquid asset is i.i.d. normally distributed. The position has a one-day VAR at the 95% confidence level of $100,000. Estimate the 10-day VAR of the same position at the 99% confidence level.

A. $1,000,000

B. $450,000

C. $320,000

D. $220,000

159. Question 4-3(2009) (VALUATION AND RISK MODELS)

Assume that portfolio daily returns are independent and identically normally distributed. Sam Neil, a new quantitative analyst, has been asked by the portfolio manager to calculate portfolio VARs over 10, 15, 20, and 25 days. The portfolio manager notices something amiss with Sam's calculations, displayed here. Which one of the following VARs on this portfolio is inconsistent with the others?

A. VAR(10-day) = USD 316M

B. VAR(15-day) = USD 465M

C. VAR(20-day) = USD 537M

D. VAR(25-day) = USD 600M

160. Question 2-29(2008)

Which of the following statements about stress testing are *true*?

I. Stress testing can complement VAR estimation in helping risk managers identify crucial vulnerabilities in a portfolio.

II. Stress testing allows users to include scenarios that did not occur in the lookback

horizon of the VAR data but are nonetheless possible.

III. A drawback of stress testing is that it is highly subjective.

IV. The inclusion of a large number of scenarios helps management better understand the risk exposure of a portfolio.

A. I and II only.

B. III and IV only.

C. I, II, and III only.

D. I, II, III, and IV.

## Example 12.9: FRM Exam 2008—Question 2-29

c. All the statements are correct except IV., because too many scenarios will make it more difficult to interpret the risk exposure.

161. EXAMPLE 10.11: FRM EXAM 2006—QUESTION 87

Which of the following is true about stress-testing?

A. It is used to evaluate the potential impact on portfolio values of unlikely,although plausible, events or movements in a set of financial variables.

B. It is a risk management tool that directly compares predicted results toobserved actual results. Predicted values are also compared with historicaldata.

C. Both a. and b. above are true.

D. None of the above are true.

Example 10.11: FRM Exam 2006—Question 87

a. Stress-testing is indeed used to evaluate the effect of extreme events. Answer b. is about backtesting, not stress-testing.

162. Question 2-18(2008)

John Flag, the manager of a $150 million distressed bond portfolio, conducts stress tests on the portfolio. The portfolio's annualized return is 12%, with an annualized return volatility of 25%. In the past two years, the portfolio encountered several days when the daily value change of the portfolio was more than 3 standard deviations. If the portfolio would suffer a 4-sigma daily event, estimate the change in the value of this portfolio.

A. $9.48 million

B. $23.70 million

C. $37.50 million

D. $150 million

## Example 12.11: FRM Exam 2008—Question 2-18

a. First, we transform the volatility into a daily measure, which is $25\%/\sqrt{252} = 1.57\%$. Multiplying, we get $150 \times 1.57\% \times 4 = \$9.45$.

163. EXAMPLE 15.1: FRM EXAM 2004—QUESTION 60

Which of the following methodologies would be most appropriate for stress
testing your portfolio?

A. Delta–gamma valuation
B. Full revaluation
C. Marked to market
D. Delta–normal VAR

Example 15.1: FRM Exam 2004—Question 60

b. By definition, stress-testing involves large movements in the risk factors. This
requires a full revaluation of the portfolio.


164. EXAMPLE 12.1: FRM EXAM 2000—QUESTION 79

Under which scenario is basis risk likely to exist?

A. A hedge (which was initially matched to the maturity of the underlying)is lifted before
expiration.
B. The correlation of the underlying and the hedge vehicle is less than oneand their
volatilities are unequal.
C. The underlying instrument and the hedge vehicle are dissimilar.
D. All of the above are correct.

Example 12.1: FRM Exam 2000—Question 79

d. Basis risk occurs if movements in the value of the cash and hedged positions do
not offset each other perfectly. This can happen if the instruments are dissimilar
or if the correlation is not unity. Even with similar instruments, if the hedge is
lifted before the maturity of the underlying, there is some basis risk.


165. EXAMPLE 12.2: FRM EXAM 2007—QUESTION 99

Which of the following trade(s) contain mainly basis risk?

I. Long 1,000 lots Nov 07 ICE Brent Oil contracts and short 1,000 lots Nov
07 NYMEX WTI Crude Oil contracts

II. Long 1,000 lots Nov 07 ICE Brent Oil contracts and long 2,000 lots Nov
07 ICE Brent Oil at-the-money put

III. Long 1,000 lots Nov 07 ICE Brent Oil contracts and short 1,000 lots Dec
07 ICE Brent Oil contracts

IV. Long 1,000 lots Nov 07 ICE Brent Oil contracts and short 1,000 lots Dec
07  YMEX WTI Crude Oil contracts

A. II and IV only
B. I and III only
C. I, III, and IV only

D.  III and IV only

Example 12.2: FRM Exam 2007—Question 99
c. There is mainly basis risk for positions that are both long and short either different months or contracts. Position II) is long twice the same contract and thus has no basis risk (but a lot of directional risk).

166. Question 3-14(2009)     (VALUATION AND RISK MODELS)

Mary has IBM stock and will sell it two months from now at a specified date in the middle of the month. Mary would like to hedge the price of risk of IBM stock. How could she best hedge the IBM stock without incurring basis risk?

   A.  Short a two-month forward contract on IBM stock
   B.  Short a three-month futures contract on IBM stock
   C.  Short a two-month forward contract on the S&P 500 index
   D.  Answers a. and b. are correct.
   E.

## Example 13.2: FRM Exam 2009—Question 3-14

a. Basis risk is minimized when the maturity of the hedging instrument coincides with the horizon of the hedge (i.e., two months) and when the hedging instrument is exposed to the same risk factor (i.e., IBM).

167. Question 3-15(2009)     (VALUATION AND RISK MODELS)

Which of the following statements is/are *true* with respect to basis risk?

I.  Basis risk arises in cross-hedging strategies, but there is no basis risk when the underlying asset and hedge asset are identical.
II.  A short hedge position benefits from unexpected strengthening of basis.
III.  A long hedge position benefits from unexpected strengthening of basis.

   A.  I and II
   B.  I and III
   C.  II only
   D.  III only

c. Basis risk can arise if the maturities are different, so answer I. is incorrect. A short hedge position is long the basis, which means that it benefits when the basis strengthens, because this means that the futures price drops relative to the spot price, which generates a profit.

168. EXAMPLE 12.3: FRM EXAM 2001—QUESTION 86

If two securities have the same volatility and a correlation equal to −0.5, their minimum variance hedge ratio is

A. 1:1
B. 2:1
C. 4:1
D. 16:1

Example 12.3: FRM Exam 2001—Question 86

b. Set $x$ as the amount to invest in the second security, relative to that in the first (or the hedge ratio). The variance is then proportional to $1 + x2 + 2xp$. Taking the derivative and setting to zero, we have $x = -rho = 0.5$. Thus, one security must have twice the amount in the other. Alternatively, the hedge ratio is given by

$N* = -\rho \frac{\sigma_s}{\sigma_f}$, which gives 0.5. Answer b. is the only one which is consistent with

this number or its inverse.

169. EXAMPLE 12.4: FRM EXAM 2007—QUESTION 125

A firm is going to buy 10,000 barrels of West Texas Intermediate Crude Oil. It plans to hedge the purchase using the Brent Crude Oil futures contract. The correlation between the spot and futures prices is 0.72. The volatility of the spot price is 0.35 per year. The volatility of the Brent Crude Oil futures price is 0.27 per year. What is the hedge ratio for the firm?

A. 0.9333
B. 0.5554
C. 0.8198
D. 1.2099

Example 12.4: FRM Exam 2007—Question 125

a. The optimal hedge ratio is $\beta s f = -\rho \frac{\sigma_s}{\sigma_f} = 0.72 \times 0.35/0.27 = 0.933$.

170. Question 3-26(2009)    (VALUATION AND RISK MODELS)

XYZ Co. is a gold producer and will sell 10,000 ounces of gold in three months at the prevailing market price at that time. The standard deviation of the change in the price of gold over a three-month period is 3.6%. In order to hedge its price exposure, XYZ Co. decides to use gold futures to hedge. The contract size of each gold futures contract is 10 ounces. The standard deviation of the gold futures price is 4.2%. The correlation between quarterly changes in the futures price and the spot price of gold is 0.86. To hedge its price exposure, how many futures contracts should XYZ Co. go long or short?

    A.    Short 632 contracts

    B.    Short 737 contracts

    C.    Long 632 contracts

    D.    Long 737 contracts

## Example 13.7: FRM Exam 2009—Question 3-26

b. XYZ will incur a loss if the price of gold falls, so should short futures as a hedge. The optimal hedge ratio is $\rho\sigma_s/\sigma_f = 0.86 \times 3.6/4.2 = 0.737$. Taking into account the size of the position, the number of contracts to sell is $0.737 \times 10,000/10 = 737$.

171. EXAMPLE 12.6: FRM EXAM 2007—QUESTION 17

On June 2, a fund manager with USD 10 million invested in governmentbonds is concerned that interest rates will be highly volatile over the nextthree months. The manager decides to use the September Treasury bondfutures contract to hedge the portfolio. The current futures price is USD95.0625. Each contract is for the delivery of USD 100,000 face value ofbonds. The duration of the manager's bond portfolio in three months will be7.8 years. ThEcheapest-to-deliver bond in the Treasury bond futures contractis expected to have a duration of 8.4 years at maturity of the contract. Atthe maturity of the Treasury bond futures contract, the duration of theunderlying benchmark Treasury bond is nine years. What position shouldthe fund manager undertake to mitigate his interest rate risk exposure?

A.    Short 94 contracts

B.    Short 98 contracts

C.    Short 105 contracts

D.    Short 113 contracts

Example 12.6: FRM Exam 2007—Question 17

b. The number of contracts to short is $N* = -\dfrac{D_s^* S}{D_F^* B} = -(7.8 \times 10{,}000{,}000)/$

$(8.4 \times (95.0625) \times 1{,}000) = -97.7$, or 98 contracts. Note that the relevant duration for the futures is that of the CTD; other numbers are irrelevant.

172. EXAMPLE 12.7: DURATION HEDGING

What assumptions does a duration-based hedging scheme make about the way in which interest rates move?

A. All interest rates change by the same amount.
B. A small parallel shift occurs in the yield curve.
C. Any parallel shift occurs in the term structure.
D. Interest rates movements are highly correlated.

Example 12.7: Duration Hedging
b. The assumption is that of (1) parallel and (2) small moves in the yield curve. Answers a. and c. are the same, and omit the size of the move. Answer d. would require perfect, not high, correlation plus small moves.

173. EXAMPLE 12.8: HEDGING WITH EURODOLLAR FUTURES

If all spot interest rates are increased by one basis point, a value of a portfolio of swaps will increase by $1,100. How many Eurodollar futures contracts are needed to hedge the portfolio?

A. 44
B. 22
C. 11
D. 1,100

Example 12.8: Hedging with Eurodollar Futures
a. The DVBP of the portfolio is $1100. That of the futures is $25. Hence the ratio is 1100/25 = 44.

174. EXAMPLE 12.9: FRM EXAM 2004—QUESTION 4

Albert Henri is the fixed-income manager of a large Canadian pension fund.The present value of the pension fund's portfolio of assets is CAD 4 billionwhile the expected present value of the fund's liabilities is CAD 5 billion.The respective modified durations are 8.254 and 6.825 years. The fundcurrently has an actuarial deficit (assets < liabilities) and Albert must avoidwidening this gap. There are currently two scenarios for the yield curve:the first scenario is an upward shift of 25 bps, with the second scenario adownward shift of 25 bps.

The most liquid interest rate futures contract hasa present value of CAD 68,336 and a duration of 2.1468 years. Analyzingboth scenarios separately, what should Albert Henry do to avoid wideningthe pension fund gap? Choose the best option.

**First Scenario Second Scenario**

A. Do nothing. Buy 7,559 contracts.
B. Do nothing. Sell 7,559 contracts.
C. Buy 7,559 contracts. Do nothing.
D. Do nothing. Do nothing.

Example 12.9: FRM Exam 2004—Question 4

a. We first have to compute the dollar duration of assets and liabilities, which gives, in millions, $4{,}000 \times 8.254 = 33{,}016$ and $5{,}000 \times 6.825 = 34{,}125$, respectively. Because the DD of liabilities exceeds that of assets, a decrease in rates will increase the liabilities more than the assets, leading to a worsening deficit. Mr. Henri needs to buy interest rate futures as an offset. The number of contracts is $(34{,}125 - 33{,}016)/(68{,}336 \times 2.1468/1{,}000{,}000) = 7{,}559$.

175. Question 3-10    (VALUATION AND RISK MODELS)

You have a portfolio of USD 5 million to be hedged using index futures. The correlation coefficient between the portfolio and futures being used is 0.65. The standard deviation of the portfolio is 7% and that of the hedging instrument is 6%. The futures price of the index futures is USD 1,500 and one contract size is 100 futures. Among the following positions, which one reduces risk the most?

A. Long 33 futures contracts
B. Short 33 futures contracts
C. Long 25 futures contracts
D. Short 25 futures contracts

## Example 13.12: FRM Exam 2009—Question 3-10

d. To hedge, the portfolio manager should sell index futures, to create a profit if the portfolio loses value. The portfolio beta is $0.65 \times (7\%/6\%) = 0.758$. The number of contracts is $N^* = -\beta S/F = -(0.758 \times 5{,}000{,}000)/(1{,}500 \times 100) = -25.3$, or 25 contracts.

176. EXAMPLE 12.10: FRM EXAM 2005—QUESTION 97

Suppose that the benchmark for an equity portfolio of USD 12 million is theS&P 500. Alsosuppose the current value of the S&P 500 is 1,040 and theportfolio beta relative to the S&P 500 is 1.4. If the portfolio manager wantsto completely hedge the portfolio over the next three months using the S&P500 index futures (that has a multiplier of 250), which of

the following is

the correct hedging strategy?

A.  Long 46 contracts

B.  Short 46 contracts

C.  Long 65 contracts

D.  Short 65 contracts

Example 12.10: FRM Exam 2005—Question 97

d. To hedge, the portfolio manager should sell index futures, to create a profitif the

portfolio loses value. The number of contracts is $N^* = -\beta S/F = -(1.4 \times 12,000,000)/(1,400 \times$

$250) = -64.6$, or 65 contracts.

177. EXAMPLE 12.11: FRM EXAM 2007—QUESTION 107

The current value of the S&P 500 index is 1,457, and each S&P futurescontract is for delivery of 250 times the index. A long-only equity portfoliowith market value of USD 300,100,000 has beta of 1.1. To reduce theportfolio beta to 0.75, how many S&P futures contract should you sell?

A.  288 contracts

B.  618 contracts

C.  906 contracts

D.  574 contracts

Example 12.11: FRM Exam 2007—Question 107

a. This is as in the previous question, but the hedge is partial, i.e. for a change

of 1.10 to 0.75. So, $N^* = -\beta S/F = -(1.10 - 0.75)300,100,000/(1457 \times 250) = -288.3$ contracts

178. EXAMPLE 13.1: FRM EXAM 2006—QUESTION 91

The dividend yield of an asset is 10% per annum. What is the delta of a long forward contract on the asset with 6 months to maturity?

A.  0.95

B.  1.00

C.  1.05

D.  Cannot determine without additional information

Example 13.1: FRM Exam 2006—Question 91

a. The delta of a long forward contract is $e^{-r\tau} = \exp(-0.10 \times 0.5) = 0.95$.

179. EXAMPLE 13.2: FRM EXAM 2004—QUESTION 21

A 90-day European put option on Microsoft has an exercise price of $30.The current market price for Microsoft is $30. The delta for this option isclose to

A.   −1
B.   −0.5
C.   0.5
D.   1

Example 13.2: FRM Exam 2004—Question 21

b. The option is ATM because the strike price is close to the spot price. This is a put, so the delta must be close to −0.5.

180. EXAMPLE 13.3: FRM EXAM 2006—QUESTION 80

You are given the following information about a European call option: Time to maturity=two years; continuous risk-free rate=4%; continuous dividend yield = 1%; N(d1) = 0.64. Calculate the delta of this option.

A.   −0.64
B.   0.36
C.   0.63
D.   0.64

Example 13.3: FRM Exam 2006—Question 80

c. This is a call option, so delta must be positive. This is given by $\_ = \exp(-r * \tau)N(d1) =$

$\exp(-0.01 \times 2) \times 0.64 = 0.63$.

181. Question 4-27

An analyst is doing a study on the effect on option prices of changes in the price of the underlying asset. The analyst wants to find out when the deltas of calls and puts are most sensitive to changes in the price of the underlying. Assume that the options are European and that the Black-Scholes formula holds. An increase in the price of the underlying has the largest absolute value impact on delta for:

   A.   Calls deep in-the-money and puts deep out-of-the-money
   B.   Deep in-the-money puts and calls
   C.   Deep out-of-the-money puts and calls
   D.   At-the-money puts and calls

d. From Figure 14.3, the delta is most sensitive, or gamma the highest, for ATM short-term options. Under the BS model, gamma is the same for calls and puts.

182. EXAMPLE 13.5: FRM EXAM 2001—QUESTION 79

A bank has sold USD 300,000 of call options on 100,000 equities. Theequities trade at 50, the option strike price is 49, the maturity is in threemonths, volatility is 20%, and the interest rate is 5%. How does the bank
delta hedge?
A.   Buy 65,000 shares
B.   Buy 100,000 shares
C.   Buy 21,000 shares
D.   Sell 100,000 shares

Example 13.5: FRM Exam 2001—Question 79
a. This is an at-the-money option with a delta of about 0.5. Since the bank sold calls, it needs to delta-hedge by buying the shares. With a delta of 0.54, it would need to buy approximately 50,000 shares. Answer a. is the closest. Note that most other information is superfluous.

183. EXAMPLE 13.6: FRM EXAM 2006—QUESTION 106

Suppose an existing short option position is delta-neutral, but has a gamma of −600. Also assume that there exists a traded option with a delta of 0.75 and a gamma of 1.50. In order to maintain the position gamma-neutral and delta-neutral, which of the following is the appropriate strategy to implement?
A.   Buy 400 options and sell 300 shares of the underlying asset.
B.   Buy 300 options and sell 400 shares of the underlying asset.
C.   Sell 400 options and buy 300 shares of the underlying asset.
D.   Sell 300 options and buy 400 shares of the underlying asset.

Example 13.6: FRM Exam 2006—Question 106
a. Because gamma is negative, we need to buy a call to increase the portfolio gamma back to zero. The number is $600/1.5 = 400$ calls. This, however, will increase the delta from zero to $400 \times 0.75 = 300$. Hence, we must sell 300 shares to bring back the delta to zero. Note that positions in shares have zero gamma.

184. EXAMPLE 13.7: FRM EXAM 2004—QUESTION 65

Which of the following statements is *true* regarding options' Greeks?

A. Theta tends to be large and positive when buying at-the-money options.
B. Gamma is greatest for in-the-money options with long maturities.
C. Vega is greatest for at-the-money options with long maturities.
D. Delta of deep in-the-money put options tends towards +1.


Example 13.7: FRM Exam 2004—Question 65
c. Theta is negative for long positions in ATM options, so a. is incorrect. Gamma
is small for ITM options, so b. is incorrect. Delta of ITM puts tends to −1, so d.
is incorrect.


185. EXAMPLE 13.8: FRM EXAM 2006—QUESTION 33
Steve, a market risk manager at Marcat Securities, is analyzing the risk of itsS&P 500 index
options trading desk. His risk report shows the desk is netlong gamma and short vegaWhich
of the following portfolios of optionsshows exposures consistent with this report?
A. The desk has substantial long-expiry long call positions and substantialshort-expiry
   short put positions.
B. The desk has substantial long-expiry long put positions and substantiallong-expiry short
   call positions.
C. The desk has substantial long-expiry long call positions and substantialshort-expiry
   short call positions.
D. The desk has substantial short-expiry long call positions and substantiallong-expiry
   short call positions.


Example 13.8: FRM Exam 2006—Question 33
d. Long gamma means that the portfolio is long options with high gamma,
typically short-term (short-expiry) ATM options. Short vega means that the portfolio
is short options with high vega, typically long-term (long-expiry) ATMoptions.


186. EXAMPLE 13.9: FRM EXAM 2006—QUESTION 54
Which of the following statements is *incorrect*?
A. The vega of a European call option is highest when the option is at-themoney.
B. The delta of a European-styled put option on an underlying stock movestoward zero as
   the price of the underlying stock rises.
C. The gamma of an at-the-money European-styled option tends to increaseas the
   remaining maturity of the option decreases.
D. Compared to an at-the-money European-styled call option, an out-ofthe-money
   European-styled option with the same strike price and remainingmaturity has a greater
   negative value for theta.


Example 13.9: FRM Exam 2006—Question 54
d. Vega is highest for ATM European options, so answer a. is correct. Delta
is negative and moves to zero as *S* increases, so answer b. is correct. Gamma

increases as the maturity of an ATM option decreases, so answer c. is correct. Theta is greater (in absolute value) for short-term ATM options, so statement d. is incorrect.

187. EXAMPLE 13.10: FRM EXAM 2000—QUESTION 76

How can a trader produce a short vega, long gamma position?
A. Buy short-maturity options, sell long-maturity options.
B. Buy long-maturity options, sell short-maturity options.
C. Buy and sell options of long maturity.
D. Buy and sell options of short maturity.

Example 13.10: FRM Exam 2000—Question 76
a. Long positions in options have positive gamma and vega. Gamma (or instability in delta) increases near maturity; vega decreases near maturity. So, to obtain positive gamma and negative vega, we need to buy short-maturity options and sell long-maturity options.

188. EXAMPLE 13.11: FRM EXAM 2001—QUESTION 113

An option portfolio exhibits high unfavorable sensitivity to increases in implied volatility and while experiencing significant daily losses with the passage of time. Which strategy would the trader most likely employ to hedge his portfolio?
A. Sell short dated options and buy long dated options
B. Buy short dated options and sell long dated options
C. Sell short dated options and sell long dated options
D. Buy short dated options and buy long dated options

Example 13.11: FRM Exam 2001—Question 113
a. Such a portfolio is short vega (volatility) and short theta (time). We need to implement a hedge that is delta-neutral and involves buying and selling options with different maturities. Long positions in short-dated options have high negative theta and low positive vega. Hedging can be achieved by selling short-term options and buying long-term options.

189. EXAMPLE 13.12: FRM EXAM 2006—QUESTION 31

You are implementing a portfolio insurance strategy using index futuresdesigned to protect the value of a portfolio of stocks not paying any dividends.Assuming the value of your stock portfolio decreases, which trade would youmake to protect your portfolio?
A. Buy an amount of index futures equivalent to the change in the call deltamtimes the original portfolio value.
B. Sell an amount of index futures equivalent to the change in the call deltatimes the

original portfolio value.

C. Buy an amount of index futures equivalent to the change in the put deltatimes the original portfolio value.

D. Sell an amount of index futures equivalent to the change in the put deltatimes the original portfolio value.

Example 13.12: FRM Exam 2006—Question 31

d. Portfolio insurance is a form of dynamic hedging that replicates a long position in a put option. If the value of the portfolio decreases, one should sell the index futures in the amount that represents the change in the put delta.

190. EXAMPLE 13.13: FRM EXAM 2000—QUESTION 97

A trader buys an at-the-money call option with the intention of delta-hedging it to maturity. Which one of the following is likely to be the most profitable over the life of the option?

A. An increase in implied volatility

B. The underlying price steadily rising over the life of the option

C. The underlying price steadily decreasing over the life of the option

D. The underlying price drifting back and forth around the strike over thelife of the option

Example 13.13: FRM Exam 2000—Question 97

d. An important aspect of the question is the fact that the option is held to maturity. Answer a. is incorrect because changes in the implied volatility would change the value of the option, but this has no effect when holding to maturity. The profit from the dynamic portfolio will depend on whether the actual volatility differs from the initial implied volatility. It does not depend on whether the option ends up in-the-money or not, so answers b. and c. are incorrect. The portfolio will be profitable if the actual volatility is small, which implies small moves around the strike price.

191. EXAMPLE 13.15: FRM EXAM 2005—QUESTION 130

An option on the Bovespa stock index is struck on 3,000 Brazilian Real (BRL). The delta of the option is 0.6, and the annual volatility of the index is 24%. Using delta-normal assumptions, what is the 10-day VAR at the 95% confidence level? Assume 260 days per year.

A. 44 BRL

B. 139 BRL

C. 2240 BRL

D. 278 BRL

Example 13.15: FRM Exam 2005—Question 130

b. The linear VAR is derived from the worst move in the index value, which is

$\alpha S \sigma \sqrt{T}$ = 1.645 × 3,000(24%/$\sqrt{260}$)$\sqrt{10}$ = 232.3. Multiplying by the delta of

0.6 gives 139.

192. Question 4-26

Ms. Zheng is responsible for the options desk in a London bank. She is concerned about the impact of dividends on the options held by the options desk. She asks you to assess which options are the most sensitive to dividend payments. What would be your answer if the value of the options is found by using the Black-Scholes model adjusted for dividends?

A. Everything else equal, out-of-the-money call options experience a larger decrease in value than in-the-money call options as expected dividends increase.

B. The increase in the value of in-the-money put options caused by an increase in expected dividends is always larger than the decrease in value of in-the-money call options.

C. Keeping the type of option constant, in-the-money options experience the largest absolute change in value and out-of-the-money options the smallest absolute change in value as expected dividends increase.

D. Keeping the type of option constant, at-the-money options experience the largest absolute change in value and out-of-the-money options the smallest absolute change in value as a result of dividend payment.

## Example 14.7: FRM Exam 2009—Question 4-26

c. OTM call options are not very sensitive to dividends, as indicated in Figure 14.7, so answer a. is incorrect. This also shows that ITM options have the highest $\rho^*$ in absolute value.

193. Question 4-6(2009)

An investor is long a short-term at-the-money put option on an underlying portfolio of equities with a notional value of USD 100,000. If the 95% VAR of the underlying portfolio is 10.4%, which of the following statements about the VAR of the option position is *correct* when second-order terms are considered?

A. The VAR of the option position is slightly more than USD 5,200.
B. The VAR of the option position is slightly more than USD 10,400.
C. The VAR of the option position is slightly less than USD 5,200.
D. The VAR of the option position is slightly less than USD 10,400.

**Example 14.14: FRM Exam 2009—Question 4-6**

c. The delta must be around 0.5, which implies a linear VAR of $100,000 × 10.4% × 0.5 = $5,200. The position is long an option and has positive gamma. As a result, the quadratic VAR must be lower than $5,200.

## Part FiveMarket Risk Management

194. EXAMPLE 10.3: FRM EXAM 2003—QUESTION 11

    Based on a 90% confidence level, how many exceptions in backtesting a VAR would be expected over a 250-day trading year?

    A.  10
    B.  15
    C.  25
    D.  50

    Example 10.3: FRM Exam 2003—Question 11
    b. Based on Equation (10.4), this is 10% × 250 = 25.

195. EXAMPLE 10.4: FRM EXAM 2007—QUESTION 101

    A large, international bank has a trading book whose size depends on the opportunities perceived by its traders. The market risk manager estimates the one-day VAR, at the 95% confidence level, to be USD 50 million. You are asked to evaluate how good of a job the manager is doing in estimating the one-day VAR. Which of the following would be the most convincing evidence that the manager is doing a poor job, assuming that losses are identically independently distributed?

    A.  Over the last 250 days, there are eight exceedences.
    B.  Over the last 250 days, the largest loss is USD 500 million.
    C.  Over the last 250 days, the mean loss is USD 60 million.
    D.  Over the last 250 days, there is no exceedence.

    Example 10.4: FRM Exam 2007—Question 101
    d. We should expect (1 − 95%)250 = 12.5 exceptions on average. Having eight exceptions is too few, but the difference could be due to luck. Having zero exceptions, however, would be very unusual, with a probability of $1 − (1 − 5\%)^{250}$, which is very low. This means that the risk manager is providing VAR estimates that are much too high. Otherwise, the largest or mean losses are not directly useful without more information on the distribution of profits.

196. EXAMPLE 30.9: FRM EXAM 2002—QUESTION 20
Which of the following procedures is essential in validating the VAR estimates?
A.   Stress testing
B.   Scenario analysis
C.   Backtesting
D.   Once approved by regulators no further validation is required.


Example 30.9: FRM Exam 2002—Question 20
c. VAR estimates need to be compared to actual P&L results to be validated,
which is called backtesting.


197. EXAMPLE 30.10: PENALTY ZONES
The Amendment to the Capital Accord defines the "yellow zone" as the
following range of exceptions out of 250 observations
A.   3 to 7
B.   5 to 9
C.   6 to 9
D.   6 to 10


Example 30.10: Penalty Zones    b.


198. EXAMPLE 30.11: FRM EXAM 2002—QUESTION 23
Backtesting routinely compares daily profits and losses with model-generated
risk measures to gauge the quality and accuracy of their risk measurementsystems.
The 1996 Market Risk Amendment describes the backtesting frameworkthat is to
accompany the internal models capital requirement. This backtestingframework involves
I. The size of outliers
II. The use of risk measure calibrated to a one-day holding period
III. The size of outliers for a risk measure calibrated to a 10-day holdingperiod
IV. Number of outliers
A.   II and III
B.   II only
C.   I and II
D.   II and IV


Example 30.11: FRM Exam 2002—Question 23
d. The backtesting framework in the IMA only counts the number of times a daily
exception occurs, i.e., a loss worse than the VAR. So, this involves the number of
outliers and the daily VAR measure.


199. Question 5-6(2009)
Tycoon Bank announced that there were eight days in the previous year for which losses

exceeded the daily 99% VAR. As a result, concerns emerged about the accuracy of the VAR implementation. Assuming that there are 250 days in the year, which of the following statements is/are correct?

I. Using a two-tailed 99% confidence level z-score test, the current VAR implementation understates the actual risk in the bank's portfolio.

II. Using a two-tailed 99% confidence level z-score test, the current VAR implementation overstates the actual risk in the bank's portfolio.

III. The bank's exception rates for VAR may be inaccurate if the bank's portfolio changes incorporate the returns from low-risk but highly profitable intraday market making activities.

IV. If these eight exceptions all happened in the previous month, the model should be reexamined for faulty assumptions and invalid parameters.

     A.   I and III
     B.   I, III, and IV
     C.   III only
     D.   I, II, and IV

## Example 15.6: FRM Exam 2009—Question 5-6

b. The z-score gives $(8 - 2.5)/\sqrt{250 \times 0.01 \times 0.99} = 3.5$. This is too high (greater than 2), which leads to rejection of the null that the VAR model is well calibrated. Hence, VAR is too low and statement I. is correct. Statement II. is incorrect. However, this may be due to intraday trading, so III. is correct, too. Finally, if all eight exceptions occurred in the last month, there is bunching, and the model should be reexamined, so IV. is correct.

200. Question 5-12(2009)

Extreme value theory (EVT) provides valuable insight about the tails of return distributions. Which of the following statements about EVT and its applications is *incorrect?*

A. The peaks over threshold (POT) approach requires the selection of a reasonable threshold,which then determines the number of observed exceedances; the threshold must be sufficiently high to apply the theory, but sufficiently low so that the number of observed exceedances is a reliable estimate.

B. EVT highlights that distributions justified by the central limit theorem (e.g., normal) can be used for extreme value estimation.

C. EVT estimates are subject to considerable model risk, and EVT results are often very sensitive to the precise assumptions made.

D. Because observed data in the tails of distribution is limited, EV estimates can be very sensitive to small sample effects and other biases.

## Example 15.7: FRM Exam 2009—Question 5-12

b. EVT estimates are subject to estimation risk, so statement c. and d. are correct. However, EVT does not apply the central limit theorem (CLT), which states that the average (as opposed to the tail) of i.i.d. random variables is normal.

201. EXAMPLE 2.16: FRM EXAM 2007—QUESTION 110

Which of the following statements regarding extreme value theory (EVT) is*incorrect*?

A. In contrast to conventional approaches for estimating VAR, EVT onlyconsiders the tail behavior of the distribution.

B. Conventional approaches for estimating VAR that assume that the distributionof returns follows a unique distribution for the entire range ofvalues may fail to properly account for the fat tails of the distribution ofreturns.

C. EVT attempts to find the optimal point beyond which all values belongto the tail and then models the distribution of the tail separately.

D. By smoothing the tail of the distribution, EVT effectively ignores extremeevents and losses that can generally be labeled outliers.

Example 2.16: FRM Exam 2007—Question 110

d. EVT only uses information in the tail, so statement a. is correct. Conventional approaches such as delta-normal VAR assume a fixed p.d.f. for the entire distribution, which may understate the extent of fat tails. So, statement b. is correct.
The first step in EVT is to choose a cutoff point for the tail, then to estimate the parameters of the tail distribution, so statement c. is correct. Finally, EVT does not ignore extreme events (as long as they are in the sample).

202. Question 2-25(2008)

A market risk manager uses historical information on 1,000 days of profit/ loss information to calculate a daily VAR at the 99th percentile, or $8 million. Loss observations beyond the 99th percentile are then used to estimate the conditional VAR. If the losses beyond the VAR level, in millions, are $9, $10, $11, $13, $15, $18, $21, $24, and $32, then what is the CVAR?

A. $9 million

B. $32 million

C. $15 million

D. $17 million

## Example 15.9: FRM Exam 2008—Question 2-25

d. CVAR is the average of observations beyond VAR. This gives $17 million. Answers a. and b. can be dismissed out of hand because they are too low and too high, respectively.

203. Question 5-8(2009)

Greg Lawrence is a risk analyst at ES Bank. After estimating the 99%, one-day VAR of the bank's portfolio using historical simulation with 1,200 past days, he is concerned that the VAR measure is not providing enough information about tail losses. He decides to reexamine

the simulation results. Sorting the simulated daily P&L from worst to best gives the following results:

| Rank | 1 | 2 | 3 | 4 | 5 | 6 |
|------|------|------|------|------|------|------|
| P&L | -2,833 | -2,333 | -2,228 | -2,084 | -1,960 | -1,751 |
| Rank | 7 | 8 | 9 | 10 | 11 | 12 |
| P&L | -1,679 | -1,558 | -1,542 | -1,484 | -1,450 | -1,428 |
| Rank | 13 | 14 | 15 | | | |
| P&L | -1,368 | -1,347 | -1,319 | | | |

What is the 99%, one-day expected shortfall (ES) of the portfolio?

A.   USD 433

B.   USD 1,428

C.   USD 1,861

D.   USD 2,259

## Example 15.10: FRM Exam 2009—Question 5-8

c. This looks like a computationally intensive question, but it can be answered using judgment. The 1% left tail for $T = 1,200$ is 12 observations, so VAR $= 1,428$. This rules out answers a. and b. The ES is then the average from observations 1 to 11. Using simple rank, the point in the middle is for observation 6, which is $-1,751$. The closest is 1,861, or answer c.

204. Question 5-14(2009)

Which of the following statements about expected shortfall (ES) is *incorrect?*

A.  ES provides a consistent risk measure across different positions and takes account of correlations.

B.   ES tells what to expect in bad states: It gives an idea of how bad the portfolio payoff can be expected to be if the portfolio has a bad outcome.

C.    ES-based rule is consistent with expected utility maximization if risks are ranked by a second-order stochastic dominance rule.

D.            Like VAR, ES does not always satisfy subadditivity (i.e., the risk of a portfolio must be less than or equal to the sum of the risks of its individual positions).

## Example 15.11: FRM Exam 2009—Question 5-14

d. ES, like VAR, does provide a consistent measure of risk that takes diversification into account, so statement a. is correct. Unlike VAR, however, CVAR is a subadditive risk measure.

205. Question 2-7 （2009） （MARKET RISK MEASUREMENT AND MANAGEMENT）

Which of these statements regarding risk factor mapping approaches is/are correct?

I. Under the cash flow (CF) mapping approach, only the risk associated with the average maturity of a fixed-income portfolio is mapped.

II. Cash flow mapping is the least precise method of risk mapping for a fixed-income portfolio.

III. Under the duration mapping approach, the risk of a bond is mapped to a zero-coupon bond of the same duration.

IV. Using more risk factors generally leads to better risk measurement but also requires more time to be devoted to the modeling process and risk computation.

A. I and II
B. I, III, and IV
C. III and IV
D. IV only

## Example 16.1: FRM Exam 2009—Question 2-7

c. Under the cash flow (CF) mapping approach, each payment (and not only the last one) is associated with a different risk factor, so statement I. is incorrect. Statement II. is incorrect because the CF mapping approach is more correct than duration or maturity mapping.

206. EXAMPLE 11.7: FRM EXAM 2002—QUESTION 44

The historical simulation (HS) approach is based on the empirical distributions and a large number of risk factors. The RiskMetrics approach assumes normal distributions and uses mapping on equity indices. The HS approach is more likely to provide an accurate estimate of VAR than the RiskMetrics approach for a portfolio that consists of

A. A small number of emerging market securities
B. A small number of broad market indexes
C. A large number of emerging market securities
D. A large number of broad market indexes

Example 11.7: FRM Exam 2002—Question 44
a. The question deals with the distribution of the assets and the effect of diversification. Emerging market securities are more volatile and less likely to be normally distributed than broad market indices. In addition, a small portfolio is less likely to be well represented by a mapping approach, and is less likely to be normal. The RiskMetrics approach assumes that the conditional distribution is normal and simplifies risk by mapping. This will be acceptable with a large number of securities with distributions close to the normal, which is answer d. Answer a. describes the least diversified portfolio, for which the HS method is best.

207. EXAMPLE 11.8: FRM EXAM 2007—QUESTION 11

A hedge fund manager has to choose a risk model for a large "equity market neutral" portfolio, which has zero beta. Many of the stocks held are recent IPOs. Among the following alternatives, the best is

A. A single index model with no specific risk, estimated over the last year

B. A diagonal index model with idiosyncratic risk, estimated over the lastyear

C. A model that maps positions on industry and style factors

D. A full covariance matrix model using a very short window

Example 11.8: FRM Exam 2007—Question 11

c. Answer a. is incorrect because it only considers the portfolio beta, which is zero by construction. So, it would erroneously conclude that there is no risk. Answer b. is better but would miss the risk of the IPO positions because they have no history. Answer c. will produce unreliable numbers because of the short window. The best solution is to replace the IPO positions by exposures on industry and style factors.

208. Question 2-9(2009)

Brenda Williams is a risk analyst who wants to model the dependence between asset returns using copulas and must convince her manager that this is the best approach. Which of the following statements are correct?

I. The dependence between the return distributions of portfolio assets is critical for risk measurement.

II. Correlation estimates often appear stable in periods of low market volatility and then become volatile in stressed market conditions. Risk measures calculated using correlations estimated over long horizons will therefore underestimate risk in stressed periods.

III. Pearson correlation is a linear measure of dependence between the return of two assets equal to the ratio of the covariance of the asset returns to the product of their volatilities.

IV. Using copulas, one can construct joint return distribution functions from marginal distribution functions in a way that allows for more general types of dependence structure of the asset returns.

A. I, II, and III

B. II and IV

C. I, II, III, and IV

D. I, III, and IV

d. The dependence is critical, so statement I. is correct. The usual Pearson correlation is a linear measure of dependence, so statement III. is correct. Statement IV. is also correct. For statement II., correlations indeed change over stressed periods, but it is not clear whether this biases long-term correlations upward or downward. Also, the effect on the portfolio risk depends on the positioning. Hence, there is not enough information to support statement II.

209. EXAMPLE 15.4: FRM EXAM 2004—QUESTION 51

In early 2000, a risk manager calculates the VAR for a technology stock fund based on the last three years of data. The strategy of the fund is to buy stocks and write out-of-the-money puts. The manager needs to compute VAR. Which of the following methods would yield results that are *least* representative of the risks inherent in the portfolio?

A. Historical simulation with full repricing
B. Delta–normal VAR assuming zero drift
C. Monte Carlo style VAR assuming zero drift with full repricing
D. Historical simulation using delta–equivalents for all positions

Example 15.4: FRM Exam 2004—Question 51

d. Because the portfolio has options, methods a. or c. based on full repricing would be appropriate. Next, recall that technology stocks have had a big increase in price until March 2000. From 1996 to 1999, the NASDAQ index went from 1300 to 4000. This creates a positive drift in the series of returns. So, historical simulation without an adjustment for this drift would bias the simulated returns upward, thereby underestimating VAR.

210. EXAMPLE 15.5: FRM EXAM 2006—QUESTION 114

Which of the following is most accurate with respect to delta–normal VAR?

A. The delta–normal method provides accurate estimates of VAR for assetsthat can be expressed as a linear or nonlinear combination of normallydistributed risk factors.
B. The delta-normal method provides accurate estimates of VAR for options that are at or near-the-money and close to expiration.
C. The delta–normal method provides estimates of VAR by generating a covariance matrix and measuring VAR using relatively simple matrixmultiplication.
D. The delta–normal method provides accurate estimates of VAR for options and other derivatives over ranges even if deltas are unstable.

Example 15.5: FRM Exam 2006—Question 114

c. The delta–normal approach will perform poorly with nonlinear payoffs, so answer a. is false. Similarly, the approach will fail to measure risk properly for

options if the delta changes, which is the case for at-the-money options, so answers b. and d. are false.

211. EXAMPLE 15.6: FRM EXAM 2005—QUESTION 94

Which of the following statements about VAR estimation methods is *wrong*?

A. The delta–normal VAR method is more reliable for portfolios that implement portfolio insurance through dynamic hedging than for portfolios that implement portfolio insurance through the purchase of put options.

B. The full valuation VAR method based on historical data is more reliable for large portfolios that contain significant option-like investments than the delta–normal VAR method.

C. The delta–normal VAR method can understate the true VAR for stock portfolios when the distribution of the return of the stocks has highkurtosis.

D. Full valuation VAR methods based on historical data take into account nonlinear relationships between risk factors and security prices.

Example 15.6: FRM Exam 2005—Question 94

a. Full valuation methods are more precise for portfolios with options, so answers b. and d. are correct. The delta–normal VAR understates the risk when distributions have fat tails, so answer c. is correct. Answer a. is indeed wrong. The delta–normal method will be poor for outright positions in options, or their dynamic replication.

212. EXAMPLE 15.7: FRM EXAM 2005—QUESTION 128

Natural gas prices exhibit seasonal volatility. Specifically the entire forward curve is more volatile during the wintertime. Which of the following statements concerning VAR is correct if the VAR is estimated using unweighted historical simulation and a three-year sample period?

A. We will overstate VAR in the summer and understate VAR in the winter.

B. We will overstate VAR in the summer and overstate VAR in the winter.

C. We will understate VAR in the summer and understate VAR in thewinter.

D. We will understate VAR in the summer and overstate VAR in the winter.

Example 15.7: FRM Exam 2005—Question 128

a. This method essentially estimates the average volatility over a three-year window, ignoring seasonality. As a result, if the conditional volatility is higher during the winter, the method will understate the true risk, and conversely for the summer.

213. EXAMPLE 15.8: FRM EXAM 2004—QUESTION 30

You are given the following information about the returns of stock P and

stock Q: Variance of return of stock P = 100.0. Variance of return of stock Q = 225.0. Covariance between the return of stock P and the return of stock Q = 53.2. At the end of 1999, you are holding USD 4 million in stock P. You are considering a strategy of shifting USD 1 million into stock Q and keeping USD 3 million in stock P. What percentage of risk, as measured by standard deviation of return, can be reduced by this strategy?

A. 0.5%

B. 5.0%

C. 7.4%

D. 9.7%

Example 15.8: FRM Exam 2004—Question 30

b. The variance of the original portfolio is 1,600, implying a volatility of 40. The new portfolio has variance of $3^2 \times 100 + 1^2 \times 225 + 2 \times 53.2 \times 3 \times 1 = 1,444$. This gives a volatility of 38, which is a reduction of 5%.

214. Question 2-11(2008)

You are asked to mark to market a book of plain-vanilla stock options. The trader is short deep out-of-the-money options and long at-the-money options. There is a pronounced smile for these options. The trader's bonus increases as the value of his book increases. Which approach should you use to mark the book?

A. Use the implied volatility of at-the-money options because the estimation of the volatility is more reliable.

B. Use the average of the implied volatilities for the traded options for which you have data because all options should have the same implied volatility with Black-Scholes and you don't know which one is the right one.

C. For each option, use the implied volatility of the most similar option traded on the market.

D. Use the historical volatility because doing so corrects for the pricing mistakes in the option market.

**Example 17.1: FRM Exam 2008—Question 2-11**

c. The book should be marked using volatilities that give prices that are closest to market prices. This means using the ISDs of the most similar options. Also, using

ATM ISDs, as suggested in answer a., will understate the value of the short OTM options, which artificially inflates the trader's profit.

215. Question 5-1(2009)

Assume that implied volatilities from equity option prices display a volatility skew and that implied vols from currency option prices display a volatility smile. Which of the following statements about option price implied volatility curves are *true?*

I. The implied volatility of a deep out-of-the-money equity put option is higher than that of a deep-in-the-money equity put.

II. The implied volatility of a deep out-of-the-money equity call option is higher than that of an at-the-money equity call option.

III. The implied volatility of a deep in-the-money currency call option cannot be the same as that of a deep in-the-money currency put option.

IV. The implied volatility of a deep out-of-the-money currency call option is higher than that of an at-the-money currency call option.

A. I and III only
B. I and IV only
C. II and III only
D. II and IV

## Example 17.2: FRM Exam 2009—Question 5-1

b. A volatility skew means that, for equities, the ISD of out-of-the-money (OTM) puts is greater than that of ITM puts, so answer I. is true. Conversely, the ISD of ITM puts, or equivalently that of OTM calls, is similar to that of ATM options, so answer II. is false. A volatility skew means that, for currencies, the ISD of out-of-the-money options is greater than that of ATM options, so answer IV. is true. On the other hand, OTM and ITM options might have similar vols (for currency options), so answer III. is false.

216. Question 4-25

You are the risk manager of your bank responsible for the derivatives desk. A trader has sold 300 call option contracts each on 100 shares of Nissan Motors with time to maturity of 90 days at USD 1.80. The delta of the option on one share is 0.60. You have hedged the option exposure by buying 18,000 shares of the underlying. The next day, the stock price falls and the delta of the options falls to 0.54. In order to keep the options hedged, you have to

A. Buy 1,800 shares of Nissan Motors
B. Sell 1,800 shares of Nissan Motors
C. Buy 1,080 shares of Nissan Motors
D. Sell 1,080 shares of Nissan Motors

## Example 17.4: FRM Exam 2009—Question 4-25

b. First, we verify that the initial amount purchased is correct. This is $0.60 \times 300 \times 100 = 18,000$ shares. If the delta falls to 0.54, or by 0.06, the risk manager will have to sell $0.06 \times 300 \times 100 = 1,800$ shares.

217. Question 5-3

Trader A purchases a down-and-out call with a strike price of USD 100 and a barrier at

USD 96 from Trader B. Both traders need to unwind their delta hedge at the barrier. Which trader is more at risk if there is a price gap (discontinuity) that prevents them from exiting the trade at the barrier?

A. Trader A has the bigger risk.
B. Trader B has the bigger risk.
C. They both have the same risk.
D. Neither trader has any risk because both are hedged.

## Example 17.7: FRM Exam 2009—Question 5-3

b. Each trader replicates dynamically the down-and-out call as a hedge. Trader B sold the option, so needs to replicate a long position in this call. The hedge ratio for a down-and-out call resembles the usual one except that it has an abrupt discontinuity, dropping to zero below the barrier. Just above the barrier, Trader B is long the asset in the amount of the hedge ratio (e.g., 0.4). When the price jumps down below the barrier, Trader B will be stuck with a large loss. Intuitively, this loss is the gain to Trader A, who has the opposite position.

218. EXAMPLE 13.14: FRM EXAM 2004—QUESTION 26

A non-dividend-paying stock has a current price of $100 per share. You have just sold a six-month European call option contract on 100 shares of this stock at a strike price of $101 per share. You want to implement a dynamic delta hedging scheme to hedge the risk of having sold the option. The option has a delta of 0.50. You believe that delta would fall to 0.44 if the stock price falls to $99 per share. Identify what action you should take **now** (i.e., when you have just written the option contract) to make your position delta neutral. After the option is written, if the stock price falls to $99 per share, identify what action should be taken at that time, i.e., **later**, to rebalance your delta-hedged position.

A. Now: buy 50 shares of stock; later: buy 6 shares of stock.
B. Now: buy 50 shares of stock; later: sell 6 shares of stock.
C. Now: sell 50 shares of stock; later: buy 6 shares of stock.
D. Now: sell 50 shares of stock; later: sell 6 shares of stock.

Example 13.14: FRM Exam 2004—Question 26
b. The dynamic hedge should replicate a long position in the call. Due to the positive delta, this implies a long position of $\Delta \times 100 = 50$ shares. If the delta falls, the position needs to be adjusted by selling $(0.5 - 0.44) \times 100 = 6$ shares.

219. Question 3-20(2009)

What is the effect on the value of a callable convertible bond of a decrease in interest rate volatility and stock price volatility?

A. An increase in value due to both interest rate volatility and stock price volatility
B. An increase and decrease in value, respectively
C. A decrease and increase in value, respectively
D. A decrease in value due to both

## Example 17.10: FRM Exam 2009—Question 3-20

b. A decrease in stock price volatility decreases the value of the equity conversion option and thus the convertible bond price. A decrease in interest rate volatility decreases the value of the interest rate call option. Because the bond investor is short the interest rate option, this increases the value of the convertible.

220. Question 2-37(2008)

MBSs are a class of securities where the underlying is a pool of mortgages. In addition to the credit risk of a borrower defaulting on the loan, mortgages also have prepayment risk because the borrower has the option to repay the loan early (at any time) usually due to favorable interest rate changes. From an investor's point of view, a mortgage-backed security is equivalent to holding a long position in a nonrepayable mortgage pool and which of the following?

A. A long American call option on the underlying
B. A short American call option on the underlying
C. A short European put option on the underlying
D. A long American put option on the underlying

## Example 18.1: FRM Exam 2008—Question 2-37

b. This is similar to an American call option because the borrower can repay at any time (American vs. European) if the yield drops or price goes up.

221. EXAMPLE 7.8: FRM EXAM 2000—QUESTION 3

How would you describe the typical price behavior of a low premium mortgage pass-through security?

A. It is similar to a U.S. Treasury bond.
B. It is similar to a plain-vanilla corporate bond.
C. When interest rates fall, its price increase would exceed that of a comparableduration U.S. Treasury bond.
D. When interest rates fall, its price increase would lag that of a comparable duration U.S. Treasury bond.

Example 7.8: FRM Exam 2000—Question 3
d. MBSs are unlike regular bonds, Treasuries, or corporates, because of their negative convexity. When rates fall, homeowners prepay early, which means that

the price appreciation is less than that of comparable duration regular bonds.

222. EXAMPLE 7.9: FRM EXAM 2003—QUESTION 52

What bond type does the following price-yield curve represent and at which yield level is convexity equal to zero?
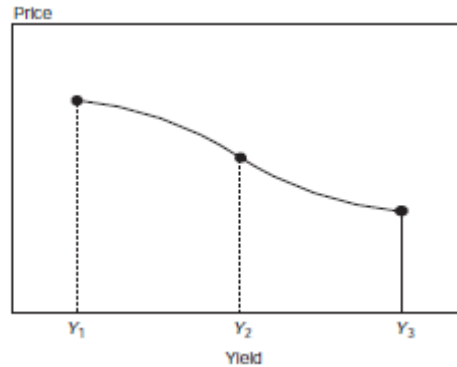


A. Puttable bond with convexity close to zero at $Y2$.
B. Puttable bond with convexity close to zero at $Y1$ and $Y3$.
C. Callable bond with convexity close to zero at $Y2$.
D. Callable bond with convexity close to zero at $Y1$ and $Y3$.

Example 7.9: FRM Exam 2003—Question 52

c. This has to be a callable bond because the price is capped if rates fall, reflecting the fact that the borrower would call back the bond. At Y1, convexity is negative, at Y2, close to zero.

223. EXAMPLE 7.10: FRM EXAM 2006—QUESTION 93

You are analyzing two comparable (same credit rating, maturity, liquidity, rate) U.S. callable corporate bonds. The following data is available for the nominal spread over the U.S. Treasury yield curve and Z spread and option-adjusted spread (OAS) relative to the U.S. Treasury spot curve.

|                | X   | Y   |
|----------------|-----|-----|
| Nominal spread | 145 | 130 |
| Z spread       | 120 | 115 |
| OAS            | 100 | 105 |

The nominal spread on the comparable option-free bonds in the market is 100 basis points. Which of the following statements is correct?

A. X only is undervalued.
B. Y only is undervalued.
C. X and Y both are undervalued.
D. Neither X nor Y is undervalued.

Example 7.10: FRM Exam 2006—Question 93
b. The nominal spreads and Z spreads do not take into account the call option,
Instead, comparisons should focus on the OAS, which is higher for Y, and also
higher than the 100bp for option-free bonds.

*224.* Question 9-2(2009)
Many observers have blamed the originate-to-distribute model of banks for having aggravated or even caused the credit crisis. Which of the following statements about the performance of the originate-to-distribute model of banks during the credit crisis is *incorrect?*
A. The originate-to-distribute model failed across all loan types equally.
B. Mortgage originators made large losses during the crisis and many went bankrupt.
C. Warehouse risk was a major cause of losses for originators of subprime mortgages.
D. The originate-to-distribute model can reduce systemic risk by having fewer risks located in banks, but a surprise during the crisis was the extent to which banks had kept risks.

## Example 18.6: FRM Exam 2009—Question 9-2

a. The problems with mortgage loans, in particular subprime loans, were much larger than for other types of debt. Otherwise, statements b. and c. are correct. Originators lost money due to warehouse risk, which involves keeping the loans on the balance sheet before they can be securitized. This led to losses when these loans fell in value.

225. EXAMPLE 7.11: FRM EXAM 2000—QUESTION 13
A CLO is generally
A. A set of loans that can be traded individually in the market
B. A pass-through
C. A set of bonds backed by a loan portfolio
D. None of the above

Example 7.11: FRM Exam 2000—Question 13
c. Like a CMO, a CLO represents a set of tradable securities backed by some collateral, in this case a loan portfolio.

226. EXAMPLE 7.12: FRM EXAM 2004—QUESTION 57
When evaluating asset-backed securitization issues, which of the following would be *least* important during the investor's analysis process?
A. The liability concentration levels of the asset originator
B. The structure of the underlying securitization transaction
C. The quality of the loan servicer for the underlying assets in the transaction
D. The quality of the underlying assets within the securitization structure

Example 7.12: FRM Exam 2004—Question 57

a. Bankruptcy by the originator would not affect the SPV, so the financial condition of the originator is the least important factor. All of the other factors would be important in evaluating the securitization.

227. EXAMPLE 7.13: FRM EXAM 1999—QUESTION 79

Suppose that the coupon and the modified duration of a 10-year bond priced to par are 6.0% and 7.5, respectively. What is the approximate modified duration of a 10-year inverse floater priced to par with a coupon of 18% – 2 × LIBOR?

A. 7.5
B. 15.0
C. 22.5
D. 0.0

Example 7.13: FRM Exam 1999—Question 79

c. Following the same reasoning as above, we must divide the fixed-rate bonds into 2/3 FRN and 1/3 inverse floater. This will ensure that the inverse floater payment is related to twice LIBOR. As a result, the duration of the inverse floater must be 3 times that of the bond.

228. EXAMPLE 7.14: FRM EXAM 2004—QUESTION 69

With LIBOR at 4%, a manager wants to increase the duration of his portfolio. Which of the following securities should he acquire to increase the duration of his portfolio the most?

A. A 10-year reverse floater that pays 8%– LIBOR, payable annually
B. A 10-year reverse floater that pays 12% – 2×LIBOR, payable annually
C. A 10-year floater that pays LIBOR, payable annually
D. A 10-year fixed rate bond carrying a coupon of 4% payable annually

Example 7.14: FRM Exam 2004—Question 69

b. The duration of a floater is about zero. The duration of a 10-year regular bond is about nine years. The first reverse floater has a duration of about 2 × 9 = 18 years, the second, 3 × 9 = 27 years.

229. EXAMPLE 7.15: FRM EXAM 2003—QUESTION 91

Which of the following statements most accurately reflects characteristics of a reverse floater (with no options attached)?

A. A portfolio of reverse floaters carries a marginally higher duration riskthan a portfolio of similar maturity normal floaters.
B. A holder of a reverse floater can synthetically convert his position into afixed rate bond by receiving floating and paying fixed on an interest rateswap.
C. A reverse floater hedges against rising benchmark yields.

D. A reverse floater's price changes by as much as that in a similar maturityfixed rate bond for a given change in yield.

Example 7.15: FRM Exam 2003—Question 91
b. The duration of a reverse floater is higher than that of a FRN, which is close to zero, or even than that of a fixed-date bond with the same maturity. So, answers a. and d. are wrong. It loses money when yields rise, so c. is wrong. A reverse floater is equivalent as a long position in a fixed-rate bond plus a receive-fixed/pay-floating swap. Hence, b. is correct.

230. EXAMPLE 7.16: FRM EXAM 2006—QUESTION 43
Which of the following mortgage-backed securities has a negative duration?
A. Interest-only strips (IO)
B. Inverse floater
C. Mortgage pass-through
D. Principal-only strips (PO)

Example 7.16: FRM Exam 2006—Question 43
a. IOs increase in value as interest rates increase because in this scenario, there will be less prepayment of mortgages. Less early payment means more total interest payments, which increases the value of the IO.

231. EXAMPLE 7.17: FRM EXAM 2004—QUESTION 45
As the CRO of a firm specializing in MBSs, you have been asked to explain how interest-only (IO) strips and principal-only (PO) strips would react if interest rates change. Which of the following is *true*?
A. When interest rates fall, both PO and IO strips will increase in value.
B. When interest rates fall, POs will increase in value, IOs decrease in value.
C. When interest rates rise, POs will increase in value, IOs decrease in value.
D. When interest rates rise, both PO and IO strips will increase in value.

Example 7.17: FRM Exam 2004—Question 45
b. POs have positive duration, IOs negative. Hence, they react in opposite directions to falls in interest rates.

232. Question 5-10(2009)
Which of following statements about mortgage-backed securities is incorrect?
A. An MBS price is more sensitive to yield curve twists than are zero-coupon bonds.
B. When the yield is higher than the coupon rate of an MBS, the MBS behaves similarly to corporate bonds as interest rates change.
C. As yield volatility increases, the value of an MBS grows, too.

D.  Due to changes in prepayment rates, mortgages and MBSs exhibit neg¬ative convexity; that is, when interest rates decrease, prepayments in¬crease.

233. Question 5-11(2009)

George Smith is an analyst in the risk management department and he is reviewing a pool of mortgages. Prepayment risk introduces complexity to the valuation of mortgages. Which of the following factors are generally considered to affect prepayment risk for a mortgage?

   I.  Changes to interest rates
   II. Age of the mortgage
   III. Season of the year
   IV. Age of the home
   V.  Amount of principal outstanding

   A.  I, II, and V
   B.  I, II, III, and V
   C.  I, II, IV, and V
   D.  III and IV

# Part SIX   CreditRisk Management

234. EXAMPLE 18.3: FRM EXAM 2002—QUESTION 130

You have granted an unsecured loan to a company. This loan will be paid off by a single payment of $50 million. The company has a 3% chance of defaulting over the life of the transaction and your calculations indicate that if they default you would recover 70% of your loan from the bankruptcy courts. If you are required to hold a credit reserve equal to your expected credit loss, how great a reserve should you hold?

   A.  $450,000
   B.  $750,000
   C.  $1,050,000
   D.  $1,500,000

Example 18.3: FRM Exam 2002—Question 130

a. The Expected Credit Loss (ECL) is the notional amount times the probability of default times the loss given default. This is $50,000,000 × 0.03 × (1 – 70%) = $450,000.

235. EXAMPLE 18.4: FRM EXAM 2003—QUESTION 17

An investor holds a portfolio of $100 million. This portfolio consists of A-rated bonds ($40 million) and BBB-rated bonds ($60 million). Assume that the one-year probabilities of default for A-rated and BBB-rated bonds are 3% and 5%, respectively, and that they are independent. If the recovery value for A-rated bonds in the event of default is 70% and the recovery value for BBB-rated bonds is 45%, what is the one-year expected credit loss from this portfolio?

A. $1,672,000
B. $1,842,000
C. $2,010,000
D. $2,218,000

Example 18.4: FRM Exam 2003—Question 17

c. The expected loss is $\sum_i p_i \times CE_i \times (1 - f_i)$ = $40,000,000 × 0.03(1 – 0.70) + $60,000,000 × 0.05(1 – 0.45) = $2,010,000.

236. Question 6-7(2009)

A bank has booked a loan with total commitment of $50,000 of which 80% is currently outstanding. The default probability of the loan is assumed to be 2% for the next year and loss given default (LGD) is estimated at 50%. The standard deviation of LGD is 40%. Drawdown on default (i.e., the fraction of the undrawn loan) is assumed to be 60%. The expected and unexpected losses (standard deviation) for the bank are

A. Expected loss = $500, unexpected loss = $4,140
B. Expected loss = $500, unexpected loss = $3,220
C. Expected loss = $460, unexpected loss = $3,220
D. Expected loss = $460, unexpected loss = $4,140

## Example 19.4: FRM Exam 2009—Question 6-7

d. First, we compute the exposure at default. This is the drawn amount, or $80\% \times \$50,000 = \$40,000$ plus the drawdown on default, which is $60\% \times \$10,000 = \$6,000$, for a total of $CE = \$46,000$. The expected loss is this amount times $p \times E[LGD] = 0.02 \times 50\% = 1\%$, or $EL = \$460$. Next, we compute the standard deviation of losses using Equation (19.7). The variance is $pV[LGD] + p(1 - p)\{E[LGD]\}^2 = 0.02(0.40)^2 + 0.02(1 - 0.02)(0.50)^2 = 0.00810$. Taking the square root gives 0.090. Multiplying by $46,000 gives $4,140. Ignoring $V[LGD]$ gives the incorrect answer of $3,220. Note that the unexpected loss is much greater than the expected loss.

237. Question 3-5(2008)

Define unexpected loss (UL) as the standard deviation of losses and expected loss (EL) as the average loss. Further define LGD as loss given default, and EDF as the expected default frequency. Which of the following statements hold(s) *true*?

I.   EL increases linearly with increasing EDF.
II.  EL is often higher than UL.
III. With increasing EDF, UL increases at a much faster rate than EL.
IV.  The lower the LGD, the higher the percentage loss for both the EL and UL.

   A.   I only
   B.   I and II
   C.   I and III
   D.   II and IV

## Example 19.5: FRM Exam 2008—Question 3-5

c. Equation (19.5) shows that EL increases linearly with $p$, so answer I. is correct. Answer II. is not correct, certainly for concentrated portfolios. Equation (19.7)

shows that UL increases faster than EL linearly with $p$, so answer III. is correct. Finally, Answer II. is incorrect, as higher (not lower) LGD would lead to higher credit losses.

238. EXAMPLE 18.5: FRM EXAM 2007—QUESTION 73

A portfolio consists of two bonds. The credit-VAR is defined as the maximum loss due to defaults at a confidence level of 98% over a one-year horizon. The probability of joint default of the two bonds is 1.27%, and the default correlation is 30%. The bond value, default probability, and recovery rate are USD 1,000,000, 3%, and 60% for one bond, and USD 600,000, 5%, and 40% for the other. What is the expected credit loss of the portfolio?

   A.   USD 0
   B.   USD 9,652
   C.   USD 20,348
   D.   USD 30,000

Example 18.5: FRM Exam 2007—Question 73
d. The ECL is for the first bond 1,000,000 × 3% × (1 − 60%) = 12,000, and for the second 600,000 × 5% × (1 − 40%) = 18,000. This adds up to $30,000. Note that this number does not depend on the default correlation.

239. EXAMPLE 18.6: FRM EXAM 2007—QUESTION 74

Continuing with the previous question, what is the best estimate of the unexpected credit loss (away from the ECL), or credit VAR, for this portfolio?

A. USD 570,000

B. USD 400,000

C. USD 360,000

D. USD 370,000

Example 18.6: FRM Exam 2007—Question 74

d. Here, the joint default probability matters. If the two bonds default, the loss is $1,000,000 × (1 − 40%) + $600,000 × (1 − 60%) = $400,000 + $360,000 = $760,000. This will happen with probability 1.27%. The next bigger loss is $400,000, which has probability of 3.00 − 1.27 = 1.73%. Its cumulative probability must be 100.00 − 1.17 = 98.73%. This is slightly above 98%, so $400,000 is the quantile at the 98% level of confidence or higher. Subtracting the mean gives $370,000.

240. EXAMPLE 18.7: FRM EXAM 2007—QUESTION 102

Suppose Bank Z lends EUR 1 million to X and EUR 5 million to Y. Over thenext year, the PD for X is 0.2 and for Y is 0.3. The PD of joint default is 0.1.The loss given default is 40% for X and 60% for Y. What is the expectedloss of default in one year for the bank?

A. EUR 0.72 million

B. EUR 0.98 million

C. EUR 0.46 million

D. EUR 0.64 million

Example 18.7: FRM Exam 2007—Question 102

b. The joint PD does not matter for the ECL. This is $ECL = 1 × 20\% × 40\% + 5 × 30\% × 60\%$, = 0.08 + 0.90, or EUR 0.98 million.

241. EXAMPLE 18.8: FRM EXAM 2004—QUESTION 46

Consider an A-rated bond and a BBB-rated bond. Assume that the one-year probabilities of default for the A- and BBB-rated bonds are 2% and 4%, respectively, and that the joint probability of default of the two bonds is 0.15%. What is the default correlation between the two bonds?

A. 0.07%

B. 2.6%

C. 93.0%

D. The default correlation cannot be calculated with the information provided

Example 18.8: FRM Exam 2004—Question 46

b. From Equation (18.7), the default correlation is $Corr(A, B) = [p(A$ and $B) − p(A)p(B)]/\{\sqrt{p(A)[1 − p(A)]}\sqrt{p(B)[1 − p(B)]}\} = [0.0015 − 0.02 × 0.04]/$

$\{\sqrt{0.02[1 − 0.02]}\sqrt{0.04[1 − 0.04]}\} = 0.025516$.

242. EXAMPLE 18.9: FRM EXAM 2002—QUESTION 92

A portfolio of bonds consists of five bonds whose default correlation is zero. The one-year probabilities of default of the bonds are: 1%, 2%, 5%, 10%, and 15%. What is the one-year probability of no default within the portfolio?

A. 71%

B. 67%

C. 85%

D. 99%.

Example 18.9: FRM Exam 2002—Question 92

a. Because the events are independent, the joint probability is given by the product $(1 − p_1)(1 − p_2)(1 − p_3)(1 − p_4)(1 − p_5) = (1 − 1\%)(1 − 2\%)(1 − 5\%)(1 − 10\%)(1 − 20\%) = 70.51\%$.

243. EXAMPLE 18.10: FRM EXAM 2004—QUESTION 15

There are 10 bonds in a credit default swap basket. The probability of default for each of the bonds is 5%. The probability of any one bond defaulting is completely independent of what happens to the other bonds in the basket. What is the probability that exactly one bond defaults?

A.    5%

B.    50%

C.    32%

D.    3%

Example 18.10: FRM Exam 2004—Question 15

c. Using the second term in Equation (18.14), we have $a_1 = \binom{10}{1} = 10$, and the probability is $10p^1(1 − p)^9 = 10 \times 0.05 \times (1 − 0.05)9 = 0.315$.

244. EXAMPLE 19.2: FRM EXAM 2003—QUESTION 100

What is the lowest tier of an investment grade credit rating by Moody's?

A.    Baa1

B.    Ba1

C.    Baa3

D.    Ba3

Example 19.2: FRM Exam 2003—Question 100

c. Baa3 is the lowest investment-grade rating for Moody's.

245. EXAMPLE 19.3: FRM EXAM 2005—QUESTION 86

You are considering an investment in one of three different bonds. Your investment

guidelines require that any bond you invest in carry an investmentgrade
rating from at least two recognized bond rating agencies. Which, if
any, of the bonds listed below would meet your investment guidelines?

A.   Bond A carries an S&P rating of BB and a Moody's rating of Baa.

B.   Bond B carries an S&P rating of BBB and a Moody's rating of Ba.

C.   Bond C carries an S&P rating of BBB and a Moody's rating of Baa.

D.   None of the above.

Example 19.3: FRM Exam 2005—Question 86

c. The lowest investment-grade ratings are BBB and Baa.

246. EXAMPLE 19.4: FRM EXAM 2002—QUESTION 110

If Moody's and S&P are equally good at rating bonds, the average default
rate on BB bonds by S&P will be lower than the average default rate on
bonds rated by Moody's as

A.   Baa3

B.   Ba1

C.   Ba

D.   Ba3

Example 19.4: FRM Exam 2002—Question 110

d. The BB rating by S&P is similar to a Ba rating by Moody's. A BB bond will
have lower default rate than a bond rated lower. Hence, the answer is the next
lower rating category by Moody's.

247. EXAMPLE 19.5: FRM EXAM 2004—QUESTION 1

Company ABC was incorporated on January 1, 2004. It has an expected
annual default rate of 10%. Assuming a constant quarterly default rate,
what is the probability that company ABC will *not* have defaulted by April
1, 2004?

A.   2.40%

B.   2.50%

C.   97.40%

D.   97.50%

Example 19.5: FRM Exam 2004—Question 1

c. The probability of survival for one year is $S1 = (1 - d) = (1 - dQ)4$. This gives
a probability of surviving the first quarter of $(1 - dQ) = (1 - 0.10)1/4 = 0.974$.

248. EXAMPLE 19.6: FRM EXAM 2002—QUESTION 77

If the default probability for an A-rated company over a three-year period is
0.30%, then the most likely probability of default for this company over a

six-year period is:

A. 0.30%
B. Between 0.30% and 0.60%
C. 0.60%
D. Greater than 0.60%

Example 19.6: FRM Exam 2002—Question 77

d. The marginal default rate increases with maturity. So, this could be for example 0.50% over the last three years of the six-year period. This gives a cumulative default probability greater than 0.60%.

249. Question 3-1(2008)

The marginal default probabilities for an A-rated issue are, respectively, for years 1, 2, and 3: 0.300%, 0.450%, and 0.550%. Assume that defaults, if they take place, happen only at the end of the year. Calculate the cumulative default rate at the end of each of the next three years.

A. 0.300%, 0.750%, 1.300%
B. 0.300%, 0.150%, 0.250%
C. 0.300%, 0.749%, 1.295%
D. 0.300%, 0.449%, 0.548%

## Example 20.8: FRM Exam 2008—Question 3-1

c. The default rate to the end of year 2 is the survival rate for year 1 times the year 2 default rate, $(1 - d_1)d_2 = (1 - 0.003)0.0045 = 0.449\%$. Hence the year 2 cumulative default rate is $0.300 + 0.449 = 0.749\%$. The default rate to the end of year 3 is $(1 - d_1)(1 - d_2)d_3 = (1 - 0.003)(1 - 0.0045)0.0055 = 0.546\%$. Hence the year 3 cumulative default rate is $0.749 + 0.546 = 1.295\%$.

250. EXAMPLE 19.10: FRM EXAM 2005—QUESTION 105

A rating transition table includes sufficient information to find all but the following item:

A. The likelihood that an AA-rated firm will fall to a BB rating over five years
B. The price of a bond that has been downgraded to BB from BBB
C. The probability of default on a B-rated bond
D. The probability that a high-yield bond will be upgraded to investmentgrade

Example 19.10: FRM Exam 2005—Question 105

b. A rating transition table has probabilities of changing from one rating to another over one year, which can be extrapolated over several years. Hence, statement a. is correct. This also include default, hence statement c. is correct. The probabilities can be used to group ratings, hence, statement d. is correct. Transitions matriceshave noinformation about prices, so answer b. is the correct one.

251. EXAMPLE 19.11: FRM EXAM 2007—QUESTION 51

Fitch ratings provides a table indicating that the number of A-rated issuers
(1) migrating to AAA is 2, (2) to AA is 5, (3) staying at A is 40, (4) migrating
to BBB is 2, and (5) going into default is 3.

Based on this information, what is the probability that an issue with a
rating of A at the beginning of the year will be downgraded by the end of the
year?

A.  13.46%

B.  13.44%

C.  9.62%

D.  3.85%


Example 19.11: FRM Exam 2007—Question 51

c. This is given by the ratio of entries to BBB and D, which is 2 + 3 over the total
of 52, which is 0.096.


252. Question 4-18(2009)

A two-year zero-coupon bond issued by ABC Co. is currently rated A. The market expects
that one year from now the probability that the rating of ABC remains at A, is downgraded
to BBB, or is upgraded to AA are, respectively, 80%, 15%, and 5%. Suppose that the risk-free
rate is flat at 1% and that credit spreads for AA-, A-, and BBB-rated debt are flat at 80, 150,
and 280 basis points, respectively. All rates are compounded annually. What is the best
approximation of the expected value of the zero-coupon bond one year from now?

A.  97.41

B.  97.37

C.  94.89

D.  92.44

**Example 20.12: FRM Exam 2009—Question 4-18**

a. After one year, the bond becomes a one-year zero-coupon bond. The respective
values are, for AA, A, and BBB, $P_{AA} = 100/(1 + 0.0180) = 98.23$, 97.56, and
96.34. Note that prices are lower for lower ratings. The expected value is given
by $P = \sum \pi_i P_i = 5\%98.23 + 80\%97.56 + 15\%96.34 = 97.41$.


253. Question 3-20(2008)

As a result of the credit crunch, a small retail bank wants to better predict and model the
likelihood that its larger commercial loans might default. It is developing an internal

ratings-based approach to assess its commercial customers. Given this one-year transition matrix, what is the probability that a loan currently rated at B will default over a two-year period?

| Rating at Beginning of Period | Rating at End of Period | | | |
|---|---|---|---|---|
| | A | B | C | Default |
| A | 0.90 | 0.10 | 0.00 | 0.00 |
| B | 0.00 | 0.75 | 0.15 | 0.10 |
| C | 0.0 | 0.05 | 0.55 | 0.40 |

A. 17.5%
B. 20.0%
C. 21.1%
D. 23.5%

## Example 20.13: FRM Exam 2008—Question 3-20

d. B can go into default the first year, with probability of 0.10. Or it could go to A, then D, with probability of $0.00 \times 0.00 = 0$. Or, it could go to B, then D, with probability of $0.75 \times 0.10 = 0.075$. Or it could go to C, then D, with probability of $0.15 \times 0.40 = 0.060$. The total is 0.235.

254. EXAMPLE 19.13: FRM EXAM 2005—QUESTION 74

Moody's estimates the average recovery rate for senior unsecured debt to be nearest to
A. 20%
B. 40%
C. 60%
D. 80%

Example 19.13: FRM Exam 2000—Question 58
a. The recovery rate on loans is typically higher than that on bonds. Hence, the credit rating, if it involves both probability of default and recovery, should be higher for loans than for bonds.

255. EXAMPLE 19.14: FRM EXAM 2002—QUESTION 123

The recovery rate on credit instruments is defined as one minus the loss rate. The loss rate can be significantly influenced by the volatility of the value of a firm's assets before default. All other things being equal, in the event of a default, which type of company would we expect to have the highest recovery rate?
A. A trading company active in volatile markets
B. An Internet merchant of trendy consumer products
C. An asset-intensive manufacturing company

D.  A highly leveraged hedge fund

Example 19.14: FRM Exam 2002—Question 123
c. The recovery rate is higher when the assets of the firm in default consist of
tangible assets that can be resold easily. More volatile assets mean that there is
a greater probability of a fall in market value upon liquidation. So, the tangible
assets of a manufacturing company is the best answer.

256. EXAMPLE 19.15: FRM EXAM 2005—QUESTION 79
In the context of evaluating sovereign risk, which of the following statements
is *incorrect*?
A.  Bankruptcy law does not typically protect investors from sovereign risk.
B.  Debt repudiation is a postponement of all current and future foreigndebt obligations of
a borrower.
C.  Debt rescheduling occurs when a group of creditors declares a moratoriumon debt
obligations and seeks to reschedule terms.
D.  Sovereign risk can be a cause of default in a non-governmental borrowerof high credit
quality.

Example 19.15: FRM Exam 2005—Question 79
b. Statements a., c., and d. are all correct. Debt repudiation is a cancellation, not
a postponement, so b. is incorrect.

257. Question 4-19(2009)
Rating agencies typically assign two ratings to debt-issuing countries. The first is the local
currency debt rating and the second is the foreign cur¬rency debt rating. Historically,
defaults have been more frequent on foreign¬currency-denominated debt than on
local-currency-denominated debt. What is the main reason behind this difference?
A.  This is a statistical anomaly, as the default rate theoretically should be the same in both
cases.
B.  Foreign-currency-denominated  debt  is  usually  less  collateralized  than
local-currency-denominated debt.
C.  Local-currency-denominated  debt  obligations  could  be  met  through  monetary
expansion.
D.  In  distressed  situations,  governments  tend  to  default  on  their
foreign¬currency-denominated debt first for political reasons.

## Example 20.17: FRM Exam 2009—Question 4-19

c. The higher default rate on foreign-currency-denominated debt is consistent with
the observation that credit ratings are lower. So, this is not a statistical anomaly
(statement a.). The main reason is that governments could force the central bank to
print more money, creating inflation that reduces the real value of local currencies.
This option is not possible with foreign-currency-denominated debt.

258. EXAMPLE 20.1: FRM EXAM 2007—QUESTION 77

The risk-free rate is 5% per year and a corporate bond yields 6% per year.
Assuming a recovery rate of 75% on the corporate bond, what is the approximate
market implied one-year probability of default of the corporatebond?

A.   1.33%

B.   4.00%

C.   8.00%

D.   1.60%

Example 20.1: FRM Exam 2007—Question 77

b. The spread is 7 − 6 = 1%. Dividing by the loss given default of $(1 − f) = 0.25$,

we get $\pi = (y* − y)/(1 − f) = 4\%$.

259. EXAMPLE 20.2: FRM EXAM 2007—QUESTION 48

The spread on a one-year BBB-rated bond relative to the risk-free Treasury
of similar maturity is 2%. It is estimated that the contribution to this spread
by all noncredit factors (e.g., liquidity risk, taxes) is 0.8%. Assuming the loss
given default rate for the underlying credit is 60%, what is, approximately,
the implied default probability for this bond?

A.   3.33%

B.   5.00%

C.   3.00%

D.   2.00%

Example 20.2: FRM Exam 2007—Question 48

d. The part of the spread due to expected credit losses is 2.00 − 0.80 = 1.20%.
Dividing by the LGD of $(1 − f) = 0.65$, we get 2%.

260. Question 3-12(2008)

A risk analyst seeks to find out the credit-linked yield spread on a BB-rated one-year coupon
bond issued by a multinational petroleum company. If the prevailing annual risk-free rate is
3%, the default rate for BB-rated bonds is 7%, and the loss given default is 60%, then the
yield to maturity of the bond is

A.   2.57%

B.   5.90%

C.   7.45%

D.  7.52%

261. EXAMPLE 20.4: FRM EXAM 2002—QUESTION 81
Which of the following is true?
A. Changes in bond spreads tend to lead changes in credit ratings.
B. Changes in bond spreads tend to lag changes in credit ratings.
C. Changes in bond spreads tend to occur at the exact same time as changes in credit ratings.
D. There is absolutely no perceived general relationship in the timing of changes in bond spreads and changes in credit ratings.

Example 20.4: FRM Exam 2002—Question 81
a. Changes in market prices, including bond spreads, tend to lead to changes in credit ratings. This is because market prices reflect all publicly available information about a company.

262. EXAMPLE 20.5: TERM STRUCTURE OF CREDIT SPREADS
Suppose XYZ Corporation has two bonds paying semiannually according to the following table:

| Remaining Maturity | Coupon (sa 30/360) | Price | T-Bill Rate (Bank Discount) |
|---|---|---|---|
| 6 months | 8.0% | 99 | 5.5% |
| 1 year | 9.0% | 100 | 6.0% |

The recovery rate for each in the event of default is 50%. For simplicity, assume that each bond will default only at the end of a coupon period. The market-implied risk-neutral probability of default for XYZ Corporation is
A.  Greater in the first six-month period than in the second
B.  Equal between the two coupon periods
C.  Greater in the second six-month period than in the first
D.  Cannot be determined from the information provided

Example 20.5: Term Structure of Credit Spreads
a. First, we compute the current yield on the six-month bond, which is selling at a

discount. We solve for y∗ such that $99 = 104/(1 + y*$

/200) and find y∗ = 10.10%.

Thus the yield spread for the first bond is 10.1 − 5.5 = 4.6%. The second bond

is at par, so the yield is y∗ = 9%. The spread for the second bond is 9 − 6 = 3%.

The default rate for the first period must be greater. The recovery rate is the same
for the two periods, so it does not matter for this problem.

263. EXAMPLE 20.6: FRM EXAM 2001—QUESTION 14
To what sort of option on the counterparty's assets can the current exposure
of a credit-risky position better be compared?
A.  A short call
B.  A short put
C.  A short knock-in call
D.  A binary option

Example 20.6: FRM Exam 2001—Question 14
b. The lender is short a put option, since exposure exists only if the value of assets
falls below the amount lent.

264. EXAMPLE 20.7: FRM EXAM 2002—QUESTION 97
Among the following variables, which one is the main driver of the probability
of default in the KMV model?
A.  Stock prices
B.  Bond prices
C.  Bond yield
D.  Loan prices

Example 20.7: FRM Exam 2002—Question 97
a. Stock prices are the main driver of KMV's estimated default frequency (EDF),
because they drive the value of equity. These models also use the volatility of asset
values and the value of liabilities.

265. Question 3-9(2008)

The capital structure of HighGear Corporation consists of two parts: one five-year zero-coupon bond with a face value of $100 million and the rest is equity. The current market value of the firm's assets is $130 million and the expected rate of change of the firm's value is 25%. The firm's assets have an annual volatility of 30%. Assume that firm value is lognormally distributed, with constant volatility. The firm's risk management division estimates the distance to default using the Merton model, or $[\ln(K/V) - \delta\tau + 0.5\sigma^2\tau]/\sigma\sqrt{\tau}$.

Given the distance to default, the estimated default probability is

A. 2.74%

B. 12.78%

C. 12.79%

D. 30.56%

## Example 21.8: FRM Exam 2008—Question 3-9

a. We compute $z = [\ln(K/V) - \delta\tau + 0.5\sigma^2\tau]/\sigma\sqrt{\tau} = [\ln(100/130) - (25\%)5 + 0.5(30\%^2)5]/[30\%\sqrt{5}] = -1.919$. The PD is then $N(z) = N(-1.919) = 2.749\%$.

266. EXAMPLE 20.9: FRM EXAM 2005—QUESTION 108

The KMV model produces a measure called Expected Default Frequency.

Which of the following statements about this variable is correct?

A. It decreases when the leverage of the firm falls.

B. It increases when the stock price of the firm has been rising.

C. It is the risk-neutral probability of default from Merton's model.

D. It tells investors how the default risk of a bond is correlated with the default risk of other bonds in the portfolio.

Example 20.9: FRM Exam 2005—Question 108

a. The EDF, similarly to the risk-neutral PD, decreases when the stock prices goes up, when the leverage goes down, or when the volatility goes down. It is a transformation of the PD from a Merton-type model. The KMV framework can be extended to finding correlations, but the EDF is not sufficient

267. EXAMPLE 20.10: FRM EXAM 2007—QUESTION 82

Using the Merton model, the value of the debt increases if all other parameters are fixed and

I. The value of the firm decreases.

II. The riskless interest rate decreases.

III. Time to maturity increases.

IV. The volatility of the firm value decreases.

A. I and II only

B. I and IV only

C. II and III only

Example 20.10: FRM Exam 2007—Question 82

b. The value of credit-sensitive debt is $B = Ke^{-(r+s)\tau}$. This increases (1) if the risk-free interest rate decreases, or (2) if the credit spread decreases, or (3) if the maturity decreases. The credit spread decreases if the value of the firm goes up, if the leverage goes down, or if the volatility goes down. Hence, the value of debt increases if the riskless rate decreases or if the volatility decreases.


268. EXAMPLE 20.11: FRM EXAM 2005—QUESTION 134

You have a large position of bonds of firm XYZ. You hedge these bonds with equity using Merton's debt valuation model. The value of the debt falls unexpectedly, but the value of equity does not fall, so you make a loss. Consider the following statements:

I. Interest rates increased.

II. Volatility fell.

III. Volatility increased.

IV. A liquidity crisis increased the liquidity component of the credit spreads.

Which statements are possible explanations for why your hedge did not work out?

A.   I and II only

B.   I and III only

C.   I, III, and IV only


Example 20.11: FRM Exam 2005—Question 134

b. We need to identify shocks that decrease the value of debt but not that of equity. An increase in the risk-free rate will decrease the value of the debt but not the equity (because this decreases leverage). An increase in volatility will have the opposite effect on debt and equity. Finally, a liquidity crisis cannot explain the divergent behavior, because, as we have seen during 2008, it would affect both corporate bonds and equity adversely.


269. Question 3-24(2008)

The Merton model is used to predict default. It builds on several very strong assumptions and its applicability is hampered by practical difficulties. Which of the following statements does *not* correctly identify limiting assumptions or practical difficulties of using the model?

A.   The model relies on a simplistic capital structure with only one debt issue.

B.   The asset value volatility cannot be estimated because firm value does not trade.

C.   The model assumes that debt does not pay a coupon while most publicly traded debt is coupon debt.

D.   The model assumes a constant riskless interest rate.

## Example 21.12: FRM Exam 2008—Question 3-24

b. This statement is incorrect because the asset volatility can be recovered iteratively from the equity volatility and model prices. Other statements are correct weaknesses of this model.

270. EXAMPLE 21.1: FRM EXAM 2006—QUESTION 95

A credit loss on market-driven instruments such as swaps and forwardsarises if:

A. Market rates move in your favor.

B. Market rates move against you.

C. Market rates move against you and the counterparty defaults.

D. Market rates move in your favor and the counterparty defaults.

Example 21.1: FRM Exam 2006—Question 95

d. For a loss to occur, the exposure must be positive, (meaning rates move in your favor, and the counterparty must default.

271. Question 6-2(2009)

Capital Bank is concerned about its counterparty credit exposure to City Bank. Which of the following trades by Capital Bank would increase its credit exposure to City Bank?

   I. Buying a put option from City Bank

   II. Selling a call option to City Bank

   III. Selling a forward contract to City Bank

   IV. Buying a secondary loan granted to Sunny Inc. from City Bank

A. I and II only

B. I and III only

C. II and III only

D. I, III, and IV only

## Example 22.2: FRM Exam 2009—Question 6-2

b. Buying an option or entering a forward contract creates credit exposure because both contracts could move in-the-money. Selling an option, in contrast, does not create exposure. Buying a loan creates exposure to Sunny, not City Bank.

272. EXAMPLE 21.3: FRM EXAM 2006—QUESTION 117

Which of the following will have the greatest potential credit exposure?

A. Long 3,000 ounces of gold for delivery in one year

B. Long 3,000 ounces of gold for delivery in two years

C. Short 3,000 ounces of gold for delivery in two years

D. Selling an at-the-money call option on 10,000 ounces of gold for deliveryin two years

Example 21.3: FRM Exam 2006—Question 117

b. Selling an option does not create exposure, so answer d. is wrong. Longer horizons create a potential for larger price movements, so answer a. is wrong. The potential gain from being long is greater than being short. Prices can go up several times from the initial price for a long position. For a short position, the maximum gain is if the price goes to zero.

273. EXAMPLE 21.4: FRM EXAM 2004—QUESTION 8

Your company has reached its credit limit to Ford but Ford is insisting that your firm provide them some increased protection in the event a major project they are undertaking results in some unforeseen liability. Ignoring settlement risk and assuming option premiums are paid immediately at the time of the transaction, which of these strategies will *not* give rise to increased credit exposure to Ford?

A. Selling a costless collar to Ford
B. Buying an option from Ford
C. Selling an option to Ford
D. None of the above

Example 21.4: FRM Exam 2004—Question 8

c. This is the only answer that involves truly selling an option, which has no credit exposure. A collar involves the sale and purchase of an option.

274. EXAMPLE 21.5: FRM EXAM 2001—QUESTION 84

If a counterparty defaults before maturity, which of the following situationswill cause a credit loss?

A. You are short euros in a one-year euro/USD forward FX contract, andthe euro has appreciated.
B. You are short euros in a one-year euro/USD forward FX contract, andthe euro has depreciated.
C. You sold a one-year OTC euro call option, and the euro has appreciated.
D. You sold a one-year OTC euro call option, and the euro has depreciated

Example 21.5: FRM Exam 2001—Question 84

b. Being short an option creates no credit exposure, so answers c. and d. are false. With the short forward contract, a gain will be realized if the euro has depreciated.

275. EXAMPLE 21.6: FRM EXAM 2004—QUESTION 43

In determining the amount of credit risk in a derivatives transaction, which of the following factors are used?

I. Notional principal amount of the underlying transaction
II. Current exposure

III. Potential exposure

IV. Peak exposure—the replacement cost in a worst case scenario

A.  I and II

B.  I, III, and IV

C.  III and IV

D.  II, III, and IV

Example 21.6: FRM Exam 2004—Question 43

d. All measures of exposure are important, current, potential, and peak. The notional amount, however, is not at risk.

276. EXAMPLE 21.7: FRM EXAM 2005—QUESTION 61

Assume that a bank enters into a USD 100 million, four-year annual pay interest rate swap, where the bank receives 6% fixed against 12-month LIBOR. Which of the following numbers best approximates the current exposure at the end of year 1 if the swap rate declines 125 basis points over the year?

A.  USD 3,420,069

B.  USD 4,458,300

C.  USD 3,341,265

D.  USD 4,331,382.

Example 21.7: FRM Exam 2005—Question 61

a. The value of the fixed-rate bond is $6/(1 + 4.75\%)^1 + 6/(1 + 4.75\%)^2 + 106/(1 + 4.75\%)^3 = 103.420$, Subtracting $100 for the floating leg gives an exposure of $3.4 million. More intuitively, the sum of the coupon difference is 3 times (6% – 4.75%)$100 = $1.25, or around $3.75 million without discounting.

277. EXAMPLE 21.10: FRM EXAM 2002—QUESTION 83

Assume that you have entered into a fixed-for-floating interest rate swap that starts today and ends in six years. Assume that the duration of your position is proportional to the time to maturity. Also assume that all changes in the yield curve are parallel shifts, and that the volatility of interest rates is proportional to the square root of time. When would the maximum potential exposure be reached?

A.  In two months

B.  In two years

C.  In six years

D.  In four years and five months

Example 21.10: FRM Exam 2002—Question 83

b. Exposure is a function of duration, which decreases with time, and interest rate volatility, which increases with the square root of time. Define T as the original maturity and k as a constant. This give $\sigma(V_t) = k(T - t)\sqrt{t}$. Taking the derivative with respect to t gives a maximum at t = (T/3). This gives t = (6/3) = two years.

278. EXAMPLE 21.11: FRM EXAM 2000—QUESTION 47
Which one of the following deals would have the greatest credit exposure for a $1,000,000 deal size (assume the counterparty in each deal is an AAA-rated bank and has no settlement risk)?
A.    Pay fixed in an Australian dollar (AUD) interest rate swap for one year.
B.    Sell USD against AUD in a one-year forward foreign exchange contract.
C.    Sell a one-year AUD cap.
D.    Purchase a one-year certificate of deposit.

Example 21.11: FRM Exam 2000—Question 47
d. The CD has the whole notional at risk. Otherwise, the next greater exposure is for the forward currency contract and the interest rate swap. The short cap position has no exposure if the premium has been collected. Note that the question eliminates settlement risk for the forward contract.

279. EXAMPLE 21.12: FRM EXAM 2001—QUESTION 8
Which of the following 10-year swaps has the highest potential credit exposure?
A.    A cross-currency swap after two years
B.    A cross-currency swap after nine years
C.    An interest rate swap after two years
D.    An interest rate swap after nine years

Example 21.12: FRM Exam 2001—Question 8
a. The question asks about potential exposure for various swaps during their life. Interest rate swaps generally have lower exposure than currency swaps because there is no market risk on the principals. Currency swaps with longer remaining maturities have greater potential exposure. This is the case for the 10-year currency swap, which after two years has eight years remaining to maturity.

280. EXAMPLE 21.13: FRM EXAM 2004—QUESTION 14
BNP Paribas has just entered into a plain-vanilla interest-rate swap as a pay-fixed counterparty. Credit Agricole is the receive-fixed counterparty in the same swap. The forward spot curve is upward-sloping. If LIBOR starts trending down and the forward spot curve flattens, the credit risk from the swap will:

A. Increase only for BNP Paribas
B. Increase only for Credit Agricole
C. Decrease for both BNP Paribas and Credit Agricole
D. Increase for both BNP Paribas and Credit Agricole

Example 21.13: FRM Exam 2004—Question 14
b. With an upward-sloping term structure, the fixed payer has greater credit exposure. He receives less initially, but receives more later. This backloading of payments increases credit exposure. Conversely, if the forward curve flattens, the fixed payer, i.e., BNP Paribas has less credit exposure. Credit Agricole must have greater credit exposure. Alternatively, if LIBOR drifts down, BNP will have to pay more, and its counterparty will have greater credit exposure.

281. EXAMPLE 21.14: FRM EXAM 2002—QUESTION 89
If we assume that the VAR for the portfolio of trades with a given counterparty can be viewed as a measure of potential credit exposure, which of the following could *not* be used to decrease this credit exposure?
A. A netting agreement
B. Collateral
C. A credit derivative that pays out if the counterparty defaults
D. An offsetting trade with a different counterparty

Example 21.14: FRM Exam 2002—Question 89
d. An offsetting trade with a different party will provide no credit protection. If the first party defaults while the contract is in-the-money, there will be a credit loss.

282. EXAMPLE 21.15: FRM EXAM 2005—QUESTION 96
Which of the following statements correctly describes the impact of signing a netting agreement with a counterparty?
A. It will increase or have no effect on the total credit exposure.
B. It will decrease or have no effect on the total credit exposure.
C. It will increase exposure if exposure is net long and decrease exposure if it is net short.
D. Its impact is impossible to determine based on the available information.

Example 21.15: FRM Exam 2005—Question 96
b. Netting should decrease the credit exposure if contracts with the same counterparty have positive and negative values. In the worst case, that of one contract with positive value, there is no effect.

283. EXAMPLE 21.16: FRM EXAM 2006—QUESTION 39

What are the benefits of novation?

A. Both parties are allowed to walk away from the contract in the event ofdefault.

B. In a bilateral contract, it is specified that on default, the non-defaultingparty nets gains and losses with the defaulting counterparty to a singlepayment for all covered transactions.

C. Financial market contracts can be terminated upon an event of defaultprior to the bankruptcy process.

D. Obligations are amalgamated with others.

Example 21.16: FRM Exam 2006—Question 39

d. Answer a. is incorrect because this is a walk-away clause. Answer b. is incorrect because this is close-out netting. Answer c. is incorrect because this is a terminationclause.

284. EXAMPLE 21.18: FRM EXAM 2003—QUESTION 24

Bank A, which is AAA-rated, trades a 10-year interest rate swap (semiannual payments) with bank B, rated A−. Because of bank B's poor credit rating, Bank A is concerned about its 10-year exposure. Which of the following measures help mitigate bank A's credit exposure to bank B?

I. Negotiate a CSA with bank B and efficiently manage the collateral management system

II. Execute the swap deal as a reset swap wherein the swap will be markedto-market every six months

III. Execute the swap deal with a break clause in the fifth year

IV. Decrease the frequency of coupon payments from semiannual to annual

A. I only

B. IV only

C. I, II, III, and IV

D. I, II, and III

Example 21.18: FRM Exam 2003—Question 24

d. Collateral management will lower credit exposure, so Answer I. is correct. Resetting, or recouponing the swap, will also lower exposure. A break clause in five years will allow the marked-to-market, which also lowers exposure. On the other hand, decreasing the frequency of coupons will not change much the exposure. In fact, extending the period will increase exposure because there is a longer time to wait for the next payment, increasing the market will move in the favor or one counterparty.

285. EXAMPLE 21.19: FRM EXAM 2002—QUESTION 73

Consider the following information. You have purchased 10,000 barrels of oil for delivery in one year at a price of $25/barrel. The rate of change of the

price of oil is assumed to be normally distributed with zero mean and annual volatility of 30%. Margin is to be paid within two days if the credit exposure becomes greater than $50,000. There are 252 business days in the year. Assuming enforceability of the margin agreement, which of the following is the closest number to the 95% one-year credit risk of this deal governed under the margining agreement?

A. $50,000
B. $58,000
C. $61,000
D. $123,000

Example 21.19: FRM Exam 2002—Question 73

c. The worst credit exposure is the $50,000 plus the worst move over two days at

the 95% level. The worst potential move is $\alpha\sigma\sqrt{T}$ = 1.645 × 30% × $\sqrt{(2/252)}$ =

4.40%. Applied to the position worth $250,000, this gives a worst move of $10,991. Adding this to $50,000 gives $60,991.

286. Question 3-35(2008)

Suppose BSM, a large derivative market maker, has six contracts with a counterparty, all transacted in New York (i.e., the same legal jurisdiction). The current market values (PV) for these contracts are: 125, 75, 25, -10, -65, and -140. Suppose BSM does not currently have a legally enforceable netting agreement with the counterparty. By how much would BSM's current credit exposure to this counterparty improve if it did have a legally enforceable netting agreement with the counterparty?

A. 0
B. 10
C. 215
D. 225

**Example 22.18: FRM Exam 2008—Question 3-35**

c. The sum of positive exposures is 225. This is the credit exposure without netting. The sum of negative exposures is 215. With netting, the exposure goes to 10, or a drop of 215.

287. Question 6-1(2009)

Which of the following statements about counterparty exposure is correct?

A. Potential future exposure is the minimum amount of exposure expected to occur on a future date with a high degree of statistical confidence.

B. Netting rights, collateral agreements, and early settlement provisions are all examples of credit risk mitigants.

C.    Current exposure refers to the current value of the exposure to a sub¬sidiary.

D.    Wrong-way exposures are exposures that are positively correlated with the credit quality of the counterparty.

## Example 22.19: FRM Exam 2009—Question 6-1

b. Statement a. is incorrect because exposure is the maximum amount, not the minimum amount, which is zero. Statement c. is incorrect because exposure occurs with a counterparty, not subsidiary. Statement d. is incorrect because wrong-way exposures are negatively correlated with the credit quality. The problem is when exposures are high and the credit quality goes down.

288. EXAMPLE 22.1: FRM EXAM 2004—QUESTION 9

If an investor holds a five-year IBM bond, it will give him a return very close to the return of the following position:

A.  A five-year IBM credit default swap on which he pays fixed and receives a payment in the event of default

B.  A five-year IBM credit default swap on which he receives fixed and makes a payment in the event of default

C.  A five-year U.S. Treasury bond plus a five-year IBM credit default swap on which he pays fixed and receives a payment in the event of default

D.  A five-year U.S. Treasury bond plus a five-year IBM credit default swap on which he receives fixed and makes a payment in the event of default

Example 22.1: FRM Exam 2004—Question 9

d. A long corporate bond position is equivalent to a long Treasury bond position plus a short CDS.

289. EXAMPLE 22.2: FRM EXAM 2007—QUESTION 18

Suppose the return on U.S. Treasuries is 3% and a risky bond is currently yielding 15%. A trader you supervise claims to be able to make an arbitrage trade earning 5% using U.S. Treasuries, the risky bond, and the credit default swap. Which of the following could be the trader's strategy, and what is the CDS premium?

A.  Go long the Treasury, short the risky bond, and sell the credit default swap with a premium of 7%.

B.  Go long the Treasury, short the risky bond, and buy the credit default swap with a premium of 6%.

C.  Short the Treasury, invest in the risky bond, and buy the credit default swap with a premium of 7%.

D.  Short the Treasury, invest in the risky bond, and sell the credit default

swap with a premium of 6%.

Example 22.2: FRM Exam 2007—Question 18
c. The bond yield spread is 15 – 3 = 12%. So, the trader could buy the corporate
bond and hedge the interest rate risk by shorting the Treasury. To protect against
default risk, he should buy a CDS on the same obligor at a spread of y. The total
profit must be 12% – y = 5%. Hence, the CDS spread must be 7%.

290. EXAMPLE 22.3: FRM EXAM 2007—QUESTION 120
Bank A makes a USD 10 million five-year loan and wants to offset the
credit exposure to the obligor. A five-year credit default swap (CDS) with
the loan as the reference asset trades on the market at a swap premium
of 50 basis points paid quarterly. In order to hedge its credit exposure, bank A
A.  Sells the five-year CDS and receives a quarterly payment of USD50,000.
B.  Buys the five-year CDS and makes a quarterly payment of USD12,500.
C.  Buys the five-year CDS and receives a quarterly payment of USD12,500.
D.  Sells the five-year CDS and makes a quarterly payment of USD50,000.

Example 22.3: FRM Exam 2007—Question 120
b. The bank should buy the swap to protect against default. The quarterly payment
will be $10M × 0.50%/4 = $12,500.

291. Question 6-3(2009)
A six-year CDS on a AA-rated issuer is offered at 150bp with semiannual payments while the
yield on a six-year annual coupon bond of this issuer is 8%. There is no counterparty risk on
the CDS. The annualized LIBOR rate paid every six months is 4.6% for all maturities. Which
strategy would exploit the arbitrage opportunity? How much would your return exceed
LIBOR?
A.  Buy the bond and the CDS with a risk-free gain of 1.9%.
B.  Buy the bond and the CDS with a risk-free gain of 0.32%.
C.  Short the bond and sell CDS protection with a risk-free gain of 4.97%.
D.  There is no arbitrage opportunity as any apparent risk-free profit is nec¬essarily
    compensation for being exposed to the credit risk of the issuer.

### Example 23.2: FRM Exam 2009—Question 6-3

a. Because LIBOR is flat, the fixed-coupon yield is also 4.6%, creating a spread of
800 − 460 = 340bp on the bond. Going long the bond and short credit via buying
the CDS yields an annual profit of 340 − 150 = 190bp.

292. EXAMPLE 22.4: FRM EXAM 2004—QUESTION 50

The table below shows the bid-ask quotes by UBS for CDS spreads for companies A, B, and C. CSFB has excessive credit exposure to company C and wants to reduce it through the CDS market.

| | 1year 3years 5years |
|---|---|
| A | 15/25 21/32 27/36 |
| B | 43/60 72/101 112/152 |
| C | 71/84 93/113 141/170 |

Since the furthest maturity of its exposure to C is three years, CSFB buys a USD 200 million three-year protection on C from UBS. In order to make its purchase of this protection cheaper, based on its views on companies A and B, CSFB decides to sell USD 300 million five-year protection on company A and to sell USD 100 million one-year protection on company B to UBS. What is the net annual premium payment made by CSFB to UBS in the first year?

A.  USD 1.02 million
B.  USD 0.18 million
C.  USD 0.58 million
D.  USD 0.62 million

Example 22.4: FRM Exam 1999—Question 135
a. Because all bonds rank equally, all defaults occur at the same time and have the same loss given default. Therefore the cash flow on the one-year credit swap can be replicated (including any risk premium) by going long the one-year Widget bond and short the 1-year T-bond.

293. EXAMPLE 22.6: FRM EXAM 2004—QUESTION 65
When an institution has sold exposure to another institution (i.e., purchased protection) in a CDS, it has exchanged the risk of default on the underlying asset for which of the following?
A.  Default risk of the counterparty
B.  Default risk of a credit exposure identified by the counterparty
C.  Joint risk of default by the counterparty and of the credit exposure identified by the counterparty
D.  Joint risk of default by the counterparty and the underlying asset

Example 22.6: FRM Exam 2004—Question 65
d. The protection buyer is exposed to the joint risk of default by the counterparty and underlying credit. If only one defaults, there is no credit risk.

294. EXAMPLE 22.7: FRM EXAM 2007—QUESTION 85
Bank A has exposure to USD 100 million of debt issued by company R. Bank A enters into a credit default swap transaction with bank B to hedge its debt exposure to company R. Bank B would fully compensate bank A if company

R defaults in exchange for a premium. Assume that the defaults of bank A, bank B, and company R are independent and that their default probabilities are 0.3%, 0.5%, and 3.6%, respectively. What is the probability that bank A will suffer a credit loss in its exposure to company R?

A.   4.1%
B.   3.6%
C.   0.0108%
D.   0.0180%

Example 22.7: FRM Exam 2007—Question 85
d. For a loss to occur, both bank B and company R must default. The joint probability of default by B and R is 0.5% times 3.6%, which gives 0.018%.


295. EXAMPLE 22.8: FRM EXAM 2005—QUESTION 111
You enter into a credit default swap with bank B that settles based upon the performance of company C. Assuming that bank B and company C have the same initial credit rating and everything else remains the same, what is the impact on the value of your credit default swap if bank B buys company C?
A.   The credit default swap value increases.
B.   The credit default swap value remains the same.
C.   The credit default swap value decreases.
D.   Impossible to determine based on the information provided.

Example 22.8: FRM Exam 2005—Question 111
c. If bank B buys company C, the two entities B and C will default at the same time. This increase in the default correlation makes the CDS contract less valuable. In Table 22.2, the fair CDS spread decreases when the correlation increases. Given that the existing CDS contract has a fixed spread, this event should decrease the value of the outstanding contract.


296. EXAMPLE 22.9: FRM EXAM 2005—QUESTION 14
Sylvia, a portfolio manager, established a Yankee bond portfolio. However, she wants to hedge the credit and interest rate risk of her portfolio. Which of the following derivatives will best fit Sylvia's need?
A.   A total return swap
B.   A credit default swap
C.   A credit-spread option
D.   A currency swap

Example 22.9: FRM Exam 2005—Question 14

a. A TRS will provide protection against both interest rate and credit risk, as it is indexed to the bond portfolio value. A CDS or CS option only provide protection against credit risk. There is no currency risk in Yankee bonds, which are denominated in dollars, anyway.

297. Question 3-31(2008)

Helman Bank has made a loan of USD 300 million at 6.5% per annum. Helman enters into a total return swap under which it will pay the interest on the loan plus the change in the marked-to-market value of the loan, and in exchange Helman will receive LIBOR + 50 basis points. Settlement payments are made *semiannually*. What is the cash flow for Helman on the first settlement date if the mark-to-market value of the loan falls by 2% and LIBOR is 4%?

A. Net inflow of USD 9.0 million
B. Net inflow of USD 12.0 million
C. Net outflow of USD 9.0 million
D. Net outflow of USD 12.0 million

## Example 23.9: FRM Exam 2008—Question 3-31

c. Note that this is a semiannual payment; hence all annual coupon rates must be divided by 2. Helman pays $300(6.5\%/2 + 2\%)$. In return, it gets $300(4.5\%/2)$. The net is $300(5.25\% - 2.25\%) = 300(3\%) = 9.0$.

298. EXAMPLE 22.14: FRM EXAM 2002—QUESTION 32

A CBO (Collateralized Bond Obligation) consists of several tranches of notes from a repackaging of corporate bonds, ranging from equity to super senior. Which of the following is generally true of these structures?

A. The total yield of all the CBO tranches is slightly less than the underlying repackaged bonds to allow the issuer to recover their fees/costs/profits.
B. The super senior tranche has expected loss rate higher than the juniortranche.
C. The super senior tranche is typically rated below AAA and sold to bondinvestors.
D. The equity tranche does not absorb the first losses of the structure.

Example 22.14: FRM Exam 2002—Question 32

a. In the absence of transaction costs or fees, the yield on the underlying portfolio should be equal to the weighted average of the yields on the different tranches. With costs, however, the CBO yield will be slightly less. Otherwise, the senior tranche is typically rated AAA, has the lowest loss rate of all tranches, and absorbs the last loss on the structure.

299. EXAMPLE 22.15: FRM EXAM 2007—QUESTION 130

A three-year, credit-linked note (CLN) with underlying company Z has a LIBOR + 60bps semi-annual coupon. The face value of the CLN is USD

100. LIBOR is 5% for all maturities. The current three-year CDS spread for company Z is 90bps. The fair value of the CLN is closest to

A.  USD 100.00

B.  USD 111.05

C.  USD 101.65

D.  USD 99.19

Example 22.15: FRM Exam 2007—Question 130

d. Because the current CDS spread is greater than the coupon, the CLN must be selling at a discount. The only solution is d. More precisely, we can use the spread duration from Equation (22.2), which is the sum of the present value factor over three years. Assuming a flat term structure, this is_PV$t$= 0.952 + 0.907 + 0.864 = 2.72 years. Multiplying by (90 − 60) = 30bp gives a fall of 0.81%, which gives $99.19.

300. Question 6-6(2009)

An investor has sold default protection on the most senior tranche of a CDO. If the default correlation decreases unexpectedly, assuming everything else is unchanged, the investor's position will

A.  Gain value since the probability of exercising the protection falls.

B.  Lose value, since the investor's protection will gain value.

C.  Neither gain nor lose value since only expected default losses matter and correlation does not affect expected default losses.

D.  It depends on the pricing model used and the market conditions.

## Example 23.12: FRM Exam 2009—Question 6-6

a. The value of the senior tranche depends on the default correlation. If this goes down, the distribution of losses will be more diversified, or tighter, which makes it less likely that losses will wipe out the lower tranches. Hence, the value of senior tranche goes up. Selling default protection is equivalent to being long the senior tranche, which creates a gain under these conditions.

301. Question 6-5(2009)

A fixed-income investor is considering investing in an asset-backed security (ABS) that has the following structure.

| | |
|---|---|
| Senior tranche | USD 250 million |
| Junior tranche | USD 100 million |
| Subordinated tranche A | USD 60 million |
| Subordinated tranche B | USD 30 million |
| Total | USD 440 million |

If the assets in the pool are worth USD 450 million, what amount of losses will cause the investor to begin to lose money if he invested in the senior tranche?

A. USD 200 million
B. USD 190 million
C. USD 100 million
D. USD 90 million

## Example 23.14: FRM Exam 2009—Question 6-5

a. This is the sum of the value of the lower tranches, or $190 million plus the overcollateralization, which is $10 million.

302. Question 3-29(2008)

In a synthetic CDO,
A. The SPV gains credit exposure by buying securities.
B. The SPV gains credit exposure by selling credit default swaps.
C. The SPV gains credit exposure by buying credit default swaps.
D. The SPV gains credit exposure by selling risk-free bonds.

## Example 23.15: FRM Exam 2008—Question 3-29

b. The SPV can either buy credit-sensitive bonds or sell default swaps.

303. EXAMPLE 22.16: FRM EXAM 2003—QUESTION 7

A standard synthetic CDO references a portfolio of 10 corporate names.Assume the following. The total reference notional is $X$, and the term is $Y$ years. The reference notional per individual reference credit name is $X/10$.The default correlations between the individual credit names are all equalto one. The single-name CDS spread for each individual name is 100 bp, fora term of $Y$ years. The assumed recovery rate on default for all individual reference credits is zero in all cases. The synthetic CDO comprises twotranches, a 50% junior tranche priced at a spread $J$, and a 50% seniortranche priced at spread $S$. All else constant, if the default correlationsbetween the individual reference credit names are reduced from 1.0 to 0.7,what is the effect on the relationship between the junior tranche spread $J$ and the senior tranche spread $S$?
A. The relationship remains the same.
B. $S$ increases relative to $J$.
C. $J$ increases relative to $S$.
D. The effect cannot be determined given the data supplied.

Example 22.16: FRM Exam 2003—Question 7
c. If the correlation is one, all names will default at the same time, and the junior and senior tranche will be equally affected. Hence, their spread should be 100bp, which is the same as for the collateral. With lower correlations, the losses will be absorbed first by the junior tranche. Therefore, the spread on the junior tranche should be higher, which is offset by a lower spread for the senior tranches.

304. EXAMPLE 22.17: FRM EXAM 2007—QUESTION 81

A bank is considering buying (i.e., selling protection on) an AAA-rated super senior tranche [10% – 11%] of a synthetic collateralized debt obligation (CDO) referencing an investment-grade portfolio. The pricing of the tranche assumes a fixed recovery of 40% for all names. All else being equal, which one of the following four changes will make the principal invested morerisky?

A. An increase in subordination of 1%, i.e., investing in the [11% – 12%]tranche

B. An increase in the tranche thickness from 1% to 3%, i.e., investing in the [10% – 13%] tranche

C. Using a recovery rate assumption of 50%

D. An increase in default correlation between names in the portfolio

Example 22.17: FRM Exam 2007—Question 81

d. Increasing the subordination will make the senior tranche less risky because there is a thicker layer beneath to absorb losses. Increasing the thickness of the tranche will make it less likely to be wiped out, so is less risky. An increase in the default correlation will increase the risk. In the limit, if all assets default at the same time, all tranches will suffer a loss.

305. EXAMPLE 22.18: FRM EXAM 2007—QUESTION 10

Consider the following homogeneous reference portfolio in a synthetic CDO: Number of reference entities, 100; CDS spread, $s$ = 150bps; recovery rate f = 50%. Assume that defaults are independent. On a single name the annual default probability is constant over five years and obeys the relation: $s$ = $(1 – f)$PD. What is the expected number of defaulting entities over the next five years, and which of the following tranches would be entirely wiped out (loses 100% of the principal invested) by the expected number of defaulting entities?

A. 14 defaults and a [3% – 14%] tranche would be wiped out.

B. Three defaults and a [0% – 1%] tranche would be wiped out.

C. Seven defaults and a [2% – 3%] tranche would be wiped out.

D. 14 defaults and a [6% – 7%] tranche would be wiped out.

Example 22.18: FRM Exam 2007—Question 10

d. The annual marginal PD is d = 1.5%/(1 – 0.50) = 3.00%. Hence, the cumulative PD for the five years is d + S1d + S2d + S3d + S4d = 3%(1 + 0.970 + 0.941 + 0.913 + 0.885) = 14.1%, where the survival rates are S1 = (1 – 3%) = 0.970, S2 = S1(1 – 3% = 0.941, and so on. The expected number of defaults is therefore 100 × 14.1%, or 14. With a recovery rate of 50%, the expected loss is 7% of the notional. So, all the tranches up to the 7% point are wiped out.

306. EXAMPLE 23.2: FRM EXAM 2002—QUESTION 74

Following is a set of identical transactions. Assuming all counterparties have the same credit rating, which transaction should preferably be executed?

A.  Buying gas from a trading firm
B.  Buying gas from a gas producer
C.  Buying gas from a distributor
D.  Indifferent between a., b., and c.

Example 23.2: FRM Exam 2002—Question 74

b. This is an example of right-way trade. To have lower credit risk, it would be preferable to engage in a trade where there is a lower probability of a default by the counterparty when the contract is in-the-money. This will happen if the counterparty enters a transaction to hedge an operating exposure. For instance, a gas producer has a natural operating exposure to gas. If the producer sells gas at a fixed price, the swap will lose money if the market price of gas goes up. In this situation, however, there is little risk of default because the producer is sitting on an inventory of gas. A trading firm or distributor could go bankrupt if the transaction loses money.

307. EXAMPLE 23.3: FRM EXAM 2003—QUESTION 26

Which of the following loans has the lowest credit risk?

| Loan | 1 Year Probability of Default | Loss Given Default | Remaining Term (Months) |
|------|-------------------------------|--------------------|-------------------------|
| a.   | 1.99%                         | 60%                | 3                       |
| b.   | 0.90%                         | 70%                | 9                       |
| c.   | 1.00%                         | 75%                | 6                       |
| d.   | 0.75%                         | 50%                | 12                      |

Example 23.3: FRM Exam 2003—Question 26

a. The one-year PD needs to be adjusted to the maturity of the loan, using $(1 - dm)T$, where $dm$ is computed from $(1 - dm)^{12} = (1 - d)$.

| Loan | PD to Maturity | Loss Given Default | EL      |
|------|----------------|--------------------|---------|
| a.   | 0.50%          | 60%                | 0.301%  |
| b.   | 0.68%          | 70%                | 0.473%  |
| c.   | 0.50%          | 75%                | 0.376%  |
| d.   | 0.75%          | 50%                | 0.375%  |

308. EXAMPLE 23.4: FRM EXAM 2007—QUESTION 38
Mr. Rosenquist, asset manager, holds a portfolio of SEK 200 million, which
consists of BBB-rated bonds. Assume that the one-year probability of default
is 4%, the recovery rate is 60%, and defaults are uncorrelated over the years.
What is the two-year cumulative expected credit loss on Mr. Rosenquist's
portfolio?
A.   SEK 6.40 million
B.   SEK 6.27 million
C.   SEK 9.60 million
D.   SEK 9.48 million

Example 23.4: FRM Exam 2007—Question 38
b. The survival rate over two years is S2 = (1 − 4%)2 = 92.16%, which implies
a cumulative two-year default rate of 7.84%. Put differently, the first-year PD is
4%, then (1 − 4%)4% = 3.84%. Multiplying by 200 and 40% gives 6.27.

309. EXAMPLE 23.7: FRM EXAM 2005—QUESTION 122
You are the credit risk manager for Bank Happy. Bank Happy holds Treasuries
for USD 500 million, one large loan that has a positive probability
of default for USD 400 million and another loan that has a positive probability
of default for USD 100 million. The defaults are uncorrelated. The
bank computes a credit VAR at 1% using CreditRisk+. Which of the following
statements made about the VAR by the analyst who works for you isnecessarily *wrong*?
A.   The VAR or WCL can be equal to zero.
B.   The expected loss on the portfolio exceeds the VAR.
C.   The expected loss on the portfolio is necessarily smaller than the VAR.
D.   None of the above statements is wrong.

Example 23.7: FRM Exam 2005—Question 122
c. The credit VAR could be zero. For instance, assume that the PD is 0.003. The
joint probability of no default is then (1 − 0.003)(1 − 0.003) = 99.4%. Because
this is greater than the 99% confidence level, the worst loss is zero. The expected
loss, however, would be 0.3% assuming zero recovery, which is greater than VAR.

310. EXAMPLE 23.8: FRM EXAM 2004—QUESTION 11
When determining the standard deviation of value due to credit quality
changes for a single exposure, the CreditMetrics model uses three primary
factors. Which of the following is not one of the factors used in this model?
A.   Credit ratings
B.   Seniority
C.   Equity prices

D. Credit spreads

Example 23.8: FRM Exam 2004—Question 11
c. CreditMetrics uses credit ratings, the transition matrix, recovery rates, and LGD
for various seniority, but not equity prices for the obligor.


311. EXAMPLE 23.9: FRM EXAM 2002—QUESTION 129
A bank computes the distribution of its loan portfolio marked-to-marketvalue one year from now using the CreditMetrics approach of computingvalues for rating transition outcomes using (1) a rating agency transition matrix,(2) current forward curves, and (3) correlations among rating transitionoutcomes derived from stock returns of the obligors. In computing firm-widerisk using this distribution of its loan portfolio, the bank is most likely tounderstate its risk because it ignores
A. The term structure of interest rates
B. Rating drift
C. Spread risk
D. The negative correlation between the Treasury rates and credit spreads

Example 23.9: FRM Exam 2002—Question 129
c. CreditMetrics ignores spread risk. It does account for ratings drift and the term structure of interest rates, albeit not their volatility.


312. EXAMPLE 23.10: FRM EXAM 2003—QUESTION 92
KMV measures the normalized distance from default. How is this defined?
A. (Expected assets – Weighted debt) / (Volatility of assets)
B. Equity/ (Volatility of equity)
C. Probability of stock price falling below a threshold
D. Leverage times stock price volatility

Example 23.10: FRM Exam 2003—Question 92
a. The distance-to-default measure is a standardized variable that measures how much the value of firm assets exceeds the liabilities.


313. EXAMPLE 23.11: FRM EXAM 2004—QUESTION 20
A firm's assets are currently valued at $500 million and its current liabilities are $300 million. The standard deviation of asset values is $80 million. The firm has no other debt. What will be the approximate distance to default using the KMV calculation?
A. 2 standard deviations
B. 2.5 standard deviations
C. 6.25 standard deviations

D.   Cannot be determined

Example 23.11: FRM Exam 2004—Question 20
b. Using Equation (23.14), the DD is (500 − 300)/80 = 2.5 standard deviations.

314. EXAMPLE 23.12: FRM EXAM 2007—QUESTION 59
You are given the following information about a firm. The market value of
assets at time 0 is 1,000; at time 1 is 1,200. Short-term debt is 500; long-term
debt is 300. The annualized asset volatility is 10%. According to the KMV
model, what are the default point and the distance to default at time 1?
A.   800 and 3.33
B.   650 and 7.50
C.   650 and 4.58
D.   500 and 5.83

Example 23.12: FRM Exam 2007—Question 59
c. The default point is given by short-term liabilities plus half of long-term liabilities,
which is 500 + 300/2 = 650. The distance to default at point 1 is
$(V − K)/\sigma V = (1{,}200 − 650)/(1{,}200 \times 0.10) = 4.58$.

315. EXAMPLE 23.13: FRM EXAM 2006—QUESTION 69
Which of the following model(s) calculates the change in portfolio value due
to rating migration of the underlying instruments?
A.   CreditRisk+
B.   CreditMetrics
C.   KMV
D.   Both a. and c.

Example 23.13: FRM Exam 2006—Question 69
b. Only CreditMetrics uses the rating migration. KMV uses the distance to default.
CreditRisk+ uses random variables drawn from a Poisson distribution.

316. EXAMPLE 23.14: FRM EXAM 2005—QUESTION 36
Which of the following credit risk models uses the option theoretic approach
for modeling correlation between the credit risky assets?
A.   CreditRisk+
B.   CreditMetrics
C.   KMV for public firms
D.   Both CreditMetrics and KMV for public firms

Example 23.14: FRM Exam 2005—Question 36

c. KMV estimates default probabilities using the Merton approach based on the company's stock price.

317. Question 6-10(2009)

Which of the following statements correctly applies to the KMV model, CreditMetrics, and CreditRisk+ together?

A. In their original implementations these models do not take into account changes in interest rates or credit spreads.

B. All three models allow for changes in default probability only when ratings change, rather than continuously.

C. It is impossible to compute a VAR measure using these models.

D. Credit migrations from one ratings class to another are ignored by these models.

## Example 24.14: FRM Exam 2009—Question 6-10

a. None of the models take into account changes in risk-free rates nor spreads, so answer a. is correct. Answer b. is incorrect, because the KMV model bases estimates of PD on the stock price, which moves continuously. Answer c. is incorrect, because the main purpose of all of these models is to estimate credit VAR measures. Answer d. is incorrect, for example, because CreditMetrics is based on credit ratings.

# Part Seven Operational and Integrated Risk Management

318. EXAMPLE 24.1: FRM EXAM 2004—QUESTION 39

Which of the following is not a type of operational risk as defined by Basel II?

A. Human error and internal fraud

B. Destruction by fire or other external catastrophes

C. Damaged reputation due to a failed merger

D. Failure or breakdown in internal control processes

Example 24.1: FRM Exam 2004—Question 39

c. Damaged reputation due to a failed merger is a business risk. Also, reputational risk is not a type of operational loss.

319. EXAMPLE 24.2: FRM EXAM 2002—QUESTION 133

Which one of the following cases or events can be considered as resulting from operational risk?

A. A bank reports losses on a diversified portfolio of stocks during the stock

market decline.
B.   The bank becomes embroiled in a high-profile lawsuit with a customer
        that accuses it of improper selling practices.
C.   The bank reports the loss of $1.5 billion due to rises in interest rates.
D.   A U.S. investor makes a loss as the yen depreciates relative to thedollar.

Example 24.2: FRM Exam 2002—Question 133
b. Answers a., c., and d. correspond to the market risk of stocks, fixed-income
securities, and currencies, respectively. Lawsuits, on the other hand, are part of
operational risk.

320. EXAMPLE 24.3: FRM EXAM 2003—QUESTION 65
Which of these outcomes is not associated with an operational risk process?
A.   The sale of call options is being booked as a purchase.
B.   A monthly volatility is inputted in a model that requires a daily volatility.
C.   A loss is incurred on an option portfolio because ex post volatility exceeded
     expected volatility.
D.   A volatility estimate is based on a time-series that includes a price that
     exceeds the other prices by a factor of 100.

Example 24.3: FRM Exam 2003—Question 65
c. Choices a., b., and d. are operational losses. Answer c. is the result of a bet on
volatility, which is market risk.

321. EXAMPLE 24.4: FRM EXAM 2007—QUESTION 56
All the following are operational risk loss events, *except*:
A.   An individual shows up at a branch presenting a check written by acustomer for an
     amount substantially exceeding the customer's lowchecking account balance. When
     the bank calls the customer to ask himfor the funds, the phone is disconnected and the
     bank cannot recoverthe funds.
B.   A bank, acting as a trustee for a loan pool, receives less than the projectedfunds due to
     delayed repayment of certain loans.
C.   During an adverse market movement, the computer network system
     becomesoverwhelmed, and only intermittent pricing information is availableto the
     bank's trading desk, leading to large losses as traders becomeunable to alter their
     hedges in response to falling prices.
D.   A loan officer inaccurately enters client financial information into thebank's proprietary
     credit risk model.

Example 24.4: FRM Exam 2007—Question 56
b. Statement a. represents external fraud, which is included in operational risk.
Statement c. represents a systems failure. Statement d. is a failure in internal
processes.

322. EXAMPLE 24.5: FRM EXAM 2007—QUESTION 139

The risk of the occurrence of a significant difference between the mark-tomodel value of a complex and/or illiquid instrument and the price at which the same instrument is revealed to have traded in the market is referred to as:

A. Liquidity risk
B. Dynamic risk
C. Model risk
D. Mark-to-market risk

Example 24.5: FRM Exam 2007—Question 139

c. This is a situation where the model price is significantly different from the market price, which is model risk. Liquidity risk could also explain part of the difference, but this is less likely to be the case given the emphasis on the complexity of the instrument.


323. Question 7-11(2009)

In the latest guidelines for computing capital for incremental risk in the trad¬ing book, the incremental risk charge (IRC) addresses a number of perceived shortcomings in the 99 %/10-day VAR framework. Which of the following statements about the IRC are *correct*?

   I. For all IRC-covered positions, the IRC model must measure losses due to default and migration over a one-year horizon at a 99% confidence level.
   II. A bank can incorporate into its IRC model any securitization positions that hedge underlying credit instruments held in the trading account.
   III. A bank must calculate the IRC measure at least weekly, or more fre¬quently as directed by its supervisor.
   IV. The incremental risk capital charge is the maximum of (1) the average of the IRC measures over 12 weeks and (2) the most recent IRC measure.

A. I and II
B. III and IV
C. I, II, and III
D. II, III, and IV

## Example 28.19: FRM Exam 2009—Question 7-11

b. Statement I. is incorrect because the confidence level is 99.9%. Statement II. is incorrect because securitizations are subject to the banking book capital requirements. The other two statements are correct.


324. EXAMPLE 24.7: FRM EXAM 2007—QUESTION 138

The severity distribution of operational losses usually has the followingshape:

A.    Symmetrical with short tails
B.    Long-tailed to the right
C.    Uniform
D.    Symmetrical with long tails

Example 24.7: FRM Exam 2007—Question 138
b. Loss severity distributions are bounded by zero but should include very large
losses. So, they are asymmetrical with long right tails.


325. Question 4-10(2008)

Randy Bartell has collected operational loss data to calibrate frequency and severity
distributions. Generally, he regards all data points as a sample from an underlying
distribution and therefore gives each data point the same weight or probability in the
statistical analysis. However, external loss data is inherently biased. Which of the following is
not typically associated with external data?
A.    Data capture bias
B.    Scale bias
C.    Truncation bias
D.    Survivorship bias

## Example 25.7: FRM Exam 2008—Question 4-10

d. Internal data certainly has a problem of survivorship bias because a bank where
employees compute the operational risk distribution is still alive. This precludes a
history of large, deadly losses.


326. EXAMPLE 24.9: FRM EXAM 2007—QUESTION 33

Suppose you are given the following information about the operational risk
losses at your bank. What is the estimate of the VAR at the 95% confidence
level, including expected loss?

| Frequency Distribution | | Severity Distribution | |
|---|---|---|---|
| Probability | Number | Probability | Loss |
| 0.5 | 0 | 0.6 | USD 1,000 |
| 0.3 | 1 | 0.3 | USD 10,000 |
| 0.2 | 2 | 0.1 | USD 100,000 |

A.    USD 100,000
B.    USD 101,000
C.    USD 200,000
D.    USD 110,000

Example 24.9: FRM Exam 2003—Question 33

a. Because VAR should include EL, there is no need to compute EL separately. The table shows that the lowest loss, such that the cumulative probability is 95% or more, is $100,000.

| Loss | Probability | | Cumulative |
|---|---|---|---|
| 0 | 0.5 | = 0.500 | 50.0% |
| 1,000 | 0.3 × 0.6 | = 0.180 | 68.0% |
| 2,000 | 0.2 × 0.6 × 0.6 | = 0.072 | 75.2% |
| 10,000 | 0.3 × 0.3 | = 0.090 | 84.2% |
| 11,000 | 0.2 × 0.6 × 0.3 × 2 | = 0.072 | 91.4% |
| 20,000 | 0.2 × 0.3 × 0.3 | = 0.018 | 93.2% |
| 100,000 | 0.3 × 0.1 | = 0.030 | 96.2% |
| 101,000 | 0.2 × 0.1 × 0.6 × 2 | = 0.024 | 98.6% |
| 110,000 | 0.2 × 0.1 × 0.3 × 2 | = 0.012 | 99.8% |
| 200,000 | 0.2 × 0.1 × 0.1 | = 0.002 | 100.0% |

327. EXAMPLE 24.11: FRM EXAM 2002—QUESTION 102

Capital is used to protect the bank from which of the following risks?

A. Risks with an extreme financial impact
B. High-frequency low-loss events
C. Low-frequency risks with significant financial impact
D. High-frequency uncorrelated events

Example 24.11: FRM Exam 2002—Question 102

c. Capital is supposed to absorb risks that have significant financial impact on the firm. Risks with extreme financial impact, such as systemic risk, cannot be absorbed by capital alone, so answer a. is wrong. Low-loss events are unimportant, so b. is wrong. Uncorrelated events tend to diversify, so d. is wrong.

328. EXAMPLE 24.12: FRM EXAM 2001—QUESTION 49

Which of the terms below is used in the insurance industry to refer to the effect of a reduction in the control of losses by an individual who is insured because of the protection provided by insurance?

A. Control trap
B. Moral hazard
C. Adverse selection
D. Control hazard

Example 24.12: FRM Exam 2001—Question 49

b. Moral hazard arises when insured individuals have no incentive to control their losses because they are insured.

329. EXAMPLE 24.13: FRM EXAM 2003—QUESTION 48

Which of the options below does not describe a problem faced by banks when purchasing insurance as a hedge against operational risk?
A. The fact that the loss reimbursement period can take several years
B. The credit rating of insurers
C. The different perspective of operational risk between banks and insurers
D. Not having an operational VAR

Example 24.13: FRM Exam 2003—Question 48
d. Answers a., b., and c. describe problems arising from the purchase of insurance against operational risk. This is irrespective of whether the bank has an operational VAR model.

330. EXAMPLE 24.14: FRM EXAM 2005—QUESTION 48

Insurance is an effective tool to transfer which of types of operational risks?
A. High frequency, low severity
B. Low frequency, high severity
C. Operational losses whose magnitude is affected by the actions of thecompany
D. Operational losses for which insurance companies only sell policies withlow limits

Example 24.14: FRM Exam 2005—Question 48
b. The purpose of insurance is to reimburse large losses, or operational risk events with high severity. Answer c. is incorrect because this type of moral hazard should result in much higher premiums.

331. EXAMPLE 24.15: FRM EXAM 2005—QUESTION 52

Which of the following statements are valid about hedging operational risk?
I. A primary disadvantage of insurance as an operational risk management tool is the limitation of policy coverage.
II. If an operational risk hedge works properly, a firm will avoid damage to its reputation from a high-severity operational risk event.
III. While all insurance contracts suffer from the problem of moral hazard, deductibles help reduce this problem.
IV. Catastrophe (cat) bonds allow a firm to hedge operational risks associated with natural disasters.
A. I, III, and IV only
B. I, II, and IV only
C. II and III only

D. III and IV only

Example 24.15: FRM Exam 2005—Question 52
a. All the statements are valid, except for II. Even if a firm implements a hedge or purchases insurance, the news of a large operational loss will still damage its reputation.

332. Question 4-33(2008)
The following statements concern differences between market and operational risk VAR models. Which of the following statements is *false*?
A. Market risk models are primarily driven by historical data, whereas operational risk models are more flexible in this regard.
B. Market risk models typically define VAR as a specific quantile of the loss distribution, whereas operational risk models are more flexible in this regard.
C. Backtesting is generally a more useful form of validation for market risk models than for operational risk models.
D. The time horizon over which VAR is evaluated differs between market and operational risk models.

## Example 25.14: FRM Exam 2008—Question 4-33

b. Statement a. is true because operational risk models often rely heavily on scenario analysis. Backtesting is more difficult for operational risk models, so c. is true. VAR is usually evaluated over shorter horizons, so d. is true. Statement b. is false because both market and operational risk models use a quantile of the distribution.

333. EXAMPLE 29.13: FRM EXAM 2007—QUESTION 117
Which of the following approaches for calculating operational risk capital charges leads to a higher capital charge for a given accounting income as riskincreases?
A. The basic indicator approach
B. The standardized approach
C. The advanced measurement approach
D. All of the above

Example 29.13: FRM Exam 2007—Question 117
c. The basic indicator approach uses a factor of $\alpha = 15\%$. The standardized approach uses a factor ranging from 12% to 18%. For the same level of income, if risk increases for instance by having more exposure to trading, the second approach will correctly pick up an increase in risk. Similarly for the AMA, which is even more risk-sensitive.

334. EXAMPLE 29.14: FRM EXAM 2004—QUESTION 53

Which of the following statements about its methodology for calculating an operational risk capital charge in Basel II is correct?

A. Basic indicator approach is suitable for institutions with sophisticated operational risk profile.

B. Under the standardized approach, capital requirement is measured for each of the business line.

C. Advanced measurement approaches will not allow an institution to adopt its own method of assessment of operational risk.

D. AMA is less risk-sensitive than the standardized approach.


Example 29.14: FRM Exam 2004—Question 53

b. The BI approach is suitable for banks with basic risk profiles, so answer a. is incorrect. The AMA approach is an internal model, so answer c. is incorrect. AMA is more risk-sensitive than the SI approach, so answer d. is incorrect.


335. EXAMPLE 29.15: FRM EXAM 2004—QUESTION 42

According to the Basel Accord's advanced measurement approach, how are operational capital requirements calculated?

A. As in credit risk, there are formulae specified in the Accord so that only the inputs have to be estimated.

B. Capital requirements have to be estimated using historical data bases but the Accord does not specify which statistical distribution has to be used.

C. The formulae are the same as those used for credit risk capital requirements.

D. Each national supervisor must specify the formulae that the banks have to use.


Example 29.15: FRM Exam 2004—Question 42

c. The AMA approach is an internal models approach, which does not specify a particular loss distribution.


336. EXAMPLE 29.16: FRM EXAM 2007—QUESTION 6

Which of the following statements regarding Basel II non-advanced approaches is incorrect?

A. The standardized approach makes it advantageous for a bank to book losses early if doing so reduces this year's gross income sufficiently to make it negative.

B. Corporate finance, trading and sales, and payment and settlement are the business lines with the highest regulatory capital requirements.

C. The standardized approach divides the bank into business lines and uses data from the last three years of a business line's gross income and a

beta factor to obtain the regulatory capital for that business line.
D. The standardized approach uses data from the last three years of gross income to obtain a bank's operational risk capital charge.

Example 29.16: FRM Exam 2007—Question 6
a. Statement b. is correct, given Table 29.12. Statement a. is incorrect, as only positive income is considered.

337. EXAMPLE 25.1: FRM EXAM 2003—QUESTION 15
Which of the following statements regarding liquidity risk is *correct*?
A.  Asset liquidity risk arises when a financial institution cannot meet payment obligations.
B. Flight to quality is usually reflected in a decrease in the yield spread between corporate and government issues.
C. Yield spread between on-the-run and off-the-run securities mainly captures the liquidity premium, and not the market and credit riskpremium.
D. Funding liquidity risk can be managed by setting limits on certain asset markets or products and by means of diversification.

Example 25.1: FRM Exam 2003—Question 15
c. The yield spread between on-the-run and off-the-run reflects a liquidity premium because the bonds are otherwise nearly identical. In answers a. and d., asset and funding risk should be interchanged. Finally, for b., a flight to quality increases the yield spread.

338. EXAMPLE 25.2: FRM EXAM 2002—QUESTION 36
The following statements compare a highly liquid asset against an (otherwise similar) illiquid asset. Which statement is most likely to be *false*?
A. It is possible to trade a larger quantity of the liquid asset without affecting the price.
B. The liquid asset has a smaller bid–ask spread.
C. The liquid asset has higher price volatility since it trades more often.
D. The liquid asset has higher trading volume.

Example 25.2: FRM Exam 2002—Question 36
c. Compare two stocks. The liquid stock typically has higher trading volumes and lower bid-ask spreads, so b. and d. are true. It also has greater depth, meaning that large quantities can be traded without affecting prices too much, so a. is true. As a result, the remaining answer c. must be wrong. There is no necessary relationship between trading activity and volatility.

339. EXAMPLE 25.3: FRM EXAM 2007—QUESTION 78

A mutual fund investing in common stocks has adopted a liquidity risk measure limiting each of its holdings to a maximum of 30% of its 30-day average value traded. If the fund size is USD 3 billion, what is the maximum weight that the fund can hold in a stock with a 30-day average value traded of USD 2.4 million?

A. 24.00%
B. 0.08%
C. 0.024%
D. 80.0%

Example 25.3 FRM Exam 2007—Question 78

c. The maximum weight w is given by $3,000 × w = 30% × $2.4, or w = 0.024%.

340. EXAMPLE 25.4: FRM EXAM 2000—QUESTION 74

In a market crash the following are usually *true*?
I. Fixed-income portfolios hedged with short Treasury bonds and futures lose less than those hedged with interest rate swaps given equivalent durations.
II. Bid–offer spreads widen because of lower liquidity.
III. The spreads between off-the-run bonds and benchmark issues widen.

A. I, II, and III
B. II and III
C. I and III
D. None of the above

Example 25.4: FRM Exam 2000—Question 74

b. In a crash, bid offer spreads widen, as do liquidity spreads. Answer I. is incorrect because Treasuries usually rally more than swaps, which leads to *greater* losses for a portfolio short Treasuries than swaps.

341. EXAMPLE 25.5: FRM EXAM 2007—QUESTION 116

You are holding 100 Wheelbarrow Company shares with a current price of $50. The daily mean and volatility of the stock return is 1% and 2%, respectively. VAR should be measured relative to the initial wealth. The bid–ask spread of the stock varies over time. The daily mean and volatility of the spread is 0.5% and 1%, respectively. Both the return and spread are normally distributed. Calculate the daily liquidity-adjusted VAR (LVAR) at a 99% confidence level.

A. USD 254
B. USD 229
C. USD 325
D. USD 275

Example 25.5: FRM Exam 2007—Question 116

a. The regular VAR relative to the initial portfolio value is VAR = W(ασ − μ) = $5,000(2.33 × 2% − 1%) = $183. (Note that this estimate of the mean is abnormally high.) To this must be added L2 = 12

W($\bar{\mu}_S$ + α'σS) = 12$5,000(0.5% +2.33 × 1%) = $70.75, for a total of $254.

342. Question 7-7(2009)

You are a manager of a renowned hedge fund and are analyzing a 1,000-share position in an undervalued but illiquid stock BNA, which has a current stock price of USD 72 (expressed as the midpoint of the current bid-ask spread). Daily return for BNA has an estimated volatility of 1.24%. The average bid-ask spread is USD 0.16. Assuming returns of BNA are normally distributed, what is the estimated liquidity-adjusted daily 95% VAR, using the constant spread approach?

A.    USD 1,389

B.    USD 1,469

C.    USD 1,549

D.    USD 1,629

## Example 26.6: FRM Exam 2009—Question 7-7

c. Conventional VAR is $72 × 1,000 × 1.24% × 1.645 = $1,469. The spread effect is $0.16 × 1,000 = $80, for a total of $1,549. As usual, we see that the spread liquidity component is small.

343. Question 2-20(2008)

You are a risk manager for a hedge fund. You are told that the TED spread increased sharply. Which of the following statements best describes the change in your situation?

A.    An increase in the TED spread indicates that the Federal Reserve will push interest rates up, so the duration of the portfolios should be reduced.

B.    An increase in the TED spread indicates a bigger gap between the fed funds rate and Treasuries, so that the Fed will choose to increase liquidity in the markets, which will increase prices of securities as demand will increase.

C.    An increase in the TED spread could indicate greater concerns about bank solvency, so that you should review your counterparty exposures and possibly hedge some exposure to banks.

D.    An increase in the TED spread could indicate more willingness of banks to lend since they get paid more for lending, so we should use the opportunity to renegotiate lines of credit.

**Example 26.7: FRM Exam 2008—Question 2-20**

c. Statement a. is not correct because a wider TED spread is consistent with the Fed lowering rates. Statement b. is not correct because the fed funds rate is for collateralized loans, whereas Eurodollar rates are for uncollateralized deposits. Statement d. is incorrect because a wider TED spread means that the cost of bank borrowing goes up, not down.

344. EXAMPLE 25.6: FRM EXAM 2007—QUESTION 57

You have been asked to review a memo on how market liquidity is affected by shocks to the financial system. Which of the following observations made in the memo is *incorrect*?

A. In periods of acute market stress, market liquidity typically increases in the most liquid markets, creating a self-correcting loop that will ultimately remove downward pressure on asset prices.

B. Evaporation of market liquidity is an important factor in determining whether and at what speed financial disturbances become financial shocks with potentially systemic threats.

C. Market shocks may not be reflected in marked-to-market portfolio values immediately for portfolios with illiquid assets. As a result, it is possible for market shocks to have delayed effects on financial institutions.

D. The impact of a market shock on the liquidity of a specific asset depends on the characteristics of the investors who own the asset.

Example 25.6: FRM Exam 2007—Question 57

a. Answer b. is correct, as proved by the events of 2007. Answer c. correctly states that the prices of illiquid assets reflect a delayed reaction to events. Answer d. explains that asset liquidity depends on investor positions, which is correct. An asset that is mainly owned by leveraged investors can experience a sharp swing in prices if the investors are forced to sell.

345. Question 7-12(2009)

Your CRO asks you to prepare a list of early warning indicators for liquidity problems for your bank. Which of the following are early warning indicators of a potential liquidity problem?

I. Rapid asset growth, especially when funded with potentially volatile liabilities
II. Growing concentrations in assets or liabilities
III. An increase of the weighted average maturity of liabilities
IV. Reduction in the frequency of positions approaching or breaching inter¬nal or regulatory limits
V. Narrowing debt or credit default swap spreads
VI. Counterparties that request additional collateral for credit exposures
VII. Increasing redemptions of CDs before maturity

A. I, II, VI, and VII

B. I, III, V, and VI

C. II, IV, V, and VII

D. I, V, VI, and VII

### Example 26.9: FRM Exam 2009—Question 7-12

a. Statement I. is correct; this is the Northern Rock story. Statement II. is also a problem because it means higher probability of either asset or funding risk. Statement III. is not a correct answer, because longer liabilities reduce the probability of a near-term funding problem. Statement IV. is not a correct answer, because this is market risk. Statement V. is not a correct answer, because a problem would arise from widening, not narrowing spreads. Statement VI. is correct because collateral demands create a claim on liquidity. Statement VII. is correct because this requires cash for repayment.

346. Question 4-24(2008)

Which of these statements about economic and regulatory capital are *valid*?

  I. Regulatory capital seeks soundness and stability in the banking system by ensuring that there is enough capital in the banking system.

  II. Economic capital is designed to keep a financial institution solvent at a specified confidence level.

  III. For an individual bank, economic capital is always less than regulatory capital.

  IV. The determination of economic capital, and its allocation to the various business units, is a strategic decision process that affects the risk/return performance of the business units and the bank as a whole.

  A. II and IV only

  B. I, II, III, and IV

  C. I, II, and IV only

  D. I and IV only

### Example 27.1: FRM Exam 2008—Question 4-24

c. All the statements are correct, except c., that economic capital must *always* be less than regulatory capital. This is too broad a statement. The two measures are not necessarily related, even though this is the goal of having more risk-sensitive capital requirements.

347. Question 7-9(2009)

Tower Bank approaches economic capital and risk aggregation by first es¬timating the stand-alone economic capital for individual risk factors. In a second step, the bank aggregates risks based on the relative amounts of eco¬nomic capital allocated to these risks, taking into account the correlations between risk factors. Which of the following variables is

*not* a primary driver of the diversification benefit that accrues from aggregation?
   A.  The number of risk positions
   B.  The size of the portfolio
   C.  The concentration of those risk positions, or their relative weights in a portfolio
   D.  The correlation between the positions

## Example 27.2: FRM Exam 2009—Question 7-9

b. A portfolio is generally more diversified when it has many positions, which are not too large, and with low correlations. Hence answers a., c., and d. involve drivers of diversification. In contrast, risk measures are homogeneous with the size of the portfolio. Doubling all the positions will double the risk of the portfolio.

348. EXAMPLE 26.2: FRM EXAM 2002—QUESTION 103
   Consider a bank that wants to have an amount of capital so that it can absorb unexpected losses corresponding to a firm-wide VAR at the 1% level. It measures firm-wide VAR by adding up the VARs for market risk, operational risk, and credit risk. There is a risk that the bank has too little capital because
   A.   It does not take into account the correlations among risks.
   B.   It ignores risks that are not market, operational, or credit risks.
   C.   It mistakenly uses VAR to measure operational risk because operational risks that matter are rare events.
   D.   It is meaningless to add VARs.

   Example 26.2: FRM Exam 2002—Question 103
   b. VAR can be added across different types of risk, but this will provide a conservative estimate of capital as diversification effects are ignored. So answer a. would be for too much capital. Answer c. is not correct because rare events can be factored into operational VAR. Most likely, the bank may have too little capital for other types of risk than those measured by these three categories.

349. EXAMPLE 26.3: FRM EXAM 2006—QUESTION 109
   Large banks typically allocate risk capital for credit, operational, and market/ALM risks. Which of the following statements ranks the typical amount of risk capital allocated to these different risks correctly?
   A.   Market/ALM risk requires more risk capital than credit risk.
   B.   Credit risk requires more risk capital than market/ALM risk, which requires more risk capital than operational risk.
   C.   Market/ALM risk requires more risk capital than operational risk but less than credit risk.
   D.   Credit risk requires more risk capital than operational risk, which requires more risk capital than market/ALM.

Example 26.3: FRM Exam 2006—Question 109

d. For most global banks, the order of importance is, first, credit risk, then operational risk, then market/ALM risk. Also, answers b. and c. are the same.

350. EXAMPLE 26.4: FRM EXAM 2005—QUESTION 33

Counterparty A is an American company with manufacturing operations in Indonesia and its main customers in the United States, while counterparty B is an American company that manufactures its goods domestically and exports solely to Indonesia. Which one of the following transactions with either counterparty will be a wrong-way exposure for a bank?

A.  A five-year plain-vanilla IDR/USD cross-currency swap between the bank and counterparty A where the bank is USD interest rate receiver.
B.  A five-year plain-vanilla IDR/USD currency option sold by the bank to counterparty A for it to buy IDR at a certain rate.
C.  A five-year plain-vanilla IDR/USD cross-currency swap between the bank and counterparty B where the bank is USD interest rate receiver.
D.  A five-year plain-vanilla IDR/USD currency option bought by the bank from counterparty B for the bank to buy IDR at a certain rate.

Example 26.4: FRM Exam 2005—Question 33

c. This is an example of a wrong-way exposure, where a gain on the instrument for the bank is associated with a higher PD for its counterparty. If the IDR depreciates, company A will make a profit because its costs will go down in dollars. Conversely for company B, because its dollar revenues will decrease. Under c., the company pays USD and receives IDR. This transaction will create a loss if the IDR depreciates. In this situation, company B will lose money as well on its exports. Hence, this is a wrong-way trade.

351. Question 4-29(2008)

Your bank calculates a one-day 95% VAR for market risk, a one-year 99% VAR for operational risk, and a one-year 99% VAR for credit risk. The measures are $100 million, $500 million, and $1 billion, respectively. Operational risk is defined to include all risks that are not market risks and credit risks, and these three categories are mutually uncorrelated. The market risk VAR assumes normally distributed returns, and the bank expects to be successful to keep its market risk VAR at that level for the whole year. Your boss wants your best estimate of a firmwide VAR at the 1% level. Among the following choices, your best estimate is:

A.  $1.7 billion
B.  $1.94 billion
C.  $2.50 billion
D.  It is impossible to aggregate risks with different distributions having only this information.

c. First, we convert the daily VAR at the 95% level to the same parameters as the other. With the normality assumption, this is $\text{VAR}_{\text{MKT}} = \$100 \times (2.326/1.645)\sqrt{252} = \$2,245$. We then combine the three VARs by taking the square

root of the sum of squares, which gives $\text{VAR} = \sqrt{\$2,245^2 + \$500^2 + \$1,000^2} = \$2,458$.

352. EXAMPLE 26.5: FRM EXAM 2004—QUESTION 47

The failure of Barings Bank is a typical example of a lack in control pertaining to which one of the following risks:
A.   Liquidity risk
B.   Credit risk
C.   Operational risk
D.   Foreign exchange risk

Example 26.5: FRM Exam 2004—Question 47
c. The Barings failure falls in the category of operational risk because of a breakdown in procedures. The trader, Nick Leeson, had control of the back office.

353. Question 4-34(2008)

According to both the CRMPG II Report and the Basel Committee, rigorous stress-testing should be an important component of risk measurement and management. To improve the value of stress-testing exercises, firms should consider all of the following except:
A.   Asking risk managers to define and clearly express firm loss tolerance levels
B.   Identifying a range of scenarios that could produce portfolio losses
C.   Ranking the stress scenarios by level of potential adverse impact and assessing relative probabilities for scenarios
D.   Ensuring that stress tests are plausible and consistent with the existing risk model framework

a. Business managers or the board of directors should define the risk tolerance, not risk managers.

354. EXAMPLE 26.7: FRM EXAM 2005—QUESTION 17

Which of the following is *not* a proper practice of risk management andcontrol for a financial institution with assets in excess of $100 million?
A.   A firm's sole mechanism to monitor the implementation of the control policies defined by the board is an external audit firm.

B. A subcommittee of the board is responsible for the approval of risk
   limits, risk management policies, and delegation of exceptional approvalauthorities.
C. Senior management is responsible for the day-to-day oversight of the
   firm's activities, implementing appropriate risk management and control
   policies, and monitoring the risks and exposures of the firm.
D. Senior management is responsible for establishing written documentation
   about control procedures at each level of the control hierarchy.

Example 26.7: FRM Exam 2005—Question 17
a. Control policies also need to be verified by an internal audit function.

355. EXAMPLE 26.8: FRM EXAM 2002—QUESTION 132
The following is not a problem of having one employee perform trading
functions and back-office functions.
   A. The employee gets paid more because she performs two functions.
   B. The employee can hide trading mistakes when processing the trades.
   C. The employee can hide the size of her book.
   D. The employee's firm may not know its true exposure.

Example 26.8: FRM Exam 2002—Question 132
a. Answers b., c., and d. all can lead to a situation where the trader loses money
and hides the losses. Answer a. is not a problem per se.

356. EXAMPLE 26.9: FRM EXAM 2000—QUESTION 69
Which of the following strategies can contribute to minimizing operationalrisk?
I. Individuals responsible for committing to transactions should perform
clearance and accounting functions.
II. To value current positions, price information should be obtained from
external sources.
III. Compensation schemes for traders should be directly linked to calendar
revenues.
IV. Trade tickets need to be confirmed with the counterparty.
   A. I and II
   B. II and IV
   C. III and IV
   D. I, II, and III

Example 26.9: FRM Exam 2000—Question 69
b. Answer I violates the principle of separation of functions. Answer III. may
create problems of traders taking too much risk. Answer II. advises the use of
external sources for valuing positions, as traders may affect internal price data.

357. EXAMPLE 26.10: FRM EXAM 2007—QUESTION 36

To control risk-taking by traders, your bank links trader compensation with their compliance with imposed VAR limits on their trading book. Why should your bank be careful in tying compensation to the VAR of eachtrader?

A. It encourages traders to select positions with high estimated risks, whichleads to an underestimation of the VAR limits.

B. It encourages traders to select positions with high estimated risks, whichleads to an overestimation of the VAR limits.

C. It encourages traders to select positions with low estimated risks, whichleads to an underestimation of the VAR limits.

D. It encourages traders to select positions with low estimated risks, whichleads to an overestimation of the VAR limits.

Example 26.10: FRM Exam 2007—Question 36

c. Traders may engage in VAR arbitrage, trying to exploit weaknesses in VAR measures. With a VAR limit, they may seek positions that have low measured VAR, in which case the VAR limits will be less effective.

358. EXAMPLE 26.11: FRM EXAM 2006—QUESTION 3

A risk manager for ABC Bank has compiled the following data regardinga bond trader and an equity trader. Assume that the returns arenormally distributed and that there are 52 trading weeks per year. ABCBank computes its capital using a 99% VAR. Dollar amounts are inmillions.

|  | After-Tax Profit | Net Book Market Value | Weekly Volatility | Tax Rate |
|---|---|---|---|---|
| Bond Trader | USD 8 | USD 120 | 1.10% | 40% |
| Equity Trader | USD 18 | USD 180 | 1.94% | 40% |

Calculate the risk-adjusted performance measure (RAPM) for the bond trader.

A. 25.24%

B. 36.08%

C. 60.15%

D. 84.92%

Example 26.11: FRM Exam 2006—Question 3

c. The 99% VAR is $2.33 \times 1.10\% \times \sqrt{52} \times (1 - 40\%) \times \$120 = \$13.3m$. Hence, RAPM = 8/13.3 = 60.1%.

359. EXAMPLE 26.12: FRM EXAM 2006—QUESTION 4

Continuing with the same ABC Bank data, which of the following statementsare correct in relation to the equity trader?

I. The equity trader has an annual, after-tax VAR at a 99% confidence levelof USD 33.2 million.

II. In comparing the RAROC for both traders, the equity trader is performingbetter than the bond trader.

A. I only

B. II only

C. Both

D. Neither

Example 26.12: FRM Exam 2006—Question 4

d. The equity trader's VAR is $2.33 \times 1.94\% \times \sqrt{52} \times (1 - 40\%) \times \$180 = \$35.2$ million, so statement I. is incorrect. The RAPM is 18/35.2, or 51.1%, which is worse than that of the bond trader, so statement II. is incorrect as well.

360. EXAMPLE 26.13: FRM EXAM 2007—QUESTION 124

The bank you work for has a RAROC model. The RAROC model, computed for each specific activity, measures the ratio of the expected yearly net income to the yearly VAR risk estimate. You are asked to estimate the RAROC of its $500 million loan business. The average interest rate is 10%. All loans have the same probability of default of 2% with a loss given default of 50%. Operating costs are $10 million. The funding cost of the business is $30 million. RAROC is estimated using a credit-VAR for loan businesses, in this case, 7.5%.

The economic capital is invested and earns 6%. The RAROC is:

A. 19.33%

B. 46.00%

C. 32.67%

D. 13.33%

Example 26.13: FRM Exam 2007—Question 124

a. First, we compute the numerator. The net interest is, after expected losses, $500 × (10% – 2%(1 – 50%)) = $45. Next, we compute economic capital, or $500 × 7.5% = $37.5. To revenues, we then add the return on economic capital, or $37.5 × 6% = $2.25. From this, we deduct operating and funding costs, which gives $47.25 – 10 – 30 = $7.25. Finally, we divide by $37.5 and get 19.33%.

361. EXAMPLE 29.2: FRM EXAM 2002—QUESTION 71

What is the best definition of tier 1 regulatory capital?

A. Equity capital, retained earnings, disclosed reserves
B. Subordinated debt, undisclosed reserves
C. Equity capital, subordinated debt with a maturity greater than five years
D. Long-term debt, revaluation reserves

Example 29.2: FRM Exam 2002—Question 71
a. Tier 1 capital includes equity capital, disclosed reserves, and retained earnings.
Tier 2 includes undisclosed reserves, hybrid debt, and subordinated debt.

362. EXAMPLE 29.3: FRM EXAM 2007—QUESTION 53
Consider a bank balance sheet with (1) common stock of USD 600,000,000;(2) unrealized long-term marketable equity securities gain: USD 5,000,000;(3) allowance in anticipation of possible credit losses: USD 5,000,000; (4)goodwill: USD 30,000,000.Based solely on the above information, the Tier 1 and Tier 2 capitalnumbers are, respectively:
A. USD 595,000,000 USD 45,000,000
B. USD 570,000,000 USD 10,000,000
C. USD 600,000,000 USD 15,000,000
D. USD 630,000,000 USD 20,000,000

Example 29.3: FRM Exam 2007—Question 53
b. Tier 1 capital consists of equity minus goodwill, or USD 570m. Tier 2 capital includes asset revaluation reserves of $5m and loan loss reserves of $5m. For this question, it is sufficient to find the correct number for tier 1 capital.

363. EXAMPLE 29.4: FRM EXAM 2004—QUESTION 29
Consider the following financial data for a bank, in millions of dollars:Shareholders' funds: 627.4. Retained earnings: 65.6. Undisclosed reserves:33.5. Goodwill: 21.3. Subordinated debt: 180.0. Specific provisions: 11.7.The ratio of tier 2 to tier 1 capital is:
A. 30.81%
B. 31.78%
C. 33.53%
D. 34.03%

Example 29.4: FRM Exam 2004—Question 29
b. Tier 1 capital consists of shareholders' funds plus retained earnings, minus goodwill, which is 671.7. Tier 2 capital consists of subordinated debt plus undisclosed reserves, or 213.5. The ratio is 31.78%. Specific provisions cannot be included in risk capital, because they are likely to be absorbed by specific bad loans.

364. EXAMPLE 29.9: FRM EXAM 2004—QUESTION 67
Which of the following statements about the Basel II capital requirements isfalse?

A. It increases the risk sensitivity of minimum capital requirements forinternationally activebanks.
B. It only addresses credit risk and market risk.
C. United States insurance companies are not required to comply with BaselII capital requirements.
D. Banks are not allowed to use their internal models for credit risk indetermining the capital requirements for credit risk.

Example 29.9: FRM Exam 2004—Question 67
b. This is because Basel II also covers operational risk. Banks can provide inputs but cannot use their internal models for credit risk, so answer d. is false.

365. EXAMPLE 29.10: FRM EXAM 2006—QUESTION 79
Which of the following is not allowed by the Basel II Accord for measuringcredit risk?
A. Banks may measure credit risk in a standardized manner supported by external credit assessments.
B. Banks may measure credit risk using a bank's internal credit ratingsystems, subject to the explicit approval of the bank's supervisor.
C. Using external ratings for certain assets and internal ratings for theremaining assets.
D. Banks may measure credit risk using their own internal estimates of the probability of default, loss given default, the exposure at default, andeffective maturity, subject to certain minimum conditions, disclosurerequirements, and supervisory approval.

Example 29.10: FRM Exam 2006—Question 79
c. The Basel II rules do not allow cherry-picking.

366. EXAMPLE 29.11: FRM EXAM 2006—QUESTION 108
Which of the following statements is not correct about the Foundation IRBand the Advanced IRB approaches for credit risk capital charges in Basel II?
A. Under the Advanced IRB approach, banks are allowed to use their own estimates of PD, LGD, EAD, and correlation coefficient but must use the risk-weighted functions provided by the supervisors.
B. Under the Foundation IRB approach, banks provide their own estimates of PD and rely on supervisory estimates for other risk components.
C. Banks adopting the Advanced IRB approach are expected to continue to employ this approach. A voluntary return to the standardized approach is only permitted in extraordinary circumstances.
D. Under both Foundation IRB and Advanced IRB approaches, the expected loss is not included in the credit risk capital charge.
Example 29.11: FRM Exam 2006—Question 108

a. Banks are never allowed to use their own correlations.

367. EXAMPLE 29.12: FRM EXAM 2006—QUESTION 90
Under the comprehensive approach for the Foundation Internal Ratings
Based approach under Basel II, which of the following methods is used for

calculating the effective loss given default (LGD∗) where:

LGD∗is the effective loss given default (considering risk mitigation measures).

LGD is that of the senior unsecured exposure before recognition of
collateral. $E$ is the current value of the exposure (i.e., cash lent or securities

lent or posted). $E∗$is the exposure value after risk mitigation.

A.   LGD∗ = LGD × ($E∗/E$)

B.   LGD∗ = LGD × ($E∗$) ∗($E$)

C.   LGD∗ = LGD × ($E∗ + E$)

D.   LGD∗ = LGD × ($E∗ − E$)

Example 29.12: FRM Exam 2006—Question 90
a. See Equation (29.12). Also, this answer is the only one that makes sense taking
units into account because LGD is a unitless ratio.

368. Question 4-18(2008)
The Basel II risk weight function for the internal ratings-based (IRB) approach is based on the

asymptotic single risk factor (ASRF) model, under which the the system-wide risks that affect all obligors are modeled with only one systematic risk factor. The major reason for using the ASRF is:

A. The model should not depend on the granularity of the portfolio.

B. The model should be portfolio invariant so that the capital required for any given loan depends only on the risk of that loan and does not depend on the portfolio it is added to.

C. The model should not be portfolio invariant and the capital required for any given loan should not depend on the risk of other loans.

D. The model corresponds to the one-year VAR at a 99.9% confidence level.

## Example 28.11: FRM Exam 2008—Question 4-18

b. Because the capital charges for individual credits are added together, it must be invariant to the rest of the portfolio. The model also assumes infinite granularity.

369. QuestionTION 4-3(2008)

Which of the following is not a drawback of the Basel II foundation internal ratings-based (IRB) approach?

A. PDs and LGDs are assumed to be uncorrelated.

B. Asset correlations decrease with increasing PDs.

C. The portfolio of the financial institution is assumed to be infinitely granular.

D. The approach uses a single risk factor portfolio model instead of a multiple risk factor model.

## Example 28.12: FRM Exam 2008—Question 4-3

b. In practice, PDs and LGDs are positively correlated, so statement a. is a problem. Years with higher PDs are associated with higher LGDs. Portfolios may not be highly granular, so statement c. is a problem. The portfolio may be exposed to multiple common risk factors, so statement d. is a problem. In contrast, we do observe in practice that low credits tend to have more idiosyncratic risk, which means that high PDs have low correlations.

370. EXAMPLE 30.2: FRM EXAM 2007—QUESTION 91

Under the Basel II Capital Accord, banks that have obtained prior regulatory approval can use the internal models approach to estimate their market risk capital requirement. What approach or methodology is used under the internal models approach to compute capital requirements?

A. Internal rating and vendor models

B. Stress testing and backtesting

C. Expected tail loss, as VAR is not a coherent measure of risk

D. VAR methodology

Example 30.2: FRM Exam 2007—Question 91
d. The internal models approach is based on the bank's internal VAR methodology.

371. EXAMPLE 30.4: FRM EXAM 2004—QUESTION 70
Under the market risk amendment to the Basel Accord, a bank can use itsinternal models to calculate its market risk charge subject to all the followingprovisions except:
A. A time horizon of 10 trading days
B. A 99% confidence level
C. One year of historical observations, which are updated semiannually
D. The market risk charge will be set at the higher of the previous day'sVAR or the average VAR over the last 60 days scaled by a multiplicative factor

Example 30.4: FRM Exam 2004—Question 70
c. The IMA requires using one year of historical data updated at least quarterly, not semiannually.

372. EXAMPLE 30.6: FRM EXAM 2001—QUESTION 42
Which of the following best describes the quantitative parameters of theInternal Models Approach?
A. Ten-day trading horizon, 99% confidence interval, minimum one yearof data, minimum quarterly updates
B. One-day trading horizon, 95% confidence interval, five years of data,updated weekly
C. One-day trading horizon, 99% confidence interval, minimum one yearof data, updated monthly
D. Ten-day trading horizon, 97.5% confidence interval, minimum five yearsof data, updated daily

Example 30.6: FRM Exam 2001—Question 42
a. The IMA is based on a 10-day horizon, 99% confidence level, and one year of data, with at least quarterly updates.

373. Question 7-4(2009)
As a risk manager for Bank ABC, John is asked to calculate the market risk capital charge of the bank's trading portfolio under the 1996 internal models approach. The VAR (95%, one-day) of the last trading day is USD 30,000; the average VAR (95%, one-day) for the last 60 trading days is USD 20,000. The multiplier is k = 3. Assuming the return of the bank's trading portfolio is normally distributed, what is the market risk capital charge of the trading portfolio?

A. USD 84,582
B. USD 189,737
C. USD 268,200
D. USD 134,594

## Example 28.18: FRM Exam 2009—Question 7-4

c. The average VAR times 3 is USD 60,000. Because this is higher than yesterday's VAR, this is the binding number. Multiplying by $\sqrt{10} \times 2.323/1.645 = 4.47$ gives USD 268,200.

374. Question 7-11(2009)

In the latest guidelines for computing capital for incremental risk in the trad¬ing book, the incremental risk charge (IRC) addresses a number of perceived shortcomings in the 99 %/10-day VAR framework. Which of the following statements about the IRC are *correct*?

I. For all IRC-covered positions, the IRC model must measure losses due to default and migration over a one-year horizon at a 99% confidence level.

II. A bank can incorporate into its IRC model any securitization positions that hedge underlying credit instruments held in the trading account.

III. A bank must calculate the IRC measure at least weekly, or more fre¬quently as directed by its supervisor.

IV. The incremental risk capital charge is the maximum of (1) the average of the IRC measures over 12 weeks and (2) the most recent IRC measure.

A. I and II
B. III and IV
C. I, II, and III
D. II, III, and IV

## Example 28.19: FRM Exam 2009—Question 7-11

b. Statement I. is incorrect because the confidence level is 99.9%. Statement II. is incorrect because securitizations are subject to the banking book capital requirements. The other two statements are correct.

375. EXAMPLE 29.18: FRM EXAM 2007—QUESTION 19

Your bank is implementing the AIRB approach for credit risk, the AMA for operational risk, and the internal model approach for market risk. The Chief Risk Officer (CRO) wants to estimate the bank's total risk by adding up the regulatory capital for market risk, credit risk, and operational risk. The CRO asks you to identify the problems with using this approach to estimate the bank's total risk. Which of the following statements about this approach is incorrect?

A. It assumes market, credit, and operational risks have zero correlation.
B. It uses a 10-day horizon for market risk.
C. It ignores strategic risks.
D. It ignores the interest risk associated with the bank's loans.

Example 29.18: FRM Exam 2007—Question 19

a. The market risk charges uses a 10-day horizon, so statement b. is correct.
The Basel capital charges do ignore strategic risk and interest rate in the banking
book. Adding up the capital charges assumes perfect correlations (or at least
high correlations, implying extreme shocks happen at the same time), not zero
correlations


# part8 Investment Risk Management


376. Question 5-9(2008)

Over the past year, the HIR Fund had a return of 7.8%, while its benchmark, the S&P 500
index, had a return of 7.2%. Over this period, the fund's volatility was 11.3%, while the S&P
index's volatility was 10.7% and the fund's TEV was 1.25%. Assume a risk-free rate of 3%.
What is the information ratio for the HIR Fund and for how many years must this
performance persist to be statistically significant at a 95% confidence level?

A.   0.480 and approximately 16.7 years
B.   0.425 and approximately 21.3 years
C.   3.840 and approximately 0.2 years
D.   1.200 and approximately 1.9 years

## Example 29.1: FRM Exam 2008—Question 5-9

a. The information ratio is $(7.8 - 7.2)/1.25 = 0.48$. Statistical significance is
achieved when the $t$-statistic is above the usual value of 1.96. By Equation (29.5),
the minimum number of years $T$ for statistical significance is $(IR1.96)^2 = 16.7$.
Note, however, that there is no need to perform the second computation because
there is only one correct answer for the IR question.


377. EXAMPLE 16.3: FRM EXAM 2006—QUESTION 25

The DataSoft Corporation has an employee pension scheme with fixed liabilitiesand a long
time horizon reflecting its young workforce. The fund'sassets are $9 billion and the present
value of its liabilities is $8.8 billion.
Which of the following statements are incorrect?
I. The present value of long-term fixed payments behaves very much like along position in a
fixed-rate bond.

II. Surplus at Risk is a measure of relative risk.

III. The DataSoft Corporation will be able to immunize its liabilities byinvesting $8 billion in long-term fixed-rate bonds.

A. I and II

B. II and III

C. I and III

D. I, II, and III

Example 16.3: FRM Exam 2006—Question 25

c. Answer I. is incorrect because this liability is similar to a *short* (not long) position in a bond. Answer II. is correct because surplus at risk is a relative risk measure, assets minus liabilities. Answer III. is incorrect because it needs to invest $8.8 billion, not $8 billion.

378. Question 8-2(2009)

Your firm hired VikramMehra as an active manager for its pension fund. His benchmark is the Russell 2000 growth index. Which of the following statistics are most suitable to evaluating Vikram's performance and risk?

A. VAR and Sharpe ratio

B. Tracking error and information ratio

C. Tracking error and Sharpe ratio

D. VAR and information ratio

## Example 29.5: FRM Exam 2009—Question 8-2

b. Because the active manager is compared to a benchmark, your firm should use relative performance measures (i.e., tracking error volatility and the information ratio).

379. EXAMPLE 16.7: FRM EXAM 2005—QUESTION 103

A database of hedge fund returns is constructed as follows. The first yearof the database is 1994. All funds existing as of the end of 1994 that werewilling to report their verified returns for that year are included in that year.The database was extended by asking the funds for verified returns before1994. Subsequently, funds are added as they are willing to report verifiedreturns to the database. If a fund stops reporting returns, its returns aredeleted from the database, but the database has an agreement with fundsthat they will keep reporting verified returns even if they stop being open tonew investors.Consider the four following statements:

I. The database suffers from backfilling bias.

II. The database suffers from survivorship bias.

III. The database suffers from an errors-in-variables bias.

IV. The equally-weighted annual return average of fund returns will underestimate

the performance one would expect from a hedge fund.

Which one of the following is correct?

A.   All the above statements are correct.

B.   Statements I and II are correct.

C.   Statements I, II, and III are correct.

D.   Statements II and IV are correct.

Example 16.7: FRM Exam 2005—Question 103

b. The database includes histories before 1994 and therefore suffers from backfill bias. Next, funds that stop reporting are deleted from the database, so this has survival bias. Errors-in-variables biases arise in other contexts, such as regression. Finally, the average of fund returns will be too high (not too low) because of these two biases. Hence, I. and II. are correct.

380. EXAMPLE 30.1: FRM EXAM 2007—QUESTION 63

You are an analyst at Bank Alpha. You were given the task to determine whether under Basel II your bank can use the simplified approach to report option exposure instead of the intermediate approach. Which of the following criteria would your bank have to satisfy in order for it to use the simplified approach?

A.   The bank writes options, but its options trading is insignificant in relation to its overall business activities.

B.   The bank purchases and writes options and has significant optionstrading.

C.   The bank solely purchases options, and its options trading is insignificant in relation to its overall business activities.

D.   The bank purchases and writes options, but its options trading isinsignificant.

Example 30.1: FRM Exam 2007—Question 63

c. A bank can only use the simplified approach if it purchases options and its option trading is not significant. Otherwise, it is required to use the intermediate approach. Another way to look at the question is that answer c. contains the weakest conditions, i.e., those least likely to lead to a large loss.

381. EXAMPLE 16.10: FRM EXAM 2005—QUESTION 140

Suppose a portfolio consists of four assets. The risk contribution of each asset is as follows: UK Large Cap, 3.9%; UK Small Cap, 4.2%; UK Bonds, 0.9%; Non-UK Bonds, 1.1%. Which of the following explanations would not be a possible explanation for the relatively high risk contribution values for UK equities?

A.   High expected returns on UK equities

B.   High weights on UK equities

C.   High volatilities of UK equities

D.    High correlation of UK equities with all other assets in the portfolio

Example 16.10: FRM Exam 2005—Question 140
a. The risk contribution is proportional to the weight times the beta. The latter involves the correlation between the asset and the portfolio, as well as the volatility of the asset. Higher weight, correlation, and volatility would create higher risk contribution. On the other hand, high expected returns would explain a high weight, but not risk contribution.

382. Question 8-12(2009)

The pension management analysts at Big Inc. use a two-step process to man¬age the assets and risk in the pension portfolio. First, they use a VAR-based risk budgeting process to determine the asset allocation across four broad as¬set classes. Then, within each asset class, they set a maximum tracking error allowance from a benchmark index and determine an active risk budget to distribute among individual managers. Assume the returns are all normally distributed. From the first step in the process, the following information is available.

|  | Expected Return (%) | Volatility (%) | Asset Allocation (%) | Individual VAR (USD) | Marginal VAR |
|---|---|---|---|---|---|
| Small Cap | 0.20% | 2.66% | 35.0% | 6,491 | 0.055 |
| Large Cap | 0.15% | 2.33% | 40.0% | 6,497 | 0.044 |
| Commodities | 0.10% | 1.91% | 16.7% | 2,216 | 0.020 |
| Emerging markets | 0.15% | 2.70% | 8.3% | 1,570 | 0.047 |
| | Total VAR:    13,322 | | | | |

Which of the following statements is/are *correct*?
  I. Using VAR as the risk budgeting measure, the emerging markets class has the smallest risk budget.
 II.   If an additional dollar were added to the portfolio, the marginal impact on portfolio VAR would be greatest if it were invested in small caps.
 III. As the maximum tracking error allowance is lowered, the individual managers have more freedom to achieve greater excess returns.
 IV. Setting well-defined risk limits and closely monitoring risk levels guar¬antee that risk limits will not be exceeded.

A.    I and II only
B.    I, II, III, and IV
C.    II and III
D.    I only

a. Risk budget is represented by the individual VAR, which is the smallest for emerging markets, so statement I. is correct. The marginal VAR is highest for small caps, so adding one dollar to that asset class would have the largest impact on the portfolio. Statement III. is incorrect, as lowering TEV would give less, not more freedom to manages. Finally, setting risk limits does not ensure they will not be exceeded. Bad luck and exceptions can happen, even if the risk model is correct.

383. Question 8-10(2009)

Continue with the previous question. Let $\beta_{ip} = \rho_{ip}\sigma_i / \sigma_p$, where $\rho_{ip}$ denotes the correlation between the return of asset i and the return of the portfolio, $\sigma_i$ is the volatility of the return of asset i, and $\sigma_p$ is the volatility of the return of the portfolio. What are $\beta_1$ and $\beta_2$?

A. $\beta_1 =$ 0.571, $\beta_2 =$1.429

B. $\beta_1 =$ 0.756, $\beta_2 =$1.513

C. $\beta_1 =$ 0.286, $\beta_2 =$0.714

D. Cannot determine from information provided

**Example 29.12: FRM Exam 2009—Question 8-10**

a. From Equation (29.18), beta is proportional to the marginal risk. Alternatively, the VAR contribution is proportional to beta times the weight times the portfolio VAR. Hence, $\beta_1 = 17.6/(0.5 \times 61.6) = 0.57$ and $\beta_2 = 44.0/(0.5 \times 61.6) = 1.43$.

384. Question 8-9(2009)

A risk manager assumes that the joint distribution of returns is multi¬variate normal and calculates the following risk measures for a two-asset portfolio:

| Asset | Position | Individual VAR | Marginal VAR | VAR Contribution |
|-------|----------|----------------|--------------|------------------|
| 1 | USD 100 | USD 23.3 | 0.176 | USD 17.6 |
| 2 | USD 100 | USD 46.6 | 0.440 | USD 44.0 |
| Total | USD 200 | USD 61.6 | | USD 62.6 |

If asset 2 is dropped from the portfolio, what is the reduction in portfolio VAR?

A.  USD 15.0

B.  USD 38.3

C.  USD 44.0

D.  USD 46.6

## Example 29.11: FRM Exam 2009—Question 8-9

b. This is 61.6 minus the portfolio VAR of asset 1 alone, which is USD 23.3, for a difference of 38.3.

385. EXAMPLE 17.1: FRM EXAM 2006—QUESTION 41

A hedge fund is long $315 million in certain stocks and short $225 millionin other stocks. The hedge fund's equity is $185 million. The fund's overallbeta is 0.75. Calculate the gross and net leverage.

A.  2.91 and 0.48

B.  2.18 and 0.36

C.  2.91 and 0.36

D.  2.18 and 0.48

Example 17.1: FRM Exam 2006—Question 41

c. The gross leverage is (315 + 225)/185 = 2.9. The net leverage is (315 −225)/185 = 0.5. Note that beta is not needed for this calculation.

386. EXAMPLE 17.3: FRM EXAM 2004—QUESTION 2

A relative value hedge fund manager holds a long position in Asset A anda short position in Asset B of roughly equal principal amounts. Asset Acurrently has a correlation with Asset B of 0.97. The risk manager decides tooverwrite this correlation assumption in the variance-covariance based VARmodel to a level of 0.30. What effect will this change have on the resultingVAR measure?

A.  It increases VAR.

B.  It decreases VAR.

C.  It has no effect on VAR, but changes profit or loss of strategy.

D.  Do not have enough information to answer.

Example 17.3: FRM Exam 2004—Question 2

a. Because the position is both long and short, high correlation implies low risk. Conversely, lowering correlation increases risk.

387. Question 8-7(2009)

A fund of hedge funds combines a mix of strategy sectors, managers, and styles, and therefore fund of funds risk managers need to understand the com¬mon attributes of hedge fund strategies. Which of the following statements is *incorrect*?

A. Equity market neutral funds aim to generate returns that have low cor¬relation to the overall equity market and to insulate their portfolios from broad market risk factors.

B. Convertible arbitrage funds typically purchase securities that are con¬vertible into the issuer's stock and simultaneously short the underlying stock. These funds earn returns in part from gamma trading on the stock's volatility.

C. Merger arbitrage funds buy the stock of an acquisition target company and simultaneously short the bidding company's stock. These funds have large exposure to deal risk.

D. Equity short-selling funds sell stocks not currently owned by the seller in order to take a directional bet that the stock price will decline. These funds tend to be uncorrelated with traditional long-only equity portfolios.

### Example 30.4: FRM Exam 2009—Question 8-7

d. Statements a., b., and c. are correct. Funds that short-sell, however, have negative correlation with long-only portfolios. They cannot be uncorrelated.

388. EXAMPLE 17.4: RISKS IN FIXED-INCOME ARBITRAGE

Identify the risks in a fixed-income arbitrage strategy that takes long positionsin interest rate swaps hedged with short positions in Treasuries.

A. The strategy could lose from decreases in the swap-Treasury spread.

B. The strategy could lose from increases in the Treasury rate, all else fixed.

C. The payoff in the strategy has negative skewness.

D. The payoff in the strategy has positive skewness.

Example 17.4: Risks in Fixed-Income Arbitrage
c. The strategy has no exposure to the level of rates but is exposed to a widening ofthe swap-Treasury spread. Assume for instance that the swap and Treasury ratesare initially 5.5% and 5%. If these rates change to 5.3% and 4.5%, for example,both values for the swap and the Treasury bond would increase. Because the dropin the Treasury rate is larger, however, the price of the Treasury bond would fallmore than the swap, leading to a net loss on the position. The strategy should *gain*from decreases in the swap-Treasury spread, so a. is wrong. The strategy should*gain* from increases in the Treasury rate, all else equal, so b. is wrong. Finally,the distribution of the payoff depends on the distribution of theswap-Treasuryspread. Because this cannot go below zero, there is a limit on the upside. The
position has negative skewness, so c. is correct.

389. EXAMPLE 17.5: RISKS IN CONVERTIBLE ARBITRAGE

Identify the risks in a convertible arbitrage strategy that takes long positionsin convertible

bonds hedged with short positions in Treasuries and theunderlying stock.

A. Short implied volatility

B. Long duration

C. Long stock delta

D. Positive gamma

Example 17.5: Risks in Convertible Arbitrage

d. This position is hedged against interest rate risk, so b. is wrong. It is also hedged against directional movements in the stock, so c. is wrong. The position is long an option (the option to convert the bond into the stock) so is long implied volatility, so a. is wrong. Long options positions have positive gamma.

390. EXAMPLE 17.6: RISKS IN MERGER ARBITRAGE—I

A major acquisition has just been announced, targeting Company B. Thebid from Company A is an exchange offer with a ratio of 2. Just afterthe announcement, the prices of A and B are $50 and $90, respectively. Ahedge fund takes a long position in Company B hedged with A's stock. Afterthe acquisition goes through, the prices move to $60 and $120. For each share of B, the gain is

A.    $30

B.    $20

C.    $10

D.    $0 since the acquisition is successful

Example 17.6: Risks in Merger Arbitrage—I

c. The position is long one share of Company B offset by a short position in two shares of Company A. The payoff is ($120 − $90) − 2($60 − $50) = $30 −$20 = $10.

391. EXAMPLE 17.7: RISKS IN MERGER ARBITRAGE—II

Suppose the payoff from a merger arbitrage operation is $5 million if successful, −$20 million if not. The probability of success is 83%. The expectedpayoff on on the operation is

A.    $5 million

B.    $0.75 million

C.    $0 since markets are efficient

D.    Symmetrically distributed

Example 17.7: Risks in Merger Arbitrage—II

b. The expected payoff is the sum of probabilities times the payoff in each state of the world, or 83% × $5 + 17% × (−$20) = $4.15 − $3.40 = $0.75. Note that the distribution is highly asymmetric, with a small probability of a large loss.

392. EXAMPLE 17.8: FRM EXAM 2005—QUESTION 47

The Big Bucks Hedge fund has the following description of its activities. It uses simultaneous long and short positions in equity with a net beta close to zero. Which of the following statements about Big Bucks are correct?

I. It uses a directional strategy.

II. It is a relative value hedge fund.

III. This fund is exposed to idiosyncratic risks.

A. I and II

B. II and III

C. I and III

D. II only

Example 17.8: FRM Exam 2005—Question 47

b. This fund has zero beta, so is a relative value fund. It is, however, exposed to idiosyncratic, stock-specific risk.

393. EXAMPLE 17.9: LIQUIDITY RISKS

Asset liquidity risk is most pronounced for

A. A $10 million position in distressed securities

B. A $10 million position in Treasury bonds

C. A $100 million position in distressed securities

D. A $100 million position in Treasury bonds

Example 17.9: Liquidity Risks

c. Asset liquidity risk is a function of the size of the position and the intrinsic liquidity of the instrument. Distressed securities trade much less than Treasury bonds, so have more liquidity risk. A $100 million is more illiquid than a $10 million in the same instrument.

394. EXAMPLE 17.10: FRM EXAM 2007—QUESTION 62

You are asked to estimate the exposure of a hedge fund to the S&P 500.Though the fund claims to mark to market weekly, it does not do so andmarks to market once a month. The fund also does not tell investors thatit simply holds an Exchange Traded Fund (ETF) indexed to the S&P 500.Because of the claims of the hedge fund, you decide to estimate the marketexposure by regressing weekly returns of the fund on the weekly return ofthe S&P 500. Which of the following correctly describes a property of yourregression estimates?

A. The intercept of your regression will be positive, showing that the fund has a positive alpha when estimated using an OLS regression.

B. The beta will be misestimated because hedge fund exposures arenonlinear.

C. The beta of your regression will be one because the fund holds theS&P 500.

D. The beta of your regression will be zero because the fund returns are not

synchronous with the S&P 500 returns.

Example 17.10: FRM Exam 2007—Question 62

d. The weekly returns are not synchronized with those of the S&P. As a result, the estimate of beta from weekly data will be too low.

395. EXAMPLE 17.11: FRM EXAM 2006—QUESTION 112

For a portfolio of illiquid assets, hedge fund managers often have considerable discretion in portfolio valuation at the end of each month and may have incentives to smooth returns by marking values below actual in high-return months and above actual in low-return months. Which of the following is *not* a consequence of return smoothing over time?

A. Higher Sharpe ratio
B. Lower volatility
C. Higher serial correlation
D. Higher market beta

Example 17.11: FRM Exam 2006—Question 112

d. Illiquidity creates an *understatement* of the total risk measure. As a result, the Sharpe ratio will be artificially higher. Illiquidity creates trends in returns (higher serial correlation), as market shocks during a month will be partially recorded in two consecutive months. Illiquidity, however, biases down the market beta.

396. EXAMPLE 17.12: TRANSPARENCY

Investors should insist on learning about the positions of hedge fundsbecause

A. They want to trade ahead of the hedge fund.
B. They do not understand the trading strategies behind the positions.
C. They want to aggregate the risk of hedge funds with the rest of theirportfolio.
D. They receive the information from the prime broker, anyway.

Example 17.12: Transparency

c. Risk aggregation is an important reason for investor to learn about the positions of their investment in hedge funds. Answer a. is incorrect because front-running the hedge fund would be a reason *not* to disclose position information. Answer b. is incorrect because misunderstanding the trading strategies would be a reason *not* to require position information. Answer d. is incorrect because they do not receive position information from the prime broker.

397. Question 8-8（2009）

Risk management of hedge funds has challenges not generally faced in tradi¬tional investment management companies. Which of the following statements are correct about

hedge fund risk management?

I. Because hedge funds can hold long and short positions, and can use derivatives and leverage, their exposure to market risks can experience large and rapid changes that make it difficult to assess these exposures using only monthly returns.

II. Many hedge funds use over-the-counter derivatives, which are valued by models or quoted prices and often hold illiquid assets; as a result, the returns of these strategies generally exhibit much lower serial correlation than mutual fund returns.

III. For hedge fund strategies that use leverage to amplify returns and rely on their ability to move out of trades quickly when they turn against them, liquidity risk must be closely monitored and managed.

IV. Hedge fund returns are often similar to the return of a basket of exotic derivatives with nonlinear payoffs, and therefore assessing risk based on past performance can be misleading.

A.  I, II, III, and IV
B.  I, III, and IV
C.  I and III
D.  II and IV

## Example 30.14: FRM Exam 2009—Question 8-8

b. Statements I., III., and IV. are correct. Statement II. is false because illiquid assets create higher serial correlation.