GARP | FRM

2016 FRM® Part II Practice Exam

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Introduction

The FRM Exam is a practice-oriented examination. Its questions are derived from a combination of theory, as set forth in the core readings, and "real-world" work experience. Candidates are expected to understand risk management concepts and approaches and how they would apply to a risk manager's day-to-day activities.

The FRM Exam is also a comprehensive examination, testing a risk professional on a number of risk management concepts and approaches. It is very rare that a risk manager will be faced with an issue that can immediately be slotted into one category. In the real world, a risk manager must be able to identify any number of risk-related issues and be able to deal with them effectively.

The 2016 FRM Part I and Part II Practice Exams have been developed to aid candidates in their preparation for the FRM Exam in May and November 2016. These Practice Exams are based on a sample of questions from prior FRM Exams and are suggestive of the questions that will be in the 2016 FRM Exam.

The 2016 FRM Part I Practice Exam contains 100 multiple-choice questions and the 2016 FRM Part II Practice Exam contains 80 multiple-choice questions, the same number of questions that the actual 2016 FRM Exam Part I and 2016 FRM Exam Part II will contain. As such, the Practice Exams were designed to allow candidates to calibrate their preparedness both in terms of material and time.

The 2016 FRM Practice Exams do not necessarily cover all topics to be tested in the 2016 FRM Exam as any test samples from the universe of testable possible knowledge points. However, the questions selected for inclusion in the Practice Exams were chosen to be broadly reflective of the material assigned for 2016 as well as to represent the style of question that the FRM Committee considers appropriate based on assigned material.

For a complete list of current topics, core readings, and key learning objectives candidates should refer to the 2016 FRM Exam Study Guide and 2016 FRM Learning Objectives.

Core readings were selected by the FRM Committee to assist candidates in their review of the subjects covered by the Exam. Questions for the FRM Exam are derived from the core readings. It is strongly suggested that candidates study these readings in depth prior to sitting for the Exam.

Suggested Use of Practice Exams

To maximize the effectiveness of the practice exams, candidates are encouraged to follow these recommendations:

1. **Plan a date and time to take the practice exam.**
   Set dates appropriately to give sufficient study/review time for the practice exam prior to the actual exam.
2. **Simulate the test environment as closely as possible.**
   - Take the practice exam in a quiet place.
   - Have only the practice exam, candidate answer sheet, calculator, and writing instruments (pencils, erasers) available.
   - Minimize possible distractions from other people, cell phones, televisions, etc.; put away any study material before beginning the practice exam.
   - Allocate 4 hours to complete FRM Part I Practice Exam and 4 hours to complete FRM Part II Practice Exam and keep track of your time. The actual FRM Exam Part I and FRM Exam Part II are 4 hours each.

- Complete the entire exam and answer all questions. Points are awarded for correct answers. There is no penalty on the FRM Exam for an incorrect answer.
- Follow the FRM calculator policy. Candidates are only allowed to bring certain types of calculators into the exam room. The only calculators authorized for use on the FRM Exam in 2016 are listed below, there will be no exceptions to this policy. You will not be allowed into the exam room with a personal calculator other than the following: Texas Instruments BA II Plus (including the BA II Plus Professional), Hewlett Packard 12C (including the HP 12C Platinum and the Anniversary Edition), Hewlett Packard 10B II, Hewlett Packard 10B II+ and Hewlett Packard 20B.

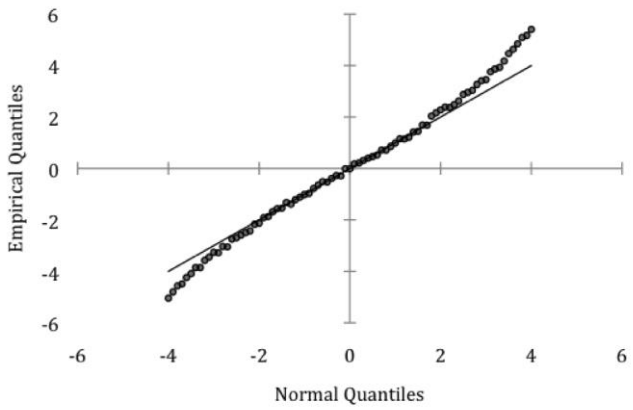
3. After completing the FRM Practice Exams

- Calculate your score by comparing your answer sheet with the practice exam answer key.
- Use the practice exam Answers and Explanations to better understand the correct and incorrect answers and to identify topics that require additional review. Consult referenced core readings to prepare for the exam.
- Remember: pass/fail status for the actual exam is based on the distribution of scores from all candidates, so use your scores only to gauge your own progress and level of preparedness.

2016 Practice Exam, Part I – Candidate Answer Sheet

1._____	21._____	41._____	61._____
2._____	22._____	42._____	62._____
3._____	23._____	43._____	63._____
4._____	24._____	44._____	61._____
5._____	25._____	45._____	65._____
6._____	26._____	46._____	66._____
7._____	27._____	47._____	67._____
8._____	28._____	48._____	68._____
9._____	29._____	49._____	69._____
10._____	30._____	50._____	70._____
11._____	31._____	51._____	71._____
12._____	32._____	52._____	72._____
13._____	33._____	53._____	73._____
14._____	34._____	54._____	74._____
15._____	35._____	55._____	75._____
16._____	36._____	56._____	76._____
17._____	37._____	57._____	77._____
18._____	38._____	58._____	78._____
19._____	39._____	59._____	79._____
20._____	40._____	60._____	80._____

1. An analyst is examining a sample of return data. As a first step, the analyst construct a QQ plot of the data as shown below:



Based on an examination of the QQ plot, which of the following statements is correct?

a. The returns are normally distributed.
b. The return distribution has thin tails relative to the normal distribution.
c. The return distribution is negatively skewed relative to the normal distribution.
d. The return distribution has fat tails relative to the normal distribution.

2. The annual mean and volatility of a portfolio are 12% and 30%, respectively. The current value of the portfolio is GBP 2,500,000. How does the 1-year 95% VaR that is calculated using a normal distribution assumption (normal VaR) compare with the 1-year 95% VaR that is calculated using the lognormal distribution assumption (lognormal VaR)?

a. Lognormal VaR is greater than normal VaR by GBP 487,050
b. Lognormal VaR is greater than normal VaR by GBP 787,050
c. Lognormal VaR is less than normal VaR by GBP 487,050
d. Lognormal VaR is less than normal VaR by GBP 787,050

3. Let X be a random variable representing the daily loss of your portfolio. The "peaks over threshold" (POT) approach considers a threshold value, u, of X and the distribution of excess losses over this threshold. Which of the following statements about this application of extreme value theory is correct?

a. To apply the POT approach, the distribution of X must be elliptical and known.
b. If X is normally distributed, the distribution of excess losses requires the estimation of only one parameter, β, which is a positive scale parameter.
c. To apply the POT approach, one must choose a threshold, *u*, which is high enough that the number of observations in excess of *u* is zero.
d. As the threshold, *u*, increases, the distribution of excess losses over *u* converges to a generalized Pareto distribution.

4. A risk analyst is comparing the use of parametric and non-parametric approaches for calculating VaR and is concerned about some of the characteristics present in the loss data. Which of the following distribution characteristics would make parametric approaches the favored method to use?

a. Skewness in the distribution
b. Fat tails in the distribution
c. Scarcity of high magnitude loss events
d. Heteroskedasticity in the distribution

5. A risk analyst is valuing a 1-year credit default swap (CDS) contract that will pay the buyer 80% of the face value of a bond issued by a corporation immediately after a default by the corporation. To purchase this CDS, the buyer will pay the CDS spread, which is a percentage of the face value, once at the end of the year. The analyst estimates that the risk-neutral default probability for the corporation is 7% per year. The risk-free rate is 2.5% per year. Assuming defaults can only occur halfway through the year and that the accrued premium is paid immediately after a default, what is the estimate for the CDS spread?

a. 560 basis points
b. 570 basis points
c. 580 basis points
d. 590 basis points

6. A risk manager at a small fixed-income hedge fund is evaluating the default conditions of several trade positions. The hedge fund specializes in bank debt and runs a strategy that utilizes both relative value and long-only trades using credit default swaps (CDS) and bonds. One of the new traders at the hedge fund has the positions described in the table below:

Bank	Position	Credit
ABC	Long USD 12 million CDS	AA
LTM	Long USD 6 million bond	BBB
XYZ	Short USD 12 million CDS	A

Some of the hedge fund's newest clients are restricted from withdrawing their funds for three years. The manager is currently evaluating the impact of various default scenarios to estimate future asset liquidity. The manager has estimated that the marginal probability of default of the LTM Bank bond is 4% in Year 1, 7% in Year 2, and 16% in Year 3. What is the probability that the LTM bond makes coupon payments for 3 years and then defaults at the end of Year 3?

a. 12.0%

b. 12.6%

c. 14.3%

d. 14.9%

7. In its efforts to enhance its enterprise risk management function, Countryside Bank introduced a new decision-making process based on economic capital that involves assessing sources of risk across different business units and organizational levels. Which of the following statements regarding the correlations between these risks is correct?

a. Correlations between the risks in the asset and liability sides of the balance sheet can be changed by management decisions.

b. Generally, correlations between broad risk types such as credit, market, and operational risk are well understood and are easy to estimate at the individual firm level.

c. Correlations between business units are only relevant in deciding total firm-wide economic capital levels and are not relevant for decisions at the individual business unit or project level.

d. The introduction of correlations into firm-wide risk evaluation will result in a total VaR that, in general, is greater than or equal to the sum of individual business unit VaRs.

8. At the end of 2014, a pension fund had USD 650 million worth of assets that were fully invested in equities and USD 320 million in fixed-income liabilities with a modified duration of 13. In 2015, the widespread effects of the global energy crisis hit the pension fund, causing its investment in equities to lose 40% of their market value. In addition, the immediate response from the government — cutting interest rates — to salvage the situation, caused bond yields to decline by 1.8%. What was the change in the pension fund's surplus in 2015?

a. USD -330.00 million
b. USD -245.12 million
c. USD -185.12 million
d. USD -144.88 million

9. A portfolio has USD 3 million invested in Stock A and USD 1.5 million invested in Stock B. The 95% 1-day VaR for each individual position is USD 70,000. The correlation between the returns of Stock A and Stock B is 0.4. While rebalancing, the portfolio manager decides to sell USD 1 million of Stock A to buy USD 1 million of Stock B. Assuming that returns are normally distributed and that the rebalancing does not affect the volatility of the individual stocks, what effect will this have on the 95% 1-day portfolio VaR?

a. The portfolio VaR will not change.
b. The portfolio VaR will increase by USD 20,370.
c. The portfolio VaR will increase by USD 24,800.
d. The portfolio VaR will increase by USD 28,281.

10. A bank uses a capital charge of 3.0% for revolving credit facilities with a loan equivalent factor of 0.4 assigned to the undrawn portion in calculating its risk-adjusted return on capital. A risk manager of the bank has become concerned that the protective covenants embedded in these loans are weak and may not prevent customers from drawing on the facilities during times of stress. As such, the manager has recommended increasing the loan equivalent factor to 0.85. This recommendation has been met with resistance from the loan origination team, and senior management has asked the risk manager to quantify the impact of the recommendation. For a typical facility that has an original principal of USD 1 billion and is 35% drawn, how much additional economic capital would have to be allocated if the loan equivalent factor is increased from 0.4 to 0.85?

a. USD 3.500 million
b. USD 6.195 million
c. USD 8.775 million
d. USD 18.300 million

11. Which of the following statements regarding frictions in the securitization of subprime mortgages is correct?

a. The arranger will typically have an information advantage over the originator with regard to the quality of the loans securitized.
b. The originator will typically have an information advantage over the arranger, which can create an incentive for the originator to collaborate with the borrower in filing false loan applications.
c. The major credit rating agencies are paid by investors for their rating service of mortgage-backed securities, and this creates a potential conflict of interest.
d. The use of escrow accounts for insurance and tax payments eliminates the risk of foreclosure.

12. A risk manager is analyzing a 1-day 99% VaR model. Assuming 225 days in a year, what is the maximum number of daily losses exceeding the 1-day 99% VaR that is acceptable in a 1-year backtest to conclude, at a 95% confidence level, that the model is calibrated correctly?

a. 3
b. 5
c. 8
d. 10

13. In fixed income portfolio mapping, when the risk factors have been selected, which of the following mapping approaches requires that one risk factor be chosen that corresponds to average portfolio maturity?

a. Principal mapping
b. Duration mapping
c. Convexity mapping
d. Cash mapping

14. A risk manager is constructing a term structure model and intends to use the Cox-Ingersoll-Ross Model. Which of the following describes this model?

a. The model presumes that the volatility of the short rate will increase at a predetermined rate.
b. The model presumes that the volatility of the short rate will decline exponentially to a constant level.
c. The model presumes that the basis-point volatility of the short rate will be proportional to the rate.
d. The model presumes that the basis-point volatility of the short rate will be proportional to the square root of the rate.

15. An analyst is reviewing a bond for investment purposes. The bond is expected to have a default probability of 3%, with an expected loss of 75 basis points in the event of default. If the current risk-free rate is 2%, what is the minimum coupon spread needed on the bond for its expected return to match the risk-free rate?

a. 90 basis points
b. 120 basis points
c. 180 basis points
d. 240 basis points

16. A credit risk manager for a bank is looking to mitigate counterparty credit risk exposure to ZTM, an A-rated firm. Currently the bank has the following derivatives contracts with ZTM:

Contract	Contract Value (HKD)
A	40,000,000
B	60,000,000
C	28,000,000
D	2,000,000

With the information provided, what is the most appropriate credit risk mitigation technique in this case?

a. Implement a netting scheme.
b. Use credit triggers.
c. Sell credit default swaps on ZTM.
d. Increase collateral.

17. A financial firm conducts several trades. As part of its risk control, it has entered into netting agreements on 10 equity trade positions with an average correlation of 0.35. The firm believes that it can improve upon the diversification benefit of netting by a judicious choice of number of exposures with a favorable correlation coefficient. Which of the following trade combinations would increase the firm's expected netting benefit the most from the current level?

Trade Combination	Number of Positions	Average Correlation
A	5	0.22
B	7	0.11
C	11	–0.07
D	14	–0.03

a. Trade combination A
b. Trade combination B
c. Trade combination C
d. Trade combination D

18. An underlying exposure with an effective annual price volatility of 6% is collateralized by a 10-year U.S. Treasury note with an effective price volatility of 8%. The correlation between the exposure and the U.S. Treasury note is zero. Changes in the value of the overall position (exposure plus collateral) are calculated for a 10-day horizon at a 95% confidence interval (assume a year of 250 days). Which of the following would one expect to observe from this analysis?

a. The presence of collateral increases the current exposure and increases the volatility of the exposure between remargining periods.
b. The presence of collateral increases the current exposure, but decreases the volatility of the exposure between remargining periods.
c. The presence of collateral decreases the current exposure, but increases the volatility of the exposure between remargining periods.
d. The presence of collateral decreases the current exposure and decreases the volatility of the exposure between remargining periods.

19. A trader observes a quote for Stock DUY, and the midpoint of its current best bid and best ask prices is CAD 45. DUY has an estimated daily return volatility of 0.38% and average bid-ask spread of CAD 0.14. Using the constant spread approach on a 20,000 share position and assuming the returns of DUY are normally distributed, what is closest to the estimated liquidity-adjusted, 1-day 95% VaR?

a. CAD 1,600
b. CAD 5,600
c. CAD 6,600
d. CAD 7,600

20. A risk analyst is evaluating the risks of a portfolio of stocks. Currently, the portfolio is valued at EUR 200 million and contains EUR 15 million in stock A. The standard deviation of returns of stock A is 16% annually and that of the overall portfolio is 21% annually. The correlation of returns between stock A and the portfolio is 0.37. Assuming the risk analyst uses a 1-year 99% VaR and that returns are normally distributed, how much is the component VaR of stock A?

a. EUR 2.066 million
b. EUR 2.326 million
c. EUR 5.582 million
d. EUR 7.327 million

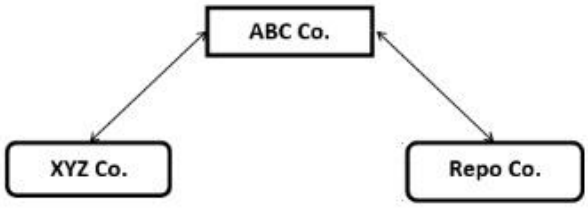
21. Which of the following statements about risk management in the pension fund industry is correct?

a. A pension plan's total VaR is equal to the sum of its policy-mix VaR and active-management VaR.
b. Pension fund risk analysis does not consider performance relative to a benchmark.
c. In most defined-benefit pension plans, if liabilities exceed assets, the shortfall does not create a risk for the plan sponsor.
d. From the plan sponsor's perspective, nominal pension obligations are similar to a short position in a long term bond.

QUESTIONS 22 AND 23 REFER TO THE FOLLOWING INFORMATION

XYZ, a small investment management firm, specializes in structuring small business loans and selling the government guaranteed portion to other institutional investors while retaining the riskier portions for high net worth investors. XYZ funds its operations by engaging in overnight repurchase agreements (repos) with three firms, but primarily with ABC, a firm that specializes in pooling funds from community banks and local government agencies and investing them in short-term, high-quality, government-secured investments.

Last week, XYZ was informed by ABC that its line had been frozen. XYZ learned that ABC had been defrauded by Repo Co., another repo borrower, who had provided false documentation of non-existent collateral of government-guaranteed loans. ABC feared a run by its investors as news of the fraud spread.
The diagram below illustrates the parties involved:



22. The use of a central clearinghouse to handle the transactions executed between XYZ's main funding source, ABC and ABC's client, Repo Co., would likely have resulted in a reduction in:

a. ABC's funding liquidity risk.
b. Repo Co.'s default risk.
c. XYZ's lending risk.
d. ABC's operational risk.

23. By using a clearinghouse to handle the repo transactions between ABC and Repo Co., obligations owed between the two could have been netted once the fraudulent documentation was discovered. Which of the following is the most appropriate type of netting to use in this situation and what would be a likely additional impact from using this netting?

a. Payment netting would be used, which would reduce ABC's counterparty risk, but this risk would be transferred to other creditors outside the clearinghouse.
b. Payment netting would be used, which would reduce Repo Co.'s counterparty risk, but ABC's counterparty risk would be increased.
c. Closeout netting would be used, which would reduce ABC's counterparty risk, but this risk would be transferred to other creditors outside the clearinghouse.
d. Closeout netting would be used, which would reduce Repo Co.'s counterparty risk, but ABC's counterparty risk would be increased.

24. The CEO of a regional bank understands that failing to anticipate cash flow needs is one of the most serious errors that a firm can make and demands that a good liquidity-at-risk (LaR) measurement system be an essential part of the bank's risk management framework. Which of the following statements concerning LaR is correct?

a. Reducing the basis risk through hedging decreases LaR.
b. Hedging using futures has the same impact on LaR as hedging using long option positions.
c. For a hedged portfolio, the LaR can differ significantly from the VaR.
d. A firm's LaR tends to decrease as its credit quality declines.

25. Pillar 1 of the Basel II framework allows banks to use various approaches to calculate the capital requirements for credit risk, operational risk, and market risk. Which of the following Basel II approaches allows a bank to explicitly recognize diversification benefits?

a. The internal models approach for market risk
b. The internal ratings based approach for credit risk
c. The basic indicator approach for operational risk
d. The standardized approach for operational risk

26. A country with a developed economy maintains its own currency, NLC, and has domestically produced oil and natural gas as its most important exports. In a recent stress test of the country's banking system, several scenarios were considered. Which of the following is most consistent with being part of a coherent scenario?

a. An increase in domestic inflation and appreciation of the NLC
b. A significant increase in crude oil prices and a decrease in the country housing price index
c. A drop in crude oil prices and appreciation of the NLC
d. A sustained decrease in natural gas prices and a decrease in the country's stock index

27. Which statement about risk control in portfolio construction is correct?

a. Quadratic programming allows for risk control through parameter estimation but generally requires many more inputs estimated from market data than other methods require.
b. The screening technique provides superior risk control by concentrating stocks in selected sectors based on expected alpha.
c. When using the stratification technique, risk control is implemented by overweighting the categories with lower risks and underweighting the categories with higher risks.
d. When using the linear programming technique, risk is controlled by selecting the portfolio with the lowest level of active risk.

28. An analyst reports the following fund information to the advisor of a pension fund that currently invests in government and corporate bonds and carries a surplus of USD 10 million:

Pension	Assets	Liabilities
Amount (in USD million)	150	120
Expected Annual Growth	7%	9%
Modified Duration	13	10
Annual Volatility of Growth	14%	6%

To evaluate the sufficiency of the fund's surplus, the advisor estimates the possible surplus values at the end of one year. The advisor assumes that annual returns on assets and the annual growth of the liabilities are jointly normally distributed and their correlation coefficient is 0.75. The advisor can report that, with a confidence level of 95%, the surplus value will be greater than or equal to:

a. USD -44.1 million
b. USD -14.4 million
c. USD -2.9 million
d. USD 0 million

29. A due diligence specialist at a company is evaluating the risk management process of a hedge fund in which the company is considering making an investment. Which of the following statements best describes criteria used for such an evaluation?

a. Because of the overwhelming importance of tail risk, the company should not invest in the fund unless it fully accounts for fat tails using extreme value theory at the 99.99% level when estimating VaR.
b. Today's best practices in risk management require that a fund employ independent risk service providers and that these service providers play important roles in risk-related decisions.
c. When considering a leveraged fund, the specialist should assess how the fund estimates risks related to leverage, including funding liquidity risks during periods of market stress.
d. It is crucial to assess the fund's valuation policy, and in general if more than 10% of asset prices are based on model prices or broker quotes, the specialist should recommend against investment in the fund regardless of other information available about the fund.

30. A chemical company is considering a project that has an estimated risk-adjusted return on capital (RAROC) of 17%. Suppose that the risk-free rate is 4% per year, the expected market rate of return is 12% per year, and the company's equity beta is 1.5. Using the criterion of adjusted risk-adjusted return on capital (ARAROC), the company should:

a. Reject the project because the ARAROC is higher than the market expected excess return.
b. Accept the project because the ARAROC is higher than the market expected excess return.
c. Reject the project because the ARAROC is lower than the market expected excess return.
d. Accept the project because the ARAROC is lower than the market expected excess return.

31. A specialist finance company only trades derivatives on rare commodities. The company and a handful of other firms, all of whom have large notional outstanding contracts with the company, dominate the market for such derivatives. The company's management would like to mitigate its overall counterparty exposure, with the goal of reducing it to almost zero. Which of the following methods, if implemented, could best achieve this goal?

a. Ensuring that sufficient collateral is posted by counterparties
b. Diversifying among counterparties
c. Cross-product netting on a single counterparty basis
d. Purchasing credit derivatives, such as credit default swaps

32. LEM Banking Corporation, a frequent user of swaps, often enters into transactions with GXT Bank, a major provider of swaps. Recently, GXT Bank was downgraded from a rating of AA to a rating of A, while LEM Banking Corporation was downgraded from a rating of A to a rating of A-. During this time, the credit spread for GTX Bank has increased from 25 bps to 155 bps, while the credit spread for LEM Banking has increased from 120 bps to 160 bps. Which of the following is the most likely action that the counterparties will request on their credit value adjustment (CVA)?

a. The credit qualities of the counterparties have migrated, but not significantly enough to justify amending existing CVA arrangements.
b. GTX Bank requests an increase in the CVA charge it receives.
c. LEM Banking Corporation requests a reduction in the CVA charge it pays.
d. CVA is no longer a relevant factor, and the counterparties should migrate to using other mitigants of counterparty risk.

33. An analyst estimates that the hazard rate for a company is 0.16 per year. The probability of survival in the first year followed by a default in the second year is closest to:

a. 11.62%.
b. 13.63%.
c. 14.79%.
d. 27.39%.

34. At the beginning of the year, a firm bought an AA-rated corporate bond at USD 108 per USD 100 face value. Using market data, the risk manager estimates the following year-end values for the bond based on interest rate simulations informed by the economics team:

Rating	Year-end Bond Value (USD per USD 100 face value)
AAA	110
AA	106
A	101
BBB	97
BB	86
B	76
CCC	67
Default	43

In addition, the risk manager estimates the 1-year transition probabilities on the AA-rated corporate bond:

Rating	Probability of State
AAA	2.00%
AA	87.00%
A	6.00%
BBB	3.30%
BB	0.65%
B	0.45%
CCC	0.25%
Default	0.35%

What is the 1-year 95% credit VaR per USD 100 of face value closest to?

a. USD 3
b. USD 11
c. USD 18
d. USD 22

35. Computing VaR on a portfolio containing a very large number of positions can be simplified by mapping these positions to a smaller number of elementary risk factors. Which of the following mappings would be adequate?

a. USD/EUR forward contracts are mapped on the USD/JPY spot exchange rate.
b. Each position in a corporate bond portfolio is mapped on the bond with the closest maturity among a set of government bonds.
c. Government bonds paying regular coupons are mapped on zero-coupon government bonds.
d. A position in the stock market index is mapped on a position in a stock within that index.

36. A risk manager is in the process of valuing several European option positions on a non-dividend-paying stock XYZ that is currently priced at GBP 30. The implied volatility skew, estimated using the Black-Scholes-Merton model and the current prices of actively traded European-style options on stock XYZ at various strike prices, is shown below:

Assuming that the implied volatility at GBP 30 is used to conduct the valuation, which of the following long positions will be undervalued?

a. An out-of-the-money call
b. An in-the-money call
c. An at-the-money put
d. An in-the-money put

37. A risk manager is pricing a 10-year call option on 10-year Treasury using a successfully tested pricing model. Current interest rate volatility is high and the risk manager is concerned about the effect this may have on short-term rates when pricing the option. Which of the following actions would best address the potential for negative short-term interest rates to arise in the model?

a. The risk manager uses a normal distribution of interest rates.
b. When short-term rates are negative, the risk manager adjusts the risk-neutral probabilities.
c. When short-term rates are negative, the risk manager increases the volatility.
d. When short-term rates are negative, the risk manager sets the rate to zero.

38. A large commercial bank is using VaR as its main risk measurement tool. Expected shortfall (ES) is suggested as a better alternative to use during market turmoil. What should be understood regarding VaR and ES before modifying current practices?

a. Despite being more complicated to calculate, ES is easier to backtest than VaR.
b. Relative to VaR, ES leads to more required economic capital for the same confidence level.
c. While VaR ensures that the estimate of portfolio risk is less than or equal to the sum of the risks of that portfolio's positions, ES does not.
d. Both VaR and ES account for the severity of losses beyond the confidence threshold.

Question 39 refers to the following information:

A profitable derivatives trading desk at a bank decides that its existing VaR model, which has been used broadly across the firm for several years, is too conservative. The existing VaR model uses a historical simulation over a three-year look-back period, weighting each day equally. A quantitative analyst in the group quickly develops a new VaR model, which uses the delta normal approach. The new model uses volatilities and correlations estimated over the past four years using the Riskmetrics EWMA method.

For testing purposes, the new model is used in parallel with the existing model for four weeks to estimate the 1-day 95% VaR. After four weeks, the new VaR model has no exceedances despite consistently estimating VaR to be considerably lower than the existing model's estimates. The analyst argues that the lack of exceedances shows that the new model is unbiased and pressures the bank's model evaluation team to agree. Following an overnight examination of the new model by one junior analyst instead of the customary evaluation that takes several weeks and involves a senior member of the team, the model evaluation team agrees to accept the new model for use by the desk.

39. Which of the following statements about the risk management implications of this replacement is correct?

a. Delta-normal VaR is more appropriate than historical simulation VaR for assets with non-linear payoffs.
b. Changing the look-back period and weighing scheme from three years, equally weighted, to four years, exponentially weighted, will understate the risk in the portfolio.
c. The desk increased its exposure to model risk due to the potential for incorrect calibration and programming errors related to the new model.
d. A 95% VaR model that generates no exceedances in four weeks is necessarily conservative.

40. The CFO at a bank is preparing a report to the board of directors on its compliance with Basel requirements. The bank's average capital and total exposure for the most recent quarter is as follows:

REGULATORY CAPITAL	USD MILLIONS
Total Common Equity Tier 1 Capital	250
Additional Tier 1 Capital	66
Prior to regulatory adjustments	40
Regulatory adjustments	8
Total Tier 1 Capital	316
Tier 2 Capital	55
Prior to regulatory adjustments	63
Regulatory adjustments	8
Total Capital	371
Total Average Exposure	4,280

Using the Basel III framework, which of the following is the best estimate of the bank's current leverage ratio?

a. 1.29%
b. 5.84%
c. 7.38%
d. 8.67%

41. Which of the following is not a type of operational risk as defined by Basel II and Basel III?

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

42. Consider a 1,200 share position in an undervalued but illiquid stock TQR that has a current stock price of EUR 76 (expressed as the midpoint of the current bid-ask spread). The daily return for TQR has an estimated volatility of 0.28%. The average bid-ask spread is EUR 0.18. Using the constant spread approach and assuming the returns of TQR are normally distributed, what is the estimated liquidity adjusted, 1-day 95% VaR?

a. EUR 108
b. EUR 210
c. EUR 420
d. EUR 528

43. The Basel Committee recommends that banks use a set of early warning indicators in order to identify emerging risks and potential vulnerabilities in their liquidity position. Which of the following is an early warning indicator of a potential liquidity problem?

a. Rapid asset growth
b. Positive publicity
c. Credit rating upgrade
d. Increased asset diversification

44. At times, large dealer banks have financed significant fractions of their assets using short-term (often, overnight) repurchase agreements in which creditors held bank securities as collateral against default losses. The table below shows the quarter-end financing of four broker-dealer financial instruments. All values are in USD billions.

	Bank W	Bank X	Bank Y	Bank Z
Financial instruments owned	2,669	2,850	3,100	3,450
Pledged as collateral	1,200	1,550	1,870	825
Not pledged	1,469	1,300	1,230	2,625

In the event that repo creditors become equally nervous about each bank's solvency, which bank is most vulnerable to a liquidity crisis?

a. Bank W
b. Bank X
c. Bank Y
d. Bank Z

45. Which of the following is an example of an operational risk loss by Firm A?

a. After a surprise announcement by the central bank that interest rates would increase, bond prices fall, and Firm A incurs a significant loss on its bond portfolio.
b. The data capture system of Firm A fails to capture the correct market rates causing derivative trades to be done at incorrect prices, leading to significant losses.
c. As a result of an increase in commodity prices, the share price of a company that Firm A invested in falls significantly, causing major investment losses.
d. A counterparty of Firm A fails to settle their debt to Firm A, and in doing this, they are in breach of a legal agreement to pay for services rendered.

46. The risk management group estimates the 1-day 99% VaR on a long-only, large-cap equity portfolio using a variety of approaches. A daily risk report shows the following information:

1-day 99% VaR Estimates (by approach):

- Delta-Normal VaR: USD 441,940
- Monte Carlo Simulation VaR: USD 473,906
- Historical Simulation VaR: 495,584

Which of the following is the most likely explanation for the variation in VaR estimates?

a. Data problems
b. Differences in model assumptions
c. Endogenous model risk
d. Programming errors

47. While building the bank's enterprise risk management system, a risk analyst takes an inventory of firm risks and categorizes these risks as market, credit, or operational. Which of the following observations of the bank's data should be considered unexpected if compared to similar industry data?

a. The operational risk loss distribution has a large number of small losses, and therefore a relatively low mode.
b. The operational risk loss distribution is symmetric and fat-tailed.
c. The credit risk distribution is asymmetric and fat-tailed.
d. The market risk distribution is similar to the distribution of the return on a portfolio of securities.

48. Bank BHC is considering a loan to be fully funded by deposits, with the following parameters:

- Loan amount: GBP 5 billion
- Average annual interest rate paid on deposits: 1.2%
- Annual interest rate on loan: 6.0%
- Expected loss: 2.0% of face value of loan
- Annual operating costs: 1.0% of face value of loan
- Economic capital: 8.0%
- Average return on economic capital: 4.0%

What is the risk-adjusted return on capital for this loan?

a. A. 9.5%
b. B. 10.5%
c. C. 26.5%
d. D. 35.5%

49. As a result of the credit crisis, the Basel Committee revised the market risk framework and introduced a stressed VaR requirement. A bank uses the internal models approach for market risk and has generated the following risk measures (in USD million) for the current trading book positions:

Confidence Level	Latest Available 10-day VaR	Latest Available 10-day Stressed VaR	Average 10-day VaR of Previous 60 Days	Average 10-day Stressed VaR of Previous 60 Days
95.0%	305	664	340	743
99.0%	588	1,345	555	1,489
99.9%	757	1,726	708	1,844

The supervisory authority has set the multiplication factors for both the VaR and stressed VaR values to 3. What is the capital requirement for general market risk?

a. USD 1,665 million
b. USD 3,977 million
c. USD 6,132 million
d. USD 8,502 million

50. Consider a 1-year maturity zero-coupon bond with a face value of USD 1,000,000 and a 0% recovery rate issued by Company K. The bond is currently trading at 90% of face value. Assuming the excess spread only captures credit risk and that the risk-free rate is 3% per annum, the risk-neutral 1-year probability of default on Company K is closest to which of the following?

a. 7%
b. 10%
c. 13%
d. 15%

51. A hedge fund is considering taking positions in various tranches of a collateralized debt obligation (CDO). The fund's chief economist predicts that the default probability will decrease significantly and that the default correlation will increase. Based on this prediction, which of the following is a good strategy to pursue?

a. Buy the senior tranche and buy the equity tranche.
b. Buy the senior tranche and sell the equity tranche.
c. Sell the senior tranche and sell the equity tranche.
d. Sell the senior tranche and buy the equity tranche.

52. A bank has many open derivative positions with an investment firm. A description and current market values are displayed in the table below:

Positions Market	Price (USD)
Long swaptions	21 million
Long credit default swaps	-33 million
Short currency derivatives	33 million

In the event that the investment firm defaults, what would be the loss to the bank if netting is used?

a. USD 0 million
b. USD 12 million
c. USD 21 million
d. USD 33 million

53. A financial firm sells a put option on ABC stock with a time to expiration of six months, a strike price of USD 105, an underlying asset price of USD 85, implied volatility of 24% and a risk-free rate of 3%. What is the firm's counterparty credit exposure from this transaction?

a. USD 0.00
b. USD 0.68
c. USD 2.38
d. USD 32.40

54. An investor has sold default protection on the most senior tranche of a CDO. If the default correlation between assets held in the CDO decreases sharply, assuming everything else is unchanged, the investor's position:

a. Will gain significant value, since the probability of exercising the protection falls.
b. Will lose significant value, since the protection will gain value.
c. Will neither gain nor lose value, since only expected default losses matter and correlation does not affect expected default losses.
d. Can either increase or decrease, depending on the pricing model used and the market conditions.

55. Suppose that you want to estimate the implied default probability for a BB-rated discount corporate bond.

- The T-bond (a risk-free bond) yields 8% per year.
- The one-year BB-rated discount bond yields 14% per year.
- The two-year BB-rated discount bond yields 21% per year.

If the recovery rate on a BB-rated bond is expected to be 0%, and the marginal default probability in year one is 7%, which of the following is the best estimate of the risk-neutral probability that the BB-rated discount bond defaults within the next two years?

a. 3.85%
b. 5.26%
c. 10.74%
d. 20.33%

56. A credit manager overseeing the structured credit book of a bank works on identifying the frictions in the securitization process that caused the recent subprime mortgage crisis in the United States. Of the following frictions in the securitization process, which one was not a cause of the subprime crisis?

a. Frictions between the mortgagor and the originator: predatory lending.
b. Frictions between the originator and the arranger: predatory borrowing and lending.
c. Frictions between the servicer and asset manager: moral hazard.
d. Frictions between the asset manager and investor: principal-agent conflict.

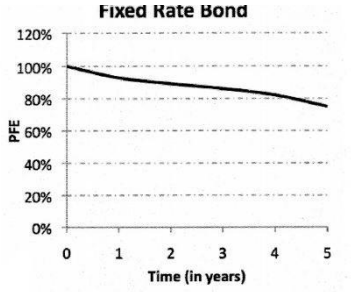
57. The exhibit below presents a summary of bilateral mark-to-market (MtM) trades for four counterparties. If netting agreements exist between all pairs of counterparties shown, what is the correct order of net exposure per counterparty, from lowest to highest?

MtM Trades for Four Counterparties (USD million)				
		Opposing Counterparty		
		B	**C**	**D**
Counterparty **A**	Trades with positive MtM	12	12	2
	Trades with negative MtM	-12	-4	-12
		A	**C**	**D**
Counterparty **B**	Trades with positive MtM	12	0	12
	Trades with negative MtM	-12	-6	-1
		A	**B**	**D**
Counterparty **C**	Trades with positive MtM	6	6	3
	Trades with negative MtM	-12	0	-2
		A	**B**	**C**
Counterparty **D**	Trades with positive MtM	12	3	1
	Trades with negative MtM	-2	-12	-1

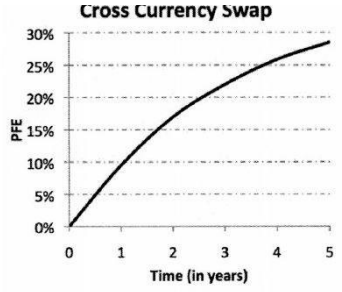
a. A, C, B, D
b. B, D, C, B
c. C, A, D, B
d. D, A, B, C

58. Which of the following graphs is an accurate representation of a typical potential future exposure (PFE) profile for the corresponding instrument?

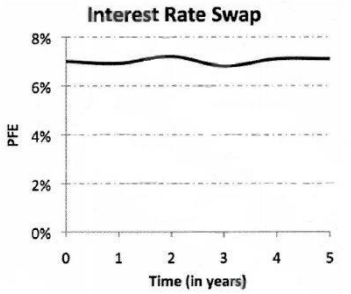
A



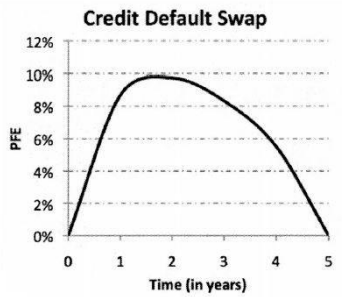
B.



C



D.



59. A risk manager is examining a firm's equity index option price assumptions. The observed volatility skew for a particular equity index slopes downward to the right. Compared to the lognormal distribution, the distribution of option prices on this index implied by the Black-Scholes-Merton (BSM) model would have:

a. A fat left tail and a thin right tail.
b. A fat left tail and a fat right tail.
c. A thin left tail and a fat right tail.
d. A thin left tail and a thin right tail.

60. A money management firm has USD 33 billion in assets. The risk manager computes the daily VaR at various confidence levels as follows:

Confidence Level	VaR (USD)
95.0%	503,700,000
95.5%	511,550,000
96.0%	520,000,000
96.5%	542,750,000
97.0%	562,250,000
97.5%	581,750,000
98.0%	605,150,000
98.5%	636,350,000
99.0%	677,300,000
99.5%	740,350,000

What is the closest estimate of the daily expected shortfall at the 96.5% confidence level?

a. USD 543 million
b. USD 588 million
c. USD 621 million
d. USD 740 million

61. You are backtesting a bank's VaR model. Currently, the bank calculates a 1-day VaR at the 99% confidence level, and you are recommending that it switch to a 95% confidence level. Which of the following statements concerning this switch is correct?

a. The 95% VaR model is less likely to be rejected using backtesting than the 99% VaR model.
b. When validating with backtesting at the 90% confidence level, there is a smaller probability of incorrectly rejecting a 95% VaR model than a 99% VaR model.
c. The decision to accept or reject a VaR model based on backtesting results is more reliable with a 95% confidence level VaR model than with a 99% confidence level model.
d. When backtesting using a 90% confidence level, there is a smaller probability of committing a type I error when backtesting a 95% VaR model than with a 99% VaR model.

62. An analyst is looking at various models used to incorporate drift into term structure models. The Ho-Lee Model:

a. Incorporates no-risk premium to the interest rate model allowing rates to vary according to their volatility.
b. Incorporates drift as a premium to interest rates that remains constant over time.
c. Allows for a risk premium to be applied to interest rates that changes over time.
d. Incorporates drift into the model following the assumption that rates revert to the long-run equilibrium value.

63. A risk manager wants to study the behavior of a portfolio that depends on only two economic variables, X and Y. X is uniformly distributed between 4 and 7, and Y is uniformly distributed between 5 and 8. The risk manager wants to model their joint distribution, H(X,Y). The theorem of Sklar proves that, for any joint distribution H, there is a copula C such that:

a. H(3X + 4, 3Y + 5) is equal to C[X,Y].
b. H(X,Y) is equal to C[u,d] where u is the density marginal distribution of X and d is the density marginal distribution of Y.
c. H(X,Y) is equal to C[(X – 4)/3, (Y – 5)/3].
d. H[(X – 4)/3, (Y – 5)/3] is equal to C(X,Y).

64. A committee of risk management practitioners discusses the difference between pricing deep out-of-the-money call options on FBX stock and pricing deep out-of-the-money call options on the EUR/JPY foreign exchange rate using the Black-Scholes-Merton (BSM) model. The practitioners price these options based on two distinct probability distributions of underlying asset prices at the option expiration date:

- A lognormal probability distribution
- An implied risk-neutral probability distribution obtained from the volatility smile for options of the same maturity

Using the lognormal, instead of the implied risk-neutral probability distribution, will tend to:

a. Price the option on FBX relatively high and price the option on EUR/JPY relatively low.
b. Price the option on FBX relatively low and price the option on EUR/JPY relatively high.
c. Price the option on FBX relatively low and price the option on EUR/JPY relatively low.
d. Price the option on FBX relatively high and price the option on EUR/JPY relatively high.

65. According to extreme value theory (EVT), when examining distributions of losses exceeding a threshold value, which of the following is correct?

a. To apply EVT, the underlying loss distribution must be either normal or lognormal.
b. The threshold value is typically chosen near the estimated mean of the underlying loss distribution.
c. The number of exceedances decreases as the threshold value decreases, which causes the reliability of the parameter estimates to increase.
d. As the threshold value is increased, the distribution of exceedances converges to a generalized Pareto distribution.

66. Based on Basel II rules for backtesting, a penalty is given to banks that have more than four exceptions to their 1-day 99% VaR over the course of 250 trading days. The supervisor gives these penalties based on four criteria. Which of the following causes of exceptions is most likely to lead to a penalty?

a. The bank increases its intraday trading activity.
b. A large move in interest rates was combined with a small move in correlations.
c. The bank's model calculates interest rate risk based on the median duration of the bonds in the portfolio.
d. A sudden market crisis in an emerging market leads to losses in the equity positions in that country.

67. A portfolio manager owns a portfolio of options on a non-dividend paying stock LTM. The portfolio is made up of 5,000 deep in-the-money call options on LTM and 25,000 deep out-of-the-money call options on LTM. The portfolio also contains 10,000 forward contracts on LTM. LTM is trading at USD 84. Assuming 250 trading days in a year and the volatility of LTM is 23% per year, which of the following amounts would be closest to the 1-day VaR of the portfolio at the 99 percent confidence level?

a. USD 2,701
b. USD 14,235
c. USD 30,151
d. USD 42,706

68. Consider the following two asset portfolios under management at an investment company:

Asset	Position Value (in millions of EUR)	Return Standard Deviation (%)	Beta
XYZ	560	4.20	0.7
ABC	640	7.85	1.5
Portfolio	1,200	5.10	1.0

What is the Component VaR of asset XYZ and the Marginal VaR of asset ABC, respectively, at the 95% confidence level?

a. Component VaR = USD 32,886,840; and Marginal VaR = 0.0587
b. Component VaR = USD 32,886,840; and Marginal VaR = 0.1258
c. Component VaR = USD 80,539,200; and Marginal VaR = 0.0587
d. Component VaR = USD 80,539,200; and Marginal VaR = 0.1258

69. Which of the following statements about risk management in the pension fund industry is correct?

a. A pension plan's total VaR is equal to the sum of its policy-mix VaR and active management VaR.
b. Pension fund risk analysis does not consider performance relative to a benchmark.
c. In most defined-benefit pension plans, if liabilities exceed assets, the shortfall does not create a risk for the plan sponsor.
d. From the plan sponsor's perspective, nominal pension obligations are similar to a short position in a bond.

Questions 70 and 71 are based on the following information.

A risk manager assumes that the joint distribution of returns is multivariate normal and calculates the following risk measures for a two-asset portfolio:

Asset	Position	Individual VaR	Marginal VaR	VaR Contribution
1	USD 180	USD 41.94	0.396	USD 39.6
2	USD 180	USD 83.88	0.792	USD 79.2
Portfolio	USD 360	USD 110.72		USD 110.72

70. If Asset 1 is dropped from the portfolio, what will be the reduction in portfolio VaR?

a. USD 26.84
b. USD 41.94
c. USD 46.94
d. USD 83.88

71. Let $\beta_i = \rho_{ip}*\sigma_i/\sigma_p$, where ρ_{ip} denotes the correlation between the return of asset i and the return of the portfolio, σ_i is the volatility of the return of asset i and σ_p is the volatility of the return of the portfolio. What is β_2?

a. 0.644
b. 1.288
c. 2.575
d. Cannot determine from information provided.

72. An analyst regresses the returns of 100 stocks against the returns of a major market index. The resulting pool of 100 alphas has a residual risk of 18% and an information coefficient of 9%. If the alphas are normally distributed with a mean of 0%, roughly how many stocks have an alpha greater than 4% or less than -4%?

a. 5
b. 10
c. 20
d. 25

73. A significant percentage of hedge funds stop trading each year and drop out of hedge fund databases. Which of the following best describes the impact this has historically had on hedge fund analyses performed using these databases?

a. The average performance of hedge funds is overstated.
b. The average volatility of hedge funds is overstated.
c. The average correlation of hedge fund returns is overstated.
d. The average Sharpe ratio of hedge fund returns is understated.

74. A portfolio manager wants to invest a small amount of new money that has recently come into a fund. The fund is benchmarked to an index and, rather than adding a new holding, the manager is considering increasing the holdings of one of the four assets described in the following table:

Asset	Portfolio Weight	Expected Return	Beta to the Index	Beta to the Portfolio
A	1.2%	12%	1.2	0.90
B	0.8%	10%	0.7	0.90
C	0.75	10%	0.6	0.85
D	0.35	8%	0.3	1.10

The portfolio manager wants to select the asset that has the lowest marginal VaR as long as its Treynor ratio is at least 0.1. Assuming the risk free rate is 2%, which asset should the portfolio manager select?

a. Asset A
b. Asset B
c. Asset C
d. Asset D

75. A risk officer of a bank is evaluating the four rules for credit scoring model performance measurement. Which of the following is correct?

a. The "Minimum-Risk" Decision Rule tries to minimize both type I and type II errors.
b. The Neyman-Pearson rule minimizes type II error with type I error remaining constant.
c. The Neyman-Pearson rule minimizes type I error with type II error remaining constant.
d. The "Minimum-Risk" Decision Rule tries to minimize both credit and market risks.

76. A major regional bank has determined that a counterparty has a constant default probability of 5.5% per year. What is the probability of this counterparty defaulting in the fourth year?

a. 4.39%
b. 4.64%
c. 4.91%
d. 5.50%

77. A company's pension fund is established as a defined benefit plan, and therefore the board must consider funding risk. Which of the following statements about the pension fund's funding risk is correct?

a. The longer the horizon for expected payouts, the lower the funding risk.
b. Decreases in interest rates will reduce funding risk.
c. The funding risk has been effectively transferred to the employees.
d. Funding risk represents the true long-term risk to the plan sponsor.

78. A risk manager is evaluating the risk profile for a portfolio of stocks. Currently, the portfolio is valued at JPY 128 billion and contains JPY 25 billion in stock XYZ. The standard deviation of returns of stock XYZ is 11% annually and that of the overall portfolio is 18% annually. The correlation of returns between stock XYZ and the portfolio is 0.6. Assuming the risk analyst uses a 1-year 95% VaR and that returns are normally distributed, what is the estimated component VaR of stock XYZ?

a. JPY 2.714 billion
b. JPY 3.838 billion
c. JPY 4.524 billion
d. JPY 6.397 billion

79. A risk team in the investment banking subsidiary of a bank holding company is setting up a Monte Carlo simulation methodology to estimate the subsidiary's aggregate loss distribution. Which of the following loss severity and loss frequency distribution pairs is the most appropriate to use?

a. Binomial distribution for severity, lognormal distribution for frequency.
b. Binomial distribution for frequency, normal distribution for severity.
c. Poisson distribution for severity, normal distribution for frequency.
d. Poisson distribution for frequency, lognormal distribution for severity.

80. The risk management department at a bank is trying to assess the impact of the capital conservation and countercyclical buffers defined in the Basel III framework. They consider a scenario in which the bank's capital and risk-weighted assets are as shown in the table below (all values are in EUR millions):

Item	Value
Risk-weighted assets	3,480
Common equity Tier 1 (CET1) capital	145
Additional Tier 1 capital	50
Total Tier 1 capital	195
Tier 2 capital	98
Tier 3 capital	0
Total capital	293

Assuming that all Basel III phase-ins have occurred and that the bank's required countercyclical buffer is 0.95%, which of the capital ratios does the bank satisfy?

a. The CET1 capital ratio only.

b. The CET1 capital ratio plus the capital conservation buffer only.

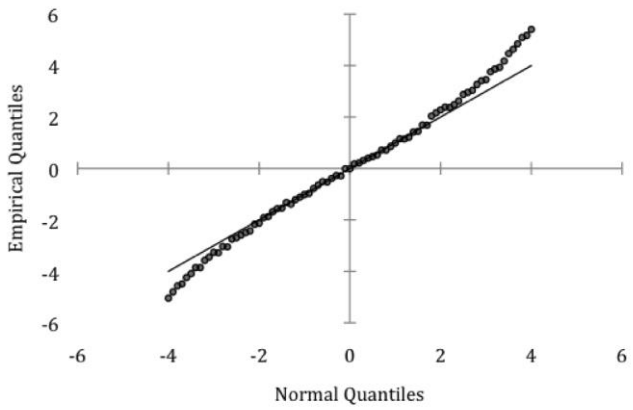
c. The CET1 capital ratio plus the capital conservation buffer and the countercyclical buffer.

d. None of the above.

2016 Practice Exam, Part II – Candidate Answer Sheet

1._____	21._____	41._____	61._____
2._____	22._____	42._____	62._____
3._____	23._____	43._____	63._____
4._____	24._____	44._____	61._____
5._____	25._____	45._____	65._____
6._____	26._____	46._____	66._____
7._____	27._____	47._____	67._____
8._____	28._____	48._____	68._____
9._____	29._____	49._____	69._____
10._____	30._____	50._____	70._____
11._____	31._____	51._____	71._____
12._____	32._____	52._____	72._____
13._____	33._____	53._____	73._____
14._____	34._____	54._____	74._____
15._____	35._____	55._____	75._____
16._____	36._____	56._____	76._____
17._____	37._____	57._____	77._____
18._____	38._____	58._____	78._____
19._____	39._____	59._____	79._____
20._____	40._____	60._____	80._____

1. An analyst is examining a sample of return data. As a first step, the analyst construct a QQ plot of the data as shown below:



Based on an examination of the QQ plot, which of the following statements is correct?

a. The returns are normally distributed.
b. The return distribution has thin tails relative to the normal distribution.
c. The return distribution is negatively skewed relative to the normal distribution.
d. The return distribution has fat tails relative to the normal distribution.

Correct answer: d

Explanation: This Q-Q plot has steeper slopes at the tails of the plot, which indicate fat tails in the distribution. A normal distribution would result in a linear QQ plot. A distribution with thin tails would produce a QQ plot with less steep slopes at the tails of the plot than a linear relationship, while this one is steeper at the tails. It is not a negatively skewed distribution, as the Q-Q plot is symmetric.

Section: Market Risk Management and Measurement
Reference: Kevin Dowd, Measuring Market Risk, Second Edition (West Sussex, England: John Wiley & Sons, 2005). Chapter 3, Estimating Market Risk Measures: An Introduction and Overview.
Learning objective: Interpret QQ plots to identify the characteristics of a distribution.

2. The annual mean and volatility of a portfolio are 12% and 30%, respectively. The current value of the portfolio is GBP 2,500,000. How does the 1-year 95% VaR that is calculated using a normal distribution assumption (normal VaR) compare with the 1-year 95% VaR that is calculated using the lognormal distribution assumption (lognormal VaR)?

a. Lognormal VaR is greater than normal VaR by GBP 487,050
b. Lognormal VaR is greater than normal VaR by GBP 787,050
c. Lognormal VaR is less than normal VaR by GBP 487,050
d. Lognormal VaR is less than normal VaR by GBP 787,050

Correct answer: a

Explanation: Normal VaR is calculated as follows:

Normal VaR (%) = $R_p - z\sigma = 0.12 - (1.645 * 0.3) = 0.3735 = 37.35\%$ (dropping negative sign)

and, Lognormal VaR is calculated as follows:

Lognormal VaR (%) = $0.12 - e^{[Rp - z\sigma]} = 0.12 - \exp [0.12 - (1.645 * 0.3)] = 0.56832 = 56.83\%$

Hence, Lognormal VaR is larger than Normal VaR by: 56.83% – 37.35% = 19.48% per year. With a portfolio of GBP 2,500,000 this translates to VaR = 0.1948 x GBP 2,500,000 = GBP 487,050.

Section: Market Risk Management and Measurement
Reference: Kevin Dowd, Measuring Market Risk, Second Edition (West Sussex, England: John Wiley & Sons, 2005). Chapter 3, Estimating Market Risk Measures: An Introduction and Overview.
Learning Objective: Estimate VaR using a parametric approach for both normal and lognormal return distributions.

3. Let X be a random variable representing the daily loss of your portfolio. The "peaks over threshold" (POT) approach considers a threshold value, u, of X and the distribution of excess losses over this threshold. Which of the following statements about this application of extreme value theory is correct?

a. To apply the POT approach, the distribution of X must be elliptical and known.

b. If X is normally distributed, the distribution of excess losses requires the estimation of only one parameter, β, which is a positive scale parameter.

c. To apply the POT approach, one must choose a threshold, *u*, which is high enough that the number of observations in excess of *u* is zero.

d. As the threshold, *u*, increases, the distribution of excess losses over *u* converges to a generalized Pareto distribution.

Correct answer: d

Explanation: The distribution of excess losses over u converges to a generalized Pareto distribution as the threshold value u increases.

The distribution of X itself can be any of the commonly used distributions: normal, lognormal, t, etc., and will usually be unknown. The distribution of excess losses requires the estimation of two parameters, a positive scale parameter β and a shape or tail index parameter ξ. One must choose a threshold u that is high enough so that the theory applies but also low enough so that there are observations in excess of u.

Section: Market Risk Management and Measurement
Reference: Kevin Dowd, Measuring Market Risk, Second Edition (West Sussex, England: John Wiley & Sons, 2005). Chapter 7, Parametric Approaches (II): Extreme Value.
Learning Objective: Describe the peaks-over-threshold (POT) approach.

4. A risk analyst is comparing the use of parametric and non-parametric approaches for calculating VaR and is concerned about some of the characteristics present in the loss data. Which of the following distribution characteristics would make parametric approaches the favored method to use?

a. Skewness in the distribution
b. Fat tails in the distribution
c. Scarcity of high magnitude loss events
d. Heteroskedasticity in the distribution

Correct answer: c

Explanation: Non-parametric approaches can accommodate fat tails, skewness, and any other non-normal features that can cause problems for parametric approaches. However, if the data period that is used in estimation includes few losses or losses with low magnitude, non-parametric methods will often produce risk measures that are too low. Hence parametric methods would be more appropriate in those situations.

Section: Market Risk Management and Measurement
Reference: Kevin Dowd, Measuring Market Risk, Second Edition (West Sussex, England: John Wiley & Sons, 2005). Chapter 4, Non-parametric Approaches.
Learning Objective: Identify advantages and disadvantages of non-parametric estimation methods.

5. A risk analyst is valuing a 1-year credit default swap (CDS) contract that will pay the buyer 80% of the face value of a bond issued by a corporation immediately after a default by the corporation. To purchase this CDS, the buyer will pay the CDS spread, which is a percentage of the face value, once at the end of the year. The analyst estimates that the risk-neutral default probability for the corporation is 7% per year. The risk-free rate is 2.5% per year. Assuming defaults can only occur halfway through the year and that the accrued premium is paid immediately after a default, what is the estimate for the CDS spread?

a. 560 basis points
b. 570 basis points
c. 580 basis points
d. 590 basis points

Correct answer: d

Explanation: The key to CDS valuation is to equate the present value (PV) of payments to the PV of expected payoff in the event of default. Let:

r = risk-free rate = 2.5%

s = CDS spread.

π = probability of default during year 1 = 7%

C = contingent payment in case of default = 80%

$d_{0.5}$ =discount factor for half-year = $e^{-0.5*r} = e^{-0.5*0.025} = 0.987578$

$d_{1.0}$ =discount factor for 1-year = $e^{-1.0*r} = e^{-0.025} = 0.975310$

Therefore, to solve for the CDS spread (s):
The PV of payments (premium leg, which includes the spread payment and accrual) is:

$s*[0.5*d_{0.5}* \pi + d_{1.0}*(1-\pi)] = s*[0.034565 + 0.907038] = s*0.941603$

The payoff leg (in the event of default) = $C * d_{0.5} * \pi = 0.8*0.987578*0.07= 0.055304$
Equating the two PVs and solving for the spread: $s*0.941603 = 0.055304$
Thus, s = 0.058734 or a spread of approximately 587 basis points.

Section: Credit Risk Measurement and Management
Reference: Allan Malz, Financial Risk Management: Models, History, and Institutions (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 7, Spread Risk and Default Intensity Models.
Learning Objective: Compare the different ways of representing credit spreads.

6. A risk manager at a small fixed-income hedge fund is evaluating the default conditions of several trade positions. The hedge fund specializes in bank debt and runs a strategy that utilizes both relative value and long-only trades using credit default swaps (CDS) and bonds. One of the new traders at the hedge fund has the positions described in the table below:

Bank	Position	Credit
ABC	Long USD 12 million CDS	AA
LTM	Long USD 6 million bond	BBB
XYZ	Short USD 12 million CDS	A

Some of the hedge fund's newest clients are restricted from withdrawing their funds for three years. The manager is currently evaluating the impact of various default scenarios to estimate future asset liquidity. The manager has estimated that the marginal probability of default of the LTM Bank bond is 4% in Year 1, 7% in Year 2, and 16% in Year 3. What is the probability that the LTM bond makes coupon payments for 3 years and then defaults at the end of Year 3?

a. 12.0%
b. 12.6%
c. 14.3%
d. 14.9%

Correct answer: c

Explanation: The probability that the bond defaults in year 3 can be modeled as a Bernoulli trial given by the following equation, where MP stands for marginal probability:

P (Default at end of year 3) = (1 – MP year 1 default) * (1 – MP year 2 default)* (MP year 3 default)
= (1 – 0.04) * (1 – 0.07) * (0.16) = 0.1429 = 14.29% = 14.3%.

Section: Credit Risk Measurement and Management
References: Allan Malz, Financial Risk Management: Models, History, and Institutions (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 7, Spread Risk and Default Intensity Models.
Learning Objective: Explain how default risk for a single company can be modeled as a Bernoulli trial.

7. In its efforts to enhance its enterprise risk management function, Countryside Bank introduced a new decision-making process based on economic capital that involves assessing sources of risk across different business units and organizational levels. Which of the following statements regarding the correlations between these risks is correct?

a. Correlations between the risks in the asset and liability sides of the balance sheet can be changed by management decisions.
b. Generally, correlations between broad risk types such as credit, market, and operational risk are well understood and are easy to estimate at the individual firm level.
c. Correlations between business units are only relevant in deciding total firm-wide economic capital levels and are not relevant for decisions at the individual business unit or project level.
d. The introduction of correlations into firm-wide risk evaluation will result in a total VaR that, in general, is greater than or equal to the sum of individual business unit VaRs.

Correct answer: a

Explanation: Management has the ability to influence the correlations between these risks by changing the asset/liability mix, so management decision-making is indeed quite relevant.

Section: Operational and Integrated Risk Management
Reference: Brian Nocco and René Stulz, "Enterprise Risk Management: Theory and Practice," Journal of Applied Corporate Finance 18, No. 4 (2006): pp. 8-20.
Learning Objective: Describe the role of and issues with correlation in risk aggregation, and describe typical properties of a firm's market risk, credit risk, and operational risk distributions.

8. At the end of 2014, a pension fund had USD 650 million worth of assets that were fully invested in equities and USD 320 million in fixed-income liabilities with a modified duration of 13. In 2015, the widespread effects of the global energy crisis hit the pension fund, causing its investment in equities to lose 40% of their market value. In addition, the immediate response from the government — cutting interest rates — to salvage the situation, caused bond yields to decline by 1.8%. What was the change in the pension fund's surplus in 2015?

a. USD -330.00 million
b. USD -245.12 million
c. USD -185.12 million
d. USD -144.88 million

Correct answer: c

Explanation: The change in the pension fund's surplus (ΔS) for the year 2015 is equal to the ending surplus (S_1) at the end of 2015 less the initial surplus (S_0) at the end of 2014. That is, $\Delta S = S_1 - S_0$.

The initial surplus is calculated as $S_0 = A_0 - L_0 = 650 - 320 =$ USD 330 million, where A_0 = the firm's initial assets and L_0 = the firm's initial liabilities.

Next we have to calculate S_1, the surplus at the end of 2015. Given the 40% decline in the equity market, the new level of assets A_1 at the end of 2015 is equal to:

$A_1 = (1 - 0.4) * 650 =$ USD 390 million.

Since the percentage change in liability value $= -D_M * \Delta y$, where DM = modified duration = 13; and Δy = change in yield = –1.8%, then the new level of liabilities L_1 at the end of 2015 can be calculated as:

$L_1 = [1 - (D_M * \Delta y)] * L_0 = (1 - 13*0.018) * 320 =$ USD 245.12 million

Thus, the ending surplus for 2015 $= S_1 = A_1 - L_1 = 390 - 245.12 =$ USD 144.88 million

Therefore the change in surplus for 2015 $= \Delta S = S_1 - S_0 = 144.88 - 330 =$ USD –185.12 million (which implies the pension fund is actually in a deficit situation at the end of 2015).

Section: Risk Management and Investment Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition (New York: McGraw-Hill, 2007). Chapter 17, VaR and Risk Budgeting in Investment Management.
Learning Objective: Describe the investment process of large investors such as pension funds.

9. A portfolio has USD 3 million invested in Stock A and USD 1.5 million invested in Stock B. The 95% 1-day VaR for each individual position is USD 70,000. The correlation between the returns of Stock A and Stock B is 0.4. While rebalancing, the portfolio manager decides to sell USD 1 million of Stock A to buy USD 1 million of Stock B. Assuming that returns are normally distributed and that the rebalancing does not affect the volatility of the individual stocks, what effect will this have on the 95% 1-day portfolio VaR?

a. The portfolio VaR will not change.
b. The portfolio VaR will increase by USD 20,370.
c. The portfolio VaR will increase by USD 24,800.
d. The portfolio VaR will increase by USD 28,281.

Correct answer: c

Explanation: The first step is to calculate the VaR of the original portfolio of two stocks, A and B. This can be done by using the following equation:

$$VaR_p = \sqrt{\left(VaR_A^2 + VaR_B^2 + 2 * \rho_{AB} * VaR_A * VaR_B\right)}$$

where ρ_{AB} is the correlation coefficient. The portfolio VaR (before the rebalancing) is therefore:

$$VaR_p = \sqrt{\left(70{,}000^2 + 70{,}000^2 + 2 * 0.4 * 70{,}000 * 70{,}000\right)} = USD\ 117{,}132$$

After the rebalance, the market value of the position in Stock A is reduced by one-third, so VaR_A is now equal to (2/3)*($70,000) = $46,667. Meanwhile the market value for the position in B has risen by two-third so that VaR_B is now (1.67)* ($70,000) = $116,667. Hence we can now calculate the VaR of the new portfolio (after rebalancing) as follows:

$$VaR_p = \sqrt{\left(46{,}667^2 + 116{,}667^2 + 2 * 0.4 * 46{,}667 * 116{,}667\right)} = USD\ 141{,}932$$

Therefore, the VaR will increase by (141,932 – 117,132), or USD 24,800.

Section: Risk Management and Investment Management

Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition, Chapter 7: Portfolio Risk — Analytical Methods, pp. 161-164.
Learning Objective: Define, calculate, and distinguish between the following portfolio VaR measures: individual VaR, incremental VaR, marginal VaR, component VaR, undiversified portfolio VaR, and diversified portfolio VaR.

10. A bank uses a capital charge of 3.0% for revolving credit facilities with a loan equivalent factor of 0.4 assigned to the undrawn portion in calculating its risk-adjusted return on capital. A risk manager of the bank has become concerned that the protective covenants embedded in these loans are weak and may not prevent customers from drawing on the facilities during times of stress. As such, the manager has recommended increasing the loan equivalent factor to 0.85. This recommendation has been met with resistance from the loan origination team, and senior management has asked the risk manager to quantify the impact of the recommendation. For a typical facility that has an original principal of USD 1 billion and is 35% drawn, how much additional economic capital would have to be allocated if the loan equivalent factor is increased from 0.4 to 0.85?

a. USD 3.500 million
b. USD 6.195 million
c. USD 8.775 million
d. USD 18.300 million

Correct answer: c

Explanation: The required economic capital to support a loan in the RAROC model can be calculated using the following formula:

Required Capital=[DRAWN + (UNDRAWN * LEF)]*CF

Where: Credit commitment = COM = USD 1 billion
Drawn amount = Drawn = 35%*COM = 0.35*USD 1 billion = USD 350 million
Undrawn amount = UnDrawn = COM – Drawn = 65%*COM = USD 650 million
Loan equivalent factor = LEF = 0.4
Capital factor (capital charge) = CF = 3.0%

Therefore the initial required economic capital is calculated as follows:
Required Capital = [350 + (650 * 0.4)] * 0.03 = USD 18.3 million,

and the required capital if the change is implemented would be: [350 + (650 * 0.85)] * 0.03 = USD 27.075 million.

Hence the additional required economic capital would be 27.075 – 18.3 = USD 8.775 million.

Section: Operational and Integrated Risk Management
Reference: Michel Crouhy, Dan Galai and Robert Mark, The Essentials of Risk Management, 2nd Edition (New York: McGraw-Hill, 2014). Chapter 17, Capital Allocation and Performance Measurement.
Learning Objective: Compute and interpret the RAROC for project, loan or loan portfolio, and use RAROC to compare business unit performance.

11. Which of the following statements regarding frictions in the securitization of subprime mortgages is correct?

a. The arranger will typically have an information advantage over the originator with regard to the quality of the loans securitized.
b. The originator will typically have an information advantage over the arranger, which can create an incentive for the originator to collaborate with the borrower in filing false loan applications.
c. The major credit rating agencies are paid by investors for their rating service of mortgage-backed securities, and this creates a potential conflict of interest.
d. The use of escrow accounts for insurance and tax payments eliminates the risk of foreclosure.

Correct answer: b

Explanation: One of the key frictions in the process of securitization involves an information problem between the originator and arranger. In particular, the originator has an information advantage over the arranger with regard to the quality of the borrower. Without adequate safeguards in place, an originator can have the incentive to collabo- rate with a borrower in order to make significant misrepresentations on the loan application. Depending on the situation, this could be either construed as predatory lending (where the lender convinces the borrower to borrow too large of a sum given the borrower's financial situation) or predatory borrowing (the borrower convinces the lender to lend too large a sum).

The major rating agencies are not paid by the investors. Escrow accounts can forestall but not eliminate the risk of foreclosure.

Section: Credit Risk Measurement and Management

Reference: Adam Ashcroft and and Til Schuermann, "Understanding the Securitization of Subprime Mortgage Credit," Federal Bank of New York Staff Reports, No. 318 (March 2008).

Learning Objective: Identify and describe key frictions in subprime mortgage securitization, and assess the relative contribution of each factor to the subprime mortgage problems.

12. A risk manager is analyzing a 1-day 99% VaR model. Assuming 225 days in a year, what is the maximum number of daily losses exceeding the 1-day 99% VaR that is acceptable in a 1-year backtest to conclude, at a 95% confidence level, that the model is calibrated correctly?

a. 3
b. 5
c. 8
d. 10

Correct answer: b

Explanation: The risk manager will reject the hypothesis that the model is correctly calibrated if the number x of losses exceeding the VaR is such that:

$$\frac{x - pT}{\sqrt{p(1-p)T}} > z = 1.96$$

where p represents the failure rate and is equal to 1-99%, or 1%; and T is the number of observations = 225. And z = 1.96 is the two-tail confidence level quantile. If

$$\frac{x - 0.01*225}{\sqrt{0.01*(1-0.01)*225}} = 1.96$$

then, x = 5.18. So the maximum number of exceedances would be 5 to conclude that the model is calibrated correctly.

Section: Market Risk Measurement and Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition. (New York: McGraw-Hill, 2007). Chapter 6, Backtesting VaR.
Learning Objective: Verify a model based on exceptions or failure rates.

13. In fixed income portfolio mapping, when the risk factors have been selected, which of the following mapping approaches requires that one risk factor be chosen that corresponds to average portfolio maturity?

a. Principal mapping
b. Duration mapping
c. Convexity mapping
d. Cash mapping

Correct answer: a

Explanation: With principal mapping, one risk factor is chosen that corresponds to the average portfolio maturity. With duration mapping, one risk factor is chosen that corresponds to the portfolio duration. With cash flow mapping, the portfolio cash flows are grouped into maturity buckets. Convexity mapping is not a method of VaR mapping for fixed income portfolios.

Section: Market Risk Measurement and Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition. (New York: McGraw-Hill, 2007). Chapter 11, VaR Mapping.
Learning Objective: Differentiate among the three methods of mapping portfolios of fixed income securities.

14. A risk manager is constructing a term structure model and intends to use the Cox-Ingersoll-Ross Model. Which of the following describes this model?

a. The model presumes that the volatility of the short rate will increase at a predetermined rate.
b. The model presumes that the volatility of the short rate will decline exponentially to a constant level.
c. The model presumes that the basis-point volatility of the short rate will be proportional to the rate.
d. The model presumes that the basis-point volatility of the short rate will be proportional to the square root of the rate.

Correct answer: d

Explanation: In the CIR model, the basis-point volatility of the short rate is not independent of the short rate as other simpler models assume. The annualized basis-point volatility equals $\sigma\sqrt{}$ and therefore increases as a function of the square root of the rate.

Section: Market Risk Measurement and Management
Reference: Tuckman, Fixed Income Securities, 3rd Edition. Chapter 10: The Art of Term Structure Models: Volatility and Distribution.
Learning Objective: Describe the short-term rate process under the Cox-Ingersoll-Ross (CIR) and lognormal models.

15. An analyst is reviewing a bond for investment purposes. The bond is expected to have a default probability of 3%, with an expected loss of 75 basis points in the event of default. If the current risk-free rate is 2%, what is the minimum coupon spread needed on the bond for its expected return to match the risk-free rate?

a. 90 basis points
b. 120 basis points
c. 180 basis points
d. 240 basis points

Correct answer: a

Explanation: The credit risky bond is preferable when $(1 - PD) * (1 + r + z) + PD * RR > 1 + r$

where PD is the probability of default, RR is the recovery rate, r is the coupon paid by a risk-free bond, and z is the coupon spread for a risky bond that compensates for the default risk. Let EL and LGD represent expected loss and loss given default, respectively.

Let: PD = 3%

EL = 75 bps = 0.75%

Since EL = PD * LGD, then LGD = (EL/PD) = 0.75/3 = 0.25. Also the recovery rate RR = 1 – LGD. Therefore RR = 1 – EL/PD = 0.75, and using the relationship above:

$(1 - 3\%) * (1 + 2\% + z) + 3\% * 75\% > 1 + 2\%.$

Making the calculations simplifies the equation as follows:

$0.97*(1.02 + z) + 0.0225 > 1.02$. Hence, $z > 0.00835$ or 83.5 bps.

Section: Credit Risk Measurement and Management.
Reference: Allan Malz, Risk Management: Models, History, and Institutions (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 6, Credit and Counterparty Risk.
Learning Objective: Calculate expected loss from recovery rates, the loss given default, and the probability of default.

16. A credit risk manager for a bank is looking to mitigate counterparty credit risk exposure to ZTM, an A-rated firm. Currently the bank has the following derivatives contracts with ZTM:

Contract	Contract Value (HKD)
A	40,000,000
B	60,000,000
C	28,000,000
D	2,000,000

With the information provided, what is the most appropriate credit risk mitigation technique in this case?

a. Implement a netting scheme.
b. Use credit triggers.
c. Sell credit default swaps on ZTM.
d. Increase collateral.

Correct answer: d

Explanation: Increasing collateral would effectively reduce current credit exposure depending on the contract parameters, mainly minimum transfer amount and threshold.

Section: Credit Risk Measurement and Management
Reference: Jon Gregory, Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets (West Sussex, UK: John Wiley & Sons, 2012). Chapter 3, Defining Counterparty Credit Risk.
Learning Objective: Identify and describe the different ways institutions can manage and mitigate counterparty risk.

17. A financial firm conducts several trades. As part of its risk control, it has entered into netting agreements on 10 equity trade positions with an average correlation of 0.35. The firm believes that it can improve upon the diversification benefit of netting by a judicious choice of number of exposures with a favorable correlation coefficient. Which of the following trade combinations would increase the firm's expected netting benefit the most from the current level?

Trade Combination	Number of Positions	Average Correlation
A	5	0.22
B	7	0.11
C	11	–0.07
D	14	–0.03

a. Trade combination A
b. Trade combination B
c. Trade combination C
d. Trade combination D

Correct answer: c

Explanation: Trade combination c is the correct answer. Netting factor is expressed as:

$$Netting \quad factor = \frac{\sqrt{n + n(n-1)\rho}}{n}$$

When n (number of positions) = 10 and ρ (correlation coefficient) = 0.35 (current position),

$$Netting \quad factor = \frac{\sqrt{n + n(n-1)\rho}}{n} = \frac{\sqrt{10 + 10*(10-1)(0.35)}}{10} = 64.42\%$$

When n = 11 and ρ = – 0.07 , there is the most reduction in netting factor,

$$Netting \quad factor = \frac{\sqrt{n + n(n-1)\rho}}{n} = \frac{\sqrt{11 + 11*(11-1)(-0.07)}}{11} = 16.52\%$$

a is incorrect. When n = 5 and ρ = 0.22, there is only a modest netting benefit:

$$Netting \quad factor = \frac{\sqrt{n + n(n-1)\rho}}{n} = \frac{\sqrt{5 + 5*(5-1)(0.22)}}{5} = 61.32\%$$

b is incorrect. When n = 7 and ρ = 0.10, there is reduction in netting factor but not as much as in c,

$$Netting \quad factor = \frac{\sqrt{n + n(n-1)\rho}}{n} = \frac{\sqrt{7 + 7*(7-1)(0.10)}}{7} = 47.81\%$$

d is incorrect. When n = 14 and ρ = −0.03, there is a reasonable reduction in netting factor but not as much as in c,

$$Netting \quad factor = \frac{\sqrt{n + n(n-1)\rho}}{n} = \frac{\sqrt{14 + 14*(14-1)(-0.03)}}{14} = 20.87\%$$

Section: Credit Risk Measurement and Management
Reference: Jon Gregory (2012), Counterparty Credit Risk: A Continuation Challenge for Global Financial Markets, Second Edition, West Sussex, UK, John Wiley & Sons. Chapter 8, Credit Exposure.
Learning Objective: Explain the impact of netting on exposure, the benefit of correlation, and calculate the netting factor.

18. An underlying exposure with an effective annual price volatility of 6% is collateralized by a 10-year U.S. Treasury note with an effective price volatility of 8%. The correlation between the exposure and the U.S. Treasury note is zero. Changes in the value of the overall position (exposure plus collateral) are calculated for a 10-day horizon at a 95% confidence interval (assume a year of 250 days). Which of the following would one expect to observe from this analysis?

a. The presence of collateral increases the current exposure and increases the volatility of the exposure between remargining periods.
b. The presence of collateral increases the current exposure, but decreases the volatility of the exposure between remargining periods.
c. The presence of collateral decreases the current exposure, but increases the volatility of the exposure between remargining periods.
d. The presence of collateral decreases the current exposure and decreases the volatility of the exposure between remargining periods.

Correct answer: c

Explanation: Worst case change for the value of the collateral is: -1.96 * 8% * $(10/250)^{0.5}$ = -3.136%. The overall volatility of the position: $(0.06^2 + .08^2)^{0.5}$ = 0.10 = 10%

Thus the worst case change in the value of this position (exposure + collateral) = -1.96 * 10% * $(10/250)^{0.5}$ = -3.920%
Thus, the collateral mitigates the exposure today while increasing the volatility of the position in the future.

Section: Credit Risk Measurement and Management
Reference: Jon Gregory, Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets (West Sussex, UK: John Wiley & Sons, 2012). Chapter 8: Credit Exposure.
Learning Objective: Identify factors that affect the calculation of the credit exposure profile and summarize the impact of collateral on exposure.

19. A trader observes a quote for Stock DUY, and the midpoint of its current best bid and best ask prices is CAD 45. DUY has an estimated daily return volatility of 0.38% and average bid-ask spread of CAD 0.14. Using the constant spread approach on a 20,000 share position and assuming the returns of DUY are normally distributed, what is closest to the estimated liquidity-adjusted, 1-day 95% VaR?

a. CAD 1,600
b. CAD 5,600
c. CAD 6,600
d. CAD 7,600

Correct answer: b

Explanation: The daily 95% VaR = 45 *20,000 * (1.645 * 0.0038) = CAD 5,625.90

The constant spread approach adds half of the bid-ask spread (as a percent) to the VaR calculation, using the following formula:

Liquidity Cost (LC) = ½*(Spread * P),

where Spread is equal to the actual spread divided by the midpoint and P is the value of the position.

Therefore the liquidity cost (LC) = 0.5 * (0.1/45)* 900,000 = CAD 1,000; and

Liquidity-adjusted VaR (LVaR) = VaR + LC = 5,625.90 + 1,000 = CAD 6,625.90.

Section: Operational and Integrated Risk Management
Reference: Kevin Dowd, Measuring Market Risk, Second Edition (West Sussex, England: John Wiley & Sons, 2005). Chapter 14, Estimating Liquidity Risks.
Learning Objective: Describe and calculate LVaR using the constant spread approach and the exogenous spread approach.

20. A risk analyst is evaluating the risks of a portfolio of stocks. Currently, the portfolio is valued at EUR 200 million and contains EUR 15 million in stock A. The standard deviation of returns of stock A is 16% annually and that of the overall portfolio is 21% annually. The correlation of returns between stock A and the portfolio is 0.37. Assuming the risk analyst uses a 1-year 99% VaR and that returns are normally distributed, how much is the component VaR of stock A?

a. EUR 2.066 million
b. EUR 2.326 million
c. EUR 5.582 million
d. EUR 7.327 million

Correct answer: a

Explanation: The component VaR for stock A ($CVaR_A$) can be presented as:

$$CVaR_A = \rho_{A,p} * VaR_A$$

where VaR = VaR of stock A; and $\rho_{A,p}$ = correlation coefficient between stock A and the portfolio.

Let w_A represent the value of stock A; σ_A represent the standard deviation of stock A returns; $\alpha(99\%)$ represent the 99% confidence factor for the VaR estimate, which is 2.326. Hence,

$VaR_A = w_A * \sigma_A * \alpha(99\%)$ = EUR 15 million x 0.16 x 2.326 = EUR 5.582 million.

Therefore,

$CVaR_A = \rho_{A,p} *$ VaRA = 0.37 x 5.582 = EUR 2.066 million

Section: Risk Management and Investment Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition. (New York: McGraw-Hill, 2007). Chapter 7, Portfolio Risk: Analytical Methods.
Learning objective: Define, calculate, and distinguish between the following portfolio VaR measures: individual VaR, incremental VaR, marginal VaR, component VaR, undiversified portfolio VaR, and diversified portfolio VaR.

21. Which of the following statements about risk management in the pension fund industry is correct?

a. A pension plan's total VaR is equal to the sum of its policy-mix VaR and active-management VaR.
b. Pension fund risk analysis does not consider performance relative to a benchmark.
c. In most defined-benefit pension plans, if liabilities exceed assets, the shortfall does not create a risk for the plan sponsor.
d. From the plan sponsor's perspective, nominal pension obligations are similar to a short position in a long term bond.

Correct answer: d

Explanation: Nominal pension obligations are similar to a short position in a bond.

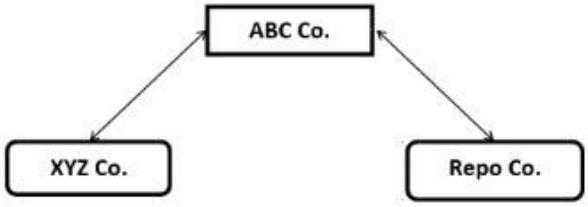
Section: Risk Management and Investment Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition. (New York: McGraw-Hill, 2007). Chapter 17, VaR and Risk Budgeting in Investment Management.
Learning Objective: Distinguish among the following types of risk: absolute risk, relative risk, policy-mix risk, active management risk, funding risk and sponsor risk.

QUESTIONS 22 AND 23 REFER TO THE FOLLOWING INFORMATION

XYZ, a small investment management firm, specializes in structuring small business loans and selling the government guaranteed portion to other institutional investors while retaining the riskier portions for high net worth investors. XYZ funds its operations by engaging in overnight repurchase agreements (repos) with three firms, but primarily with ABC, a firm that specializes in pooling funds from community banks and local government agencies and investing them in short-term, high-quality, government-secured investments.

Last week, XYZ was informed by ABC that its line had been frozen. XYZ learned that ABC had been defrauded by Repo Co., another repo borrower, who had provided false documentation of non-existent collateral of government-guaranteed loans. ABC feared a run by its investors as news of the fraud spread.

The diagram below illustrates the parties involved:



22. The use of a central clearinghouse to handle the transactions executed between XYZ's main funding source, ABC and ABC's client, Repo Co., would likely have resulted in a reduction in:

a. ABC's funding liquidity risk.
b. Repo Co.'s default risk.
c. XYZ's lending risk.
d. ABC's operational risk.

Correct answer: d

Explanation: If it uses a clearinghouse and the clearinghouse makes a mistake (operational risk) like that made by ABC, ABC will have recourse to the clearinghouse and it would have, therefore, reduced its operational risk exposure.
A. Incorrect. ABC is not funding from Repo Co.
B. Incorrect. The use of a clearinghouse does not change Repo Co.'s default risk – just ABC's exposure to Repo Co. defaults.
C. Incorrect. The use of a clearinghouse in this situation does not reduce XYZ's lending risk.

Reference: Jon Gregory, Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets, 2nd Edition (West Sussex, UK: John Wiley & Sons, 2012). Chapter 3 – Defining Counterparty Credit Risk
Learning Objective: Describe counterparty risk and differentiate it from lending risk.

23. By using a clearinghouse to handle the repo transactions between ABC and Repo Co., obligations owed between the two could have been netted once the fraudulent documentation was discovered. Which of the following is the most appropriate type of netting to use in this situation and what would be a likely additional impact from using this netting?

a. Payment netting would be used, which would reduce ABC's counterparty risk, but this risk would be transferred to other creditors outside the clearinghouse.
b. Payment netting would be used, which would reduce Repo Co.'s counterparty risk, but ABC's counterparty risk would be increased.
c. Closeout netting would be used, which would reduce ABC's counterparty risk, but this risk would be transferred to other creditors outside the clearinghouse.
d. Closeout netting would be used, which would reduce Repo Co.'s counterparty risk, but ABC's counterparty risk would be increased.

Correct answer: c

Explanation:
Payment netting per the reading is the simple netting of cash flows due on the same day. Closeout netting occurs if there is an event of default, which would include an incidence of fraud. One of the shortcomings of clearinghouses, and closeout netting as well, is that the other party, in this case ABC Bank, jumps to the head of the queue with its claim on Repo Co. to the possible detriment of others, particularly those outside the clearinghouse in general.

Reference: Jon Gregory, Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets, 2nd Edition (West Sussex, UK: John Wiley & Sons, 2012). Chapter 4 – Netting, Compression, Resets, and Termination Features
Learning Objective: Summarize netting and close-out procedures (including multilateral netting), explain their advantages and disadvantages, and describe how they fit into the framework of the ISDA master agreement.

24. The CEO of a regional bank understands that failing to anticipate cash flow needs is one of the most serious errors that a firm can make and demands that a good liquidity-at-risk (LaR) measurement system be an essential part of the bank's risk management framework. Which of the following statements concerning LaR is correct?

a. Reducing the basis risk through hedging decreases LaR.
b. Hedging using futures has the same impact on LaR as hedging using long option positions.
c. For a hedged portfolio, the LaR can differ significantly from the VaR.
d. A firm's LaR tends to decrease as its credit quality declines.

Correct answer: c

Explanation: The LaR can differ substantially from the VaR in a hedged portfolio, and in different situations can be larger or smaller than the VaR. For example, consider a portfolio where futures contracts are used to hedge. While the hedge can reduce the VaR of the portfolio, the LaR can be larger than the VaR as the futures contracts create an exposure to margin calls and the potential for cash outflows. Alternatively, in situations where the hedging instruments do not result in potential cash outflows over the measurement period (e.g. a portfolio of European options which do not expire during the period), the LaR can be smaller than the VaR.

Section: Operational and Integrated Risk Management
Reference: Kevin Dowd, Measuring Market Risk, Second Edition (West Sussex, England: John Wiley & Sons, 2005). Chapter 14, Estimating Liquidity Risks.
Learning Objective: Describe liquidity at risk (LaR) and compare it to VaR, describe the factors that affect future cash flows, and explain challenges in estimating and modeling LaR.

25. Pillar 1 of the Basel II framework allows banks to use various approaches to calculate the capital requirements for credit risk, operational risk, and market risk. Which of the following Basel II approaches allows a bank to explicitly recognize diversification benefits?

a. The internal models approach for market risk
b. The internal ratings based approach for credit risk
c. The basic indicator approach for operational risk
d. The standardized approach for operational risk

Correct answer: a

Explanation: The internal models approach allows banks to use risk measures derived from their own internal risk management models, subject to a set of qualitative conditions and quantitative standards. In terms of risk aggregation within market risk, banks are explicitly allowed to recognize empirical correlations across broad market risk categories, and, thus, diversification benefits.

Section: Operational and Integrated Risk Management
Reference: John Hull, Risk Management and Financial Institutions, Fourth Edition, (New York: John Wiley & Sons, 2015). Chapter 15, Basel I, Basel II, and Solvency II.
Learning Objective: Describe and contrast the major elements—including a description of the risks covered—of the two options available for the calculation of market risk: Standardized Measurement Method and Internal Models Approach.

26. A country with a developed economy maintains its own currency, NLC, and has domestically produced oil and natural gas as its most important exports. In a recent stress test of the country's banking system, several scenarios were considered. Which of the following is most consistent with being part of a coherent scenario?

a. An increase in domestic inflation and appreciation of the NLC
b. A significant increase in crude oil prices and a decrease in the country housing price index
c. A drop in crude oil prices and appreciation of the NLC
d. A sustained decrease in natural gas prices and a decrease in the country's stock index

Correct answer: d

Explanation: A scenario is coherent when a change in one factor influences other factors in a logical manner. In this case, choice d is a coherent scenario since the country's economy depends heavily on exports of oil and natural gas, so therefore a sustained decrease in natural gas prices should lead to a decrease in stock prices as the domestic economy weakens. In stress testing banks, it is often challenging to develop scenarios where all factors behave coherently.

Section: Operational and Integrated Risk Management
Reference: Til Schuermann. Stress Testing Banks, April 2012.
Learning Objective: Explain challenges in designing stress test scenarios, including the problem of coherence in modeling risk factors.

27. Which statement about risk control in portfolio construction is correct?

a. Quadratic programming allows for risk control through parameter estimation but generally requires many more inputs estimated from market data than other methods require.
b. The screening technique provides superior risk control by concentrating stocks in selected sectors based on expected alpha.
c. When using the stratification technique, risk control is implemented by overweighting the categories with lower risks and underweighting the categories with higher risks.
d. When using the linear programming technique, risk is controlled by selecting the portfolio with the lowest level of active risk.

Correct answer: a

Explanation: Quadratic programming requires many more inputs than other portfolio construction techniques because it entails estimating volatilities and pair-wise correlations between all assets in a portfolio. Quadratic programming is a powerful process, but given the large number of inputs it introduces the potential for noise and poor calibration given the less than perfect nature of most data.

On the other hand, the screening technique strives for risk control by including a sufficient number of stocks that meet the screening parameters and by weighting them to avoid concentrations in any particular stock. However, screening does not necessarily select stocks evenly across sectors and can ignore entire sectors or classes of stocks entirely if they do not pass the screen. Therefore, risk control in a screening process is fragmentary at best.
Stratification separates stocks into categories (for example, economic sectors) and implements risk control by ensuring that the weighting in each sector matches the benchmark weighting. Therefore, it does not allow for overweighting or underweighting specific categories.

Linear programming does not necessarily select the portfolio with the lowest level of active risk. Rather, it attempts to improve on stratification by introducing many more dimensions of risk control and ensuring that the portfolio approximates the benchmark for all these dimensions.

Section: Risk Management and Investment Management
Reference: Richard Grinold and Ronald Kahn, Active Portfolio Management: A Quantitative Approach for Producing Superior Returns and Controlling Risk, 2nd Edition (New York: McGraw-Hill, 2000). Chapter 14, Portfolio Construction.
Learning Objective: Evaluate the strengths and weaknesses of the following portfolio construction techniques: screens, stratification, linear programming, and quadratic programming.

28. An analyst reports the following fund information to the advisor of a pension fund that currently invests in government and corporate bonds and carries a surplus of USD 10 million:

Pension	Assets	Liabilities
Amount (in USD million)	150	120
Expected Annual Growth	7%	9%
Modified Duration	13	10
Annual Volatility of Growth	14%	6%

To evaluate the sufficiency of the fund's surplus, the advisor estimates the possible surplus values at the end of one year. The advisor assumes that annual returns on assets and the annual growth of the liabilities are jointly normally distributed and their correlation coefficient is 0.75. The advisor can report that, with a confidence level of 95%, the surplus value will be greater than or equal to:

a. USD -44.1 million
b. USD -14.4 million
c. USD -2.9 million
d. USD 0 million

Correct answer: c

Explanation: The lower bound of the 95% confidence interval is equal to:

Expected Surplus – (95% confidence factor * Volatility of Surplus).

The required variables can be calculated as follows (note: because of liability, correlation should be negative 0.8):

$$Variance\ of\ surplus = V_A^2 * \sigma_A^2 + V_L^2 * \sigma_L^2 - 2 * V_A * V_L * \sigma_A * \sigma_L * \rho_{AL}$$

= $150^2*0.14^2 + 120^2*0.06^2 - 2*150*120*0.14*0.06*0.75 = 719.64$; and so,

$$Volatility\ \ of\ \ surplus = \sqrt{719.64} = USD\ 26.826 million$$

The expected surplus = $V_A*(1 + R_A) - V_L*(1 + R_L)$ = 150*1.07 – 120*1.09 = USD 29.7 million.

Therefore, the lower bound of the 95% confidence interval = 29.7 – 1.645*26.826 = USD –14.429 million.

Section: Risk Management and Investment Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition. (New York: McGraw-Hill, 2007). Chapter 17, VaR and Risk Budgeting in Investment Management.
Learning Objective: Distinguish among the following types of risk: absolute risk, relative risk, policy-mix risk, active management risk, funding risk, and sponsor risk.

29. A due diligence specialist at a company is evaluating the risk management process of a hedge fund in which the company is considering making an investment. Which of the following statements best describes criteria used for such an evaluation?

a. Because of the overwhelming importance of tail risk, the company should not invest in the fund unless it fully accounts for fat tails using extreme value theory at the 99.99% level when estimating VaR.
b. Today's best practices in risk management require that a fund employ independent risk service providers and that these service providers play important roles in risk-related decisions.
c. When considering a leveraged fund, the specialist should assess how the fund estimates risks related to leverage, including funding liquidity risks during periods of market stress.
d. It is crucial to assess the fund's valuation policy, and in general if more than 10% of asset prices are based on model prices or broker quotes, the specialist should recommend against investment in the fund regardless of other information available about the fund.

Correct answer: c

Explanation: Generally speaking, with a leveraged fund, an investor will need to evaluate historical and current changes in leverage, as well as the level of liquidity of the portfolio, particularly during times of market stress. Certain strategies may in fact expose an investor to tail risk, so while an investor should inquire whether the manager believes that tail risk exists, and whether or not it is hedged, it is then up to the investor to decide whether to accept the risk unhedged or hedge it on their own. Many funds employ independent risk service providers to report risks to investors, but these firms do not get involved in risk related decision making. And finally, while it is important to know what percentage of the assets is exchange-traded and marked to market, what might be acceptable may differ depending on the strategy of the fund.

Section: Risk Management and Investment Management
Reference: Kevin R. Mirabile, Hedge Fund Investing: A Practical Approach to Understanding Investor Motivation, Manager Profits, and Fund Performance (Hoboken, NJ: Wiley Finance, 2013). Chapter 11, Performing Due Diligence on Specific Managers and Funds.
Learning Objective: Describe criteria that can be evaluated in assessing a fund’s risk management process.

30. A chemical company is considering a project that has an estimated risk-adjusted return on capital (RAROC) of 17%. Suppose that the risk-free rate is 4% per year, the expected market rate of return is 12% per year, and the company's equity beta is 1.5. Using the criterion of adjusted risk-adjusted return on capital (ARAROC), the company should:

a. Reject the project because the ARAROC is higher than the market expected excess return.
b. Accept the project because the ARAROC is higher than the market expected excess return.
c. Reject the project because the ARAROC is lower than the market expected excess return.
d. Accept the project because the ARAROC is lower than the market expected excess return.

Correct answer: b

Explanation:
ARAROC = (RAROC – R_f)/β = (0.17 – 0.04)/1.5 = 8.67%.
Market excess return = R_m – R_f = 0.12 – 0.04 = 8%.

where: R_f = risk-free rate of return
β = beta of company equity
R_m= market rate of return

As ARAROC is higher than the market excess return, the project should be accepted.

Section: Operational and Integrated Risk Management
Reference: Michel Crouhy, Dan Galai and Robert Mark, Risk Management, 2nd edition (New York: McGraw-Hill, 2014). Chapter 17, Risk Capital Attribution and Risk-Adjusted Performance Measurement.
Learning Objective: Compute the adjusted RAROC for a project to determine its viability.

31. A specialist finance company only trades derivatives on rare commodities. The company and a handful of other firms, all of whom have large notional outstanding contracts with the company, dominate the market for such derivatives. The company's management would like to mitigate its overall counterparty exposure, with the goal of reducing it to almost zero. Which of the following methods, if implemented, could best achieve this goal?

a. Ensuring that sufficient collateral is posted by counterparties
b. Diversifying among counterparties
c. Cross-product netting on a single counterparty basis
d. Purchasing credit derivatives, such as credit default swaps

Correct answer: a

Explanation: Counterparty exposure, in theory, can be almost completely neutralized as long as a sufficient amount of high quality collateral, such as cash or short-term investment grade government bonds, is held against it. If the counterparty were to default, the holder of an open derivative contract with exposure to that counterparty would be allowed to receive the collateral. Cross-product netting would only reduce the exposure to one of the counter- parties, and purchasing credit derivatives would replace the counterparty risk from the individual counterparties with counterparty risk from the institution who wrote the CDS.

Section: Credit Risk Measurement and Management
Reference: Jon Gregory, Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets. Chapter 3, Defining Counterparty Credit Risk.
Learning Objective: Identify and describe the different ways institutions can manage and mitigate counterparty risk.

32. LEM Banking Corporation, a frequent user of swaps, often enters into transactions with GXT Bank, a major provider of swaps. Recently, GXT Bank was downgraded from a rating of AA to a rating of A, while LEM Banking Corporation was downgraded from a rating of A to a rating of A-. During this time, the credit spread for GTX Bank has increased from 25 bps to 155 bps, while the credit spread for LEM Banking has increased from 120 bps to 160 bps. Which of the following is the most likely action that the counterparties will request on their credit value adjustment (CVA)?

a. The credit qualities of the counterparties have migrated, but not significantly enough to justify amending existing CVA arrangements.
b. GTX Bank requests an increase in the CVA charge it receives.
c. LEM Banking Corporation requests a reduction in the CVA charge it pays.
d. CVA is no longer a relevant factor, and the counterparties should migrate to using other mitigants of counterparty risk.

Correct answer: c

Explanation: Because LEM Banking Corporation has a lower credit rating than GTX Bank, it would typically pay a CVA charge to GXT Bank which would be a function of the relative credit spread between the two banks. After the downgrades of both GTX Bank and LEM Banking Corporation y, the credit spread between the two firms narrowed from 95 bps initially to only 5 bps after the downgrades. Therefore, with the spread much lower between the two banks, LEM Banking Corporation would be in a position to request a reduction in the CVA charge that it pays.

Section: Credit Risk Measurement and Management
Reference: Jon Gregory, Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets, Chapter 12, "Credit Value Adjustment."
Learning Objective: Explain the motivation for and the challenges of pricing counterparty risk.

33. An analyst estimates that the hazard rate for a company is 0.16 per year. The probability of survival in the first year followed by a default in the second year is closest to:

a. 11.62%.
b. 13.63%.
c. 14.79%.
d. 27.39%.

Correct answer: c

Explanation: The probability that the firm defaults in the second year is conditional on its surviving the first year. Using λ to represent the given hazard rate, we can calculate the cumulative probability of default in the first year using the formula $1 - \exp(-1*\lambda) = 1 - \exp(-0.16) = 0.14786$. Thus, probability of survival in the first year
$= 1 - 0.14786 = 0.85214$.

Then, the cumulative probability that the firm defaults in the second year $= 1 - \exp(-2*\lambda) = 1 - \exp(-2*0.16) = 0.27385$, and the conditional one year default probability given that the firm survived the first year is the difference between the two year cumulative probability of default and the one year probability divided by the probability of survival in the first year $= (0.27385 - 0.14786)/0.85214 = 0.14785 = 14.79\%$.

Section: Credit Risk Measurement and Management
Reference: Allan Malz, Financial Risk Management: Models, History, and Institutions (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 7, Spread Risk and Default Intensity Models.
Learning Objective: Define the hazard rate and use it to define probability functions for default time and condition- al default probabilities.

34. At the beginning of the year, a firm bought an AA-rated corporate bond at USD 108 per USD 100 face value. Using market data, the risk manager estimates the following year-end values for the bond based on interest rate simulations informed by the economics team:

Rating	Year-end Bond Value (USD per USD 100 face value)
AAA	110
AA	106
A	101
BBB	97
BB	86
B	76
CCC	67
Default	43

In addition, the risk manager estimates the 1-year transition probabilities on the AA-rated corporate bond:

Rating	Probability of State
AAA	2.00%
AA	87.00%
A	6.00%
BBB	3.30%
BB	0.65%
B	0.45%
CCC	0.25%
Default	0.35%

What is the 1-year 95% credit VaR per USD 100 of face value closest to?

a. USD 3
b. USD 11
c. USD 18
d. USD 22

Correct answer: b

Explanation: The 95% credit VaR corresponds to the unexpected loss (UL) at the 95th percentile minus the expected loss (EL), or the expected future value at the 95% loss percentile minus the current value. Using the probabilities in the given ratings transition matrix, the 95% percentile corresponds to a downgrade to BBB (lowest investment grade border-line), at which the value of the bond would be estimated at 97. Since cash flows for the bond are not provided, we cannot derive the precise EL and UL, but the credit VaR (the difference) is easily derived by subtracting the estimated value given a BBB rating from the current value. Thus, 95% credit VaR = 108–97 = 11.

Section: Credit Risk Measurement and Management
Reference: Allan Malz, Financial Risk Management: Models, History, and Institutions (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 6, Credit and Counterparty Risk.
Learning Objective: Define and calculate Credit VaR.

35. Computing VaR on a portfolio containing a very large number of positions can be simplified by mapping these positions to a smaller number of elementary risk factors. Which of the following mappings would be adequate?

a. USD/EUR forward contracts are mapped on the USD/JPY spot exchange rate.
b. Each position in a corporate bond portfolio is mapped on the bond with the closest maturity among a set of government bonds.
c. Government bonds paying regular coupons are mapped on zero-coupon government bonds.
d. A position in the stock market index is mapped on a position in a stock within that index.

Correct answer: c

Explanation: Mapping government bonds paying regular coupons onto zero coupon government bonds is an adequate process, because both categories of bonds are government issued and therefore have a very similar sensitivity to risk factors. However, this is not a perfect mapping since the sensitivity of both classes of bonds to specific risk factors (i.e. changes in interest rates) may differ.

Section: Market Risk Measurement and Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition, Chapter 11, VaR Mapping.
Learning Objective: Explain the principles underlying VaR mapping, and describe the mapping process.

36. A risk manager is in the process of valuing several European option positions on a non-dividend-paying stock XYZ that is currently priced at GBP 30. The implied volatility skew, estimated using the Black-Scholes-Merton model and the current prices of actively traded European-style options on stock XYZ at various strike prices, is shown below:

Assuming that the implied volatility at GBP 30 is used to conduct the valuation, which of the following long positions will be undervalued?

a. An out-of-the-money call
b. An in-the-money call
c. An at-the-money put
d. An in-the-money put

Correct answer: b

Explanation: An in-the-money call has a strike price below 30. Therefore, using the chart above, its implied volatility is greater than the at-the-money volatility, so using the at-the-money implied volatility would result in pricing an in-the-money call option lower than its fair price.

Section: Market Risk Measurement and Management
Reference: John Hull, Options, Futures, and Other Derivatives, 9th Edition, Chapter 20, "Volatility Smiles."
Learning Objective: Compare the shape of the volatility smile (or skew) to the shape of the implied distribution of the underlying asset price and to the pricing of options on the underlying asset.

37. A risk manager is pricing a 10-year call option on 10-year Treasury using a successfully tested pricing model. Current interest rate volatility is high and the risk manager is concerned about the effect this may have on short-term rates when pricing the option. Which of the following actions would best address the potential for negative short-term interest rates to arise in the model?

a. The risk manager uses a normal distribution of interest rates.
b. When short-term rates are negative, the risk manager adjusts the risk-neutral probabilities.
c. When short-term rates are negative, the risk manager increases the volatility.
d. When short-term rates are negative, the risk manager sets the rate to zero.

Correct answer: d

Explanation: Negative short-term interest rates can arise in models for which the terminal distribution of interest rates follows a normal distribution. The existence of negative interest rates does not make much economic sense since market participants would generally not lend cash at negative interest rates when they can hold cash and earn a zero return. One method that can be used to address the potential for negative interest rates when constructing interest rate trees is to set all negative interest rates to zero. This localizes the change in assumptions to points in the distribution corresponding to negative interest rates and preserves the original rate tree for all other observations. In comparison, adjusting the risk neutral probabilities would alter the dynamics across the entire range of interest rates and therefore not be an optimal approach.

When a model displays the potential for negative short-term interest rates, it can still be a desirable model to use in certain situations, especially in cases where the valuation depends more on the average path of the interest rate, such as in valuing coupon bonds. Therefore, the potential for negative rates does not automatically rule out the use of the model.

Section: Market Risk Measurement and Management
Reference: Bruce Tuckman, Fixed Income Securities, 3rd Edition (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 9, The Art of Term Structure Models: Drift.
Learning Objective: Describe methods for addressing the possibility of negative short-term rates in term structure models.

38. A large commercial bank is using VaR as its main risk measurement tool. Expected shortfall (ES) is suggested as a better alternative to use during market turmoil. What should be understood regarding VaR and ES before modifying current practices?

a. Despite being more complicated to calculate, ES is easier to backtest than VaR.
b. Relative to VaR, ES leads to more required economic capital for the same confidence level.
c. While VaR ensures that the estimate of portfolio risk is less than or equal to the sum of the risks of that portfolio's positions, ES does not.
d. Both VaR and ES account for the severity of losses beyond the confidence threshold.

Correct answer: b

Explanation: Expected shortfall is always greater than or equal to VaR for a given confidence level, since ES accounts for the severity of expected losses beyond a particular confidence level, while VaR measures the maximum expected loss at that confidence level. Therefore, ES would lead to a higher level of required economic capital than VaR for the same confidence level. In practice, however, regulators often correct for the difference between ES and VaR by lowering the required confidence level for banks using ES compared to those using VaR.

Section: Market Risk Measurement and Management
Reference: Basel Committee on Banking Supervision, Messages from the Academic Literature on Risk Measurement for the Trading Book, Working Paper No. 19, January 2011.
Learning Objective: Compare VaR, expected shortfall, and other relevant risk measures.

Question 39 refers to the following information:

A profitable derivatives trading desk at a bank decides that its existing VaR model, which has been used broadly across the firm for several years, is too conservative. The existing VaR model uses a historical simulation over a three-year look-back period, weighting each day equally. A quantitative analyst in the group quickly develops a new VaR model, which uses the delta normal approach. The new model uses volatilities and correlations estimated over the past four years using the Riskmetrics EWMA method.

For testing purposes, the new model is used in parallel with the existing model for four weeks to estimate the 1-day 95% VaR. After four weeks, the new VaR model has no exceedances despite consistently estimating VaR to be considerably lower than the existing model's estimates. The analyst argues that the lack of exceedances shows that the new model is unbiased and pressures the bank's model evaluation team to agree. Following an overnight examination of the new model by one junior analyst instead of the customary evaluation that takes several weeks and involves a senior member of the team, the model evaluation team agrees to accept the new model for use by the desk.

39. Which of the following statements about the risk management implications of this replacement is correct?

a. Delta-normal VaR is more appropriate than historical simulation VaR for assets with non-linear payoffs.
b. Changing the look-back period and weighing scheme from three years, equally weighted, to four years, exponentially weighted, will understate the risk in the portfolio.
c. The desk increased its exposure to model risk due to the potential for incorrect calibration and programming errors related to the new model.
d. A 95% VaR model that generates no exceedances in four weeks is necessarily conservative.

Correct answer: c

Explanation: Given the quick implementation of the new VaR model and the insufficient amount of testing that was done, the desk has increased its exposure to model risk due to the increased potential for incorrect calibration and programming errors. This situation is similar to the JP Morgan London Whale case in 2012, where a new VaR model was very quickly introduced for its Synthetic Credit portfolio without appropriate time to test the model in response to increasing losses and multiple exceedances of the earlier VaR model limit in the portfolio.

Section: Operational and Integrated Risk Management
Reference: Allan Malz, Financial Risk Management: Models, History, and Institutions (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 11, Assessing the Quality of Risk Measures.
Learning Objective: Describe ways that errors can be introduced into models.

40. The CFO at a bank is preparing a report to the board of directors on its compliance with Basel requirements. The bank's average capital and total exposure for the most recent quarter is as follows:

REGULATORY CAPITAL	USD MILLIONS
Total Common Equity Tier 1 Capital	250
Additional Tier 1 Capital	66
Prior to regulatory adjustments	40
Regulatory adjustments	8
Total Tier 1 Capital	316
Tier 2 Capital	55
Prior to regulatory adjustments	63
Regulatory adjustments	8
Total Capital	371
Total Average Exposure	4,280

Using the Basel III framework, which of the following is the best estimate of the bank's current leverage ratio?

a. 1.29%
b. 5.84%
c. 7.38%
d. 8.67%

Correct answer: c

Explanation: For Basel III purposes, the leverage ratio = (Tier 1 Capital)/(Total Exposure) = 316/4,280= 7.38%.

Section: Operational and Integrated Risk Management
Reference: John Hull, Risk Management and Financial Institutions, 4th Edition (New York: John Wiley & Sons, 2015). Chapter 16, Basel 2.5, Basel III, and Dodd-Frank.
Learning Objective: Describe and calculate ratios intended to improve the management of liquidity risk, including the required leverage ratio, the liquidity coverage ratio, and the net stable funding ratio.

41. Which of the following is not a type of operational risk as defined by Basel II and Basel III?

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

Correct answer: c

Explanation: Basel II and Basel III define operational risk (inclusive of technological risk) as "the risk of direct or indirect loss resulting from inadequate or failed internal processes, people and systems or from external events." Although a number of financial institutions add reputation risk and strategic risk (e.g., due to a failed merger) as part of a broadened definition of operational risk, they are not within the scope of definition by Basel II/III.

Section: Operational and Integrated Risk Management
Reference: Principles for the Sound Management of Operational Risk, (Basel Committee on Banking Supervision Publication, June 2011).
Learning Objective: Summarize the fundamental principles of operational risk management as suggested by the Basel committee.

42. Consider a 1,200 share position in an undervalued but illiquid stock TQR that has a current stock price of EUR 76 (expressed as the midpoint of the current bid-ask spread). The daily return for TQR has an estimated volatility of 0.28%. The average bid-ask spread is EUR 0.18. Using the constant spread approach and assuming the returns of TQR are normally distributed, what is the estimated liquidity adjusted, 1-day 95% VaR?

a. EUR 108
b. EUR 210
c. EUR 420
d. EUR 528

Correct answer: d

Explanation: The liquidity adjusted VaR (LVaR) derived using the constant spread approach adds half of the bid-ask spread (as a percent) to the VaR calculation, using the following formula:

LVaR = VaR + Liquidity Cost (LC) = VaR + ½*(Spread * P)

where Spread is equal to the actual spread divided by the midpoint and P is the value of the position.

Therefore,

Daily 95% VaR = 76*1,200*(1.645*0.0028) = EUR 420.07
Liquidity cost = 76*1,200*(0.5*0.18/76) = 108

And so,

LVaR = VaR + LC = 528.07

Section: Operational and Integrated Risk Management
Reference: Kevin Dowd, Measuring Market Risk, Second Edition (West Sussex, England: John Wiley & Sons, 2005). Chapter 14, Estimating Liquidity Risks.
Learning Objective: Describe and calculate LVaR using the constant spread approach and the exogenous spread approach.

43. The Basel Committee recommends that banks use a set of early warning indicators in order to identify emerging risks and potential vulnerabilities in their liquidity position. Which of the following is an early warning indicator of a potential liquidity problem?

a. Rapid asset growth
b. Positive publicity
c. Credit rating upgrade
d. Increased asset diversification

Correct answer: a

Explanation: Rapid asset growth is an early warning of a potential liquidity problem. Positive publicity, credit rating upgrade, and increased asset diversification are all not early warnings of a potential liquidity problem.

Section: Operational and Integrated Risk Management
Reference: Darrell Duffie, The Failure Mechanics of Dealer Banks, Journal of Economic Perspectives (2010, Volume 24, Number 1) pp. 51-72.
Learning Objective: Identify situations that can cause a liquidity crisis at a dealer bank and explain responses that can mitigate these risks.

44. At times, large dealer banks have financed significant fractions of their assets using short-term (often, overnight) repurchase agreements in which creditors held bank securities as collateral against default losses. The table below shows the quarter-end financing of four broker-dealer financial instruments. All values are in USD billions.

	Bank W	Bank X	Bank Y	Bank Z
Financial instruments owned	2,669	2,850	3,100	3,450
Pledged as collateral	1,200	1,550	1,870	825
Not pledged	1,469	1,300	1,230	2,625

In the event that repo creditors become equally nervous about each bank's solvency, which bank is most vulnerable to a liquidity crisis?

a. Bank W
b. Bank X
c. Bank Y
d. Bank Z

Correct answer: c

Explanation:

	Bank w	Bank x	Bank y	Bank z
Financial instruments owned	2,669	2,850	3,100	3,450
Pledged as collateral	1,200	1,550	1,870	825
Not pledged	1,469	1,300	1,230	2,625
Fraction Pledged	45%	54%	60%	24%

A liquidity crisis could materialize if repo creditors become nervous about a bank's solvency and choose not to renew their positions. If enough creditors choose not to renew, the bank could likely be unable to raise sufficient cash by other means on such short notice, thereby precipitating a crisis. However, this vulnerability is directly related to the proportion of assets a bank has pledged as collateral.

Bank Y is most vulnerable since it has the largest dependence on short-term repo financing (i.e. the highest percentage of its assets out of the four banks is pledged as collateral.

Section: Operational and Integrated Risk Management
Reference: Darrell Duffie, The Failure Mechanics of Dealer Banks, Journal of Economic Perspectives (2010, Volume 24, Number 1) pp. 51-72.
Learning Objective: Identify situations that can cause a liquidity crisis at a dealer bank and explain responses that can mitigate these risks.

45. Which of the following is an example of an operational risk loss by Firm A?

a. After a surprise announcement by the central bank that interest rates would increase, bond prices fall, and Firm A incurs a significant loss on its bond portfolio.
b. The data capture system of Firm A fails to capture the correct market rates causing derivative trades to be done at incorrect prices, leading to significant losses.
c. As a result of an increase in commodity prices, the share price of a company that Firm A invested in falls significantly, causing major investment losses.
d. A counterparty of Firm A fails to settle their debt to Firm A, and in doing this, they are in breach of a legal agreement to pay for services rendered.

Correct answer: b

Explanation: In (b), systems failure or incorrect systems caused the problem. The losses are directly due to an operational risk exposure. In (a) and (c), an increase in interest rates and the fall in the value of an investment, respectively, are both examples of market risk exposure. In (d), failure to repay debt, is an example of credit risk exposure.

Section: Operational and Integrated Risk Management
Reference: "Principles for the Sound Management of Operational Risk," (Basel Committee on Banking Supervision Publication, June 2011).
Learning Objective: Identify examples of tools which can be used to identify and assess operational risk.

46. The risk management group estimates the 1-day 99% VaR on a long-only, large-cap equity portfolio using a variety of approaches. A daily risk report shows the following information:

1-day 99% VaR Estimates (by approach):

- Delta-Normal VaR: USD 441,940
- Monte Carlo Simulation VaR: USD 473,906
- Historical Simulation VaR: 495,584

Which of the following is the most likely explanation for the variation in VaR estimates?

a. Data problems
b. Differences in model assumptions
c. Endogenous model risk
d. Programming errors

Correct answer: b

Explanation: VaR measures will vary according to the approach (delta-normal, historical simulation, Monte Carlo simulation). The variation in these values does not suggest bigger problems with data or programming/implementation nor is there any reason to suspect endogenous model risk (e.g., traders gaming the system to lower risk values).

Section: Operational and Integrated Risk Management
Reference: Allan Malz, Financial Risk Management: Models, History, and Institutions (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 11, Assessing the Quality of Risk Measures.
Learning Objective: Describe how horizon, computational and modeling decisions can impact VaR estimates.

47. While building the bank's enterprise risk management system, a risk analyst takes an inventory of firm risks and categorizes these risks as market, credit, or operational. Which of the following observations of the bank's data should be considered unexpected if compared to similar industry data?

a. The operational risk loss distribution has a large number of small losses, and therefore a relatively low mode.
b. The operational risk loss distribution is symmetric and fat-tailed.
c. The credit risk distribution is asymmetric and fat-tailed.
d. The market risk distribution is similar to the distribution of the return on a portfolio of securities.

Correct answer: b

Explanation: Statements (a), (c), and (d) are consistent with industry data. However, with operational risk, there tends to be large numbers of small losses and a small number of large losses, so the distribution is asymmetric (and fat-tailed).

Section: Operational and Integrated Risk Management
Reference: Brian Nocco and René Stulz, Enterprise Risk Management: Theory and Practice, Journal of Applied Corporate Finance (Volume 18, Number 4, 2006), pp. 8 – 20.
Learning Objective: Describe the development and implementation of an ERM system.

48. Bank BHC is considering a loan to be fully funded by deposits, with the following parameters:

- Loan amount: GBP 5 billion
- Average annual interest rate paid on deposits: 1.2%
- Annual interest rate on loan: 6.0%
- Expected loss: 2.0% of face value of loan
- Annual operating costs: 1.0% of face value of loan
- Economic capital: 8.0%
- Average return on economic capital: 4.0%

What is the risk-adjusted return on capital for this loan?

a. A. 9.5%
b. B. 10.5%
c. C. 26.5%
d. D. 35.5%

Correct answer: c

Explanation:
The risk-adjusted return on capital (RAROC) is computed by:

$$RAROC = \frac{\text{Revenue} + Income - Interest - Operating\ Cost - Loss}{Economic\ Capital}$$

Where:
Economic Capital = GBP 5 billion x 0.08 = GBP 400,000,000
Revenue = expected revenue = GBP 5 billion x 0.06 = GBP 300,000,000
Income = return on invested economic capital = GBP 400,000,000 x 0.04 = GBP 16,000,000
Interest = interest expense = GBP 5 billion x 0.012 = GBP 60,000,000
Operating Cost = GBP 5 billion x 0.01 = GBP 50,000,000
Loss = expected loss = GBP 5 billion x 0.02 = GBP 100,000,000

Therefore,

$$RAROC = \frac{300 + 16 - 60 - 50 - 100}{400} = 0.2650 = 26.5\%$$

Section: Operational and Integrated Risk Management
Reference: Michel Crouhy, Dan Galai and Robert Mark, The Essentials of Risk Management, 2nd Edition (New York: McGraw-Hill, 2014). Chapter 17, Capital Allocation and Performance Measurement.
Learning Objective: Compute and interpret the RAROC for a project, loan, or loan portfolio, and use RAROC to compare business unit performance.

49. As a result of the credit crisis, the Basel Committee revised the market risk framework and introduced a stressed VaR requirement. A bank uses the internal models approach for market risk and has generated the following risk measures (in USD million) for the current trading book positions:

Confidence Level	Latest Available 10-day VaR	Latest Available 10-day Stressed VaR	Average 10-day VaR of Previous 60 Days	Average 10-day Stressed VaR of Previous 60 Days
95.0%	305	664	340	743
99.0%	588	1,345	555	1,489
99.9%	757	1,726	708	1,844

The supervisory authority has set the multiplication factors for both the VaR and stressed VaR values to 3. What is the capital requirement for general market risk?

a. USD 1,665 million
b. USD 3,977 million
c. USD 6,132 million
d. USD 8,502 million

Correct answer: c

Explanation:
The revised market risk capital requirement is:

Market Risk Capital = $\max(VaR_{t-1}, m_c * VaR_{60\text{-day Avg}}) + \max(SVaR_{t-1}, ms * SVaR_{60\text{-day Avg}})$
= max(588, 3*555) + max(1345, 3*1489) = USD 6,132 million

Section: Operational and Integrated Risk Management
Reference: John Hull, Risk Management and Financial Institutions, 4th Edition (New York: John Wiley & Sons, 2015). Chapter 16, Basel 2.5, Basel III, and Dodd-Frank.
Learning Objective: Describe and calculate the stressed value-at-risk measure introduced in Basel 2.5, and calculate the market risk capital charge.

50. Consider a 1-year maturity zero-coupon bond with a face value of USD 1,000,000 and a 0% recovery rate issued by Company K. The bond is currently trading at 90% of face value. Assuming the excess spread only captures credit risk and that the risk-free rate is 3% per annum, the risk-neutral 1-year probability of default on Company K is closest to which of the following?

a. 7%
b. 10%
c. 13%
d. 15%

Correct answer: a

Explanation: This can be calculated by using the formula which equates the future value of a risky bond with yield (y) and default probability (p) to a risk free asset with yield (r). That is,

$$1 + r = (1 - \pi) * (1 + y) + \pi R$$

where π = Probability of default and R = Recovery rate

In the situation where the recovery rate is assumed to be zero, the risk-neutral probability of default can be derived from the following equation:

$$1 + r = (1 - \pi) * (FV/MV)$$

where MV = market value and FV = face value.

Inputting the data into this equation yields $\pi = 1 - (900{,}000 * 1.03)/1{,}000{,}000 = 0.073 = 7.3\%$.

Section: Credit Risk Measurement and Management
Reference: Allan Malz, Financial Risk Management: Models, History, and Institutions (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 7, Spread Risk and Default Intensity Models.
Learning Objective: Calculate risk-neutral default rates from spreads.

51. A hedge fund is considering taking positions in various tranches of a collateralized debt obligation (CDO). The fund's chief economist predicts that the default probability will decrease significantly and that the default correlation will increase. Based on this prediction, which of the following is a good strategy to pursue?

a. Buy the senior tranche and buy the equity tranche.
b. Buy the senior tranche and sell the equity tranche.
c. Sell the senior tranche and sell the equity tranche.
d. Sell the senior tranche and buy the equity tranche.

Correct answer: d

Explanation: The decrease in probability of default would increase the value of the equity tranche. Also, a default of the equity tranche would increase the probability of default of the senior tranche, due to increased correlation, reducing its value. Thus, it is better to go long the equity tranche and short the senior tranche.

Section: Credit Risk Measurement and Management
Reference: Allan Malz, Financial Risk Management: Models, History, and Institutions (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 9, Structured Credit Risk.
Learning Objective: Explain how the default probabilities and default correlations affect the credit risk in a securitization.

52. A bank has many open derivative positions with an investment firm. A description and current market values are displayed in the table below:

Positions Market	Price (USD)
Long swaptions	21 million
Long credit default swaps	-33 million
Short currency derivatives	33 million

In the event that the investment firm defaults, what would be the loss to the bank if netting is used?

a. USD 0 million
b. USD 12 million
c. USD 21 million
d. USD 33 million

Correct answer: c

Explanation: Netting means that the payments between the two counterparties are netted out, so that only a net payment has to be made. With netting, the investment firm is not required to make the payout of 33 million. Hence the loss will be reduced to: USD 21 million + USD 33 million – USD 33 million = USD 21 million.

Section: Credit Risk Measurement and Management
Reference: Allan Malz, Financial Risk Management: Models, History, and Institutions (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 9, Structured Credit Risk.
Learning Objective: Explain how the default probabilities and default correlations affect the credit risk in a securitization.

53. A financial firm sells a put option on ABC stock with a time to expiration of six months, a strike price of USD 105, an underlying asset price of USD 85, implied volatility of 24% and a risk-free rate of 3%. What is the firm's counterparty credit exposure from this transaction?

a. USD 0.00
b. USD 0.68
c. USD 2.38
d. USD 32.40

Correct answer: a

Explanation: Selling a put option exposes the firm to zero counterparty credit risk as the premium is paid up front. The correct answer is therefore (a). All the information necessary to price the option is provided but it is not necessary.

Section: Credit Risk Measurement and Management
Reference: Jon Gregory, Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets, 2nd Edition (West Sussex, UK: John Wiley & Sons, 2012). Chapter 3, Defining Counterparty Credit Risk.
Learning Objective: Describe transactions that carry counterparty risk and explain how counterparty risk can arise in each transaction.

54. An investor has sold default protection on the most senior tranche of a CDO. If the default correlation between assets held in the CDO decreases sharply, assuming everything else is unchanged, the investor's position:

a. Will gain significant value, since the probability of exercising the protection falls.
b. Will lose significant value, since the protection will gain value.
c. Will neither gain nor lose value, since only expected default losses matter and correlation does not affect expected default losses.
d. Can either increase or decrease, depending on the pricing model used and the market conditions.

Correct answer: a

Explanation: The senior tranche will gain value if the default correlation decreases. High correlation implies that if one name defaults, a large number of other names in the CDO will also default. Low correlation implies that if one name defaults, there would be little impact on the default probability of the other names. Therefore, as the correlation decreases, the cumulative probability of enough defaults occurring to exceed the credit enhancement on the senior tranche will also decrease. Hence the investor who has sold protection on the senior tranche will see a gain.

Section: Credit Risk Measurement and Management
Reference: Allan Malz, Financial Risk Management: Models, History, and Institutions (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 9, Structured Credit Risk.
Learning Objective: Explain how the default probabilities and default correlations affect the credit risk in a securitization.

55. Suppose that you want to estimate the implied default probability for a BB-rated discount corporate bond.

- The T-bond (a risk-free bond) yields 8% per year.
- The one-year BB-rated discount bond yields 14% per year.
- The two-year BB-rated discount bond yields 21% per year.

If the recovery rate on a BB-rated bond is expected to be 0%, and the marginal default probability in year one is 7%, which of the following is the best estimate of the risk-neutral probability that the BB-rated discount bond defaults within the next two years?

a. 3.85%
b. 5.26%
c. 10.74%
d. 20.33%

Correct answer: d

Explanation: $(1 + 0.08)^2 = PD * 0 + (1 - PD) * (1 + 0.21)^2 \rightarrow PD = 20.33\%$

Section: Credit Risk Measurement and Management
Reference: Jon Gregory, Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets, 2nd Edition (West Sussex, UK: John Wiley & Sons, 2012). Chapter 10, Default Probability, Credit Spreads, and Credit Derivatives
Learning Objective: Calculate risk-neutral default probabilities, and compare the use of risk-neutral and real-world default probabilities in pricing derivative contracts.

56. A credit manager overseeing the structured credit book of a bank works on identifying the frictions in the securitization process that caused the recent subprime mortgage crisis in the United States. Of the following frictions in the securitization process, which one was not a cause of the subprime crisis?

a. Frictions between the mortgagor and the originator: predatory lending.
b. Frictions between the originator and the arranger: predatory borrowing and lending.
c. Frictions between the servicer and asset manager: moral hazard.
d. Frictions between the asset manager and investor: principal-agent conflict.

Correct answer: c

Explanation:
a is incorrect; frictions between the mortgagor and the originator: predatory lending have been identified as key frictions that caused the subprime mortgage crisis. b is incorrect; frictions between the originator and the arranger: predatory borrowing and lending, have been identified as key frictions that caused the subprime mortgage crisis. c is correct; frictions between the servicer and asset manager or credit ratings agency: moral hazard, although important, these frictions have not been identified as key frictions that caused the subprime mortgage crisis. d is incorrect; frictions between the asset manager and investor: principal–agent, have been identified as key frictions that caused the subprime mortgage crisis.

Section: Credit Risk Measurement and Management
Reference: Allan Malz, Financial Risk Management: Models, History, and Institutions (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 9, Structured Credit Risk.
Learning Objective: Identify the key participants in the securitization process, and describe conflicts of interest that can arise in the process.

57. The exhibit below presents a summary of bilateral mark-to-market (MtM) trades for four counterparties. If netting agreements exist between all pairs of counterparties shown, what is the correct order of net exposure per counterparty, from lowest to highest?

MtM Trades for Four Counterparties (USD million)				
		Opposing Counterparty		
		B	**C**	**D**
Counterparty **A**	Trades with positive MtM	12	12	2
	Trades with negative MtM	-12	-4	-12
		A	**C**	**D**
Counterparty **B**	Trades with positive MtM	12	0	12
	Trades with negative MtM	-12	-6	-1
		A	**B**	**D**
Counterparty **C**	Trades with positive MtM	6	6	3
	Trades with negative MtM	-12	0	-2
		A	**B**	**C**
Counterparty **D**	Trades with positive MtM	12	3	1
	Trades with negative MtM	-2	-12	-1

a. A, C, B, D
b. B, D, C, B
c. C, A, D, B
d. D, A, B, C

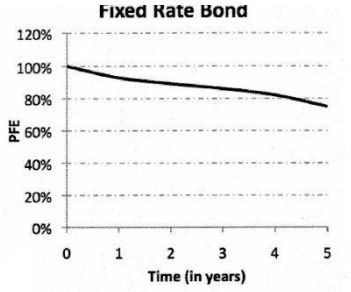
Correct answer: c

Explanation: The properly netted amounts are:
For counterparty A: B = 12-12= $0; C = 12-4 = $8; D = 2-12 = -10 = 0; for a sum of $8.
For counterparty B: A = 12-12 = $0, C = 0-6 = -5 = $0; D = 12-1 = $11; for a sum of $11.
For counterparty C: A = 6-12 = -8 = $0; B = 6-0 = $6; D = 3-2= $1; for a sum of $7.
For counterparty D: A = 12-2 = $10, B = 3-12 = -9 = $0; C = 1-1 = $0; for a sum of $10.
Therefore, the correct sequence of net exposure amounts per counterparty, (lowest to highest), is C, A, D, B.
Note that a negative netted amount means the counterparty has no exposure.

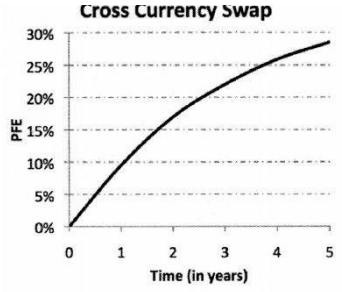
Section: Credit Risk Measurement and Management
Reference: Jon Gregory, Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets, 2nd Edition (West Sussex, UK: John Wiley & Sons, 2012). Chapter 4, Netting, Compression, Resets, and Termination Features.
Learning Objective: Describe the effectiveness of netting in reducing credit exposure under various scenarios.

58. Which of the following graphs is an accurate representation of a typical potential future exposure (PFE) profile for the corresponding instrument?

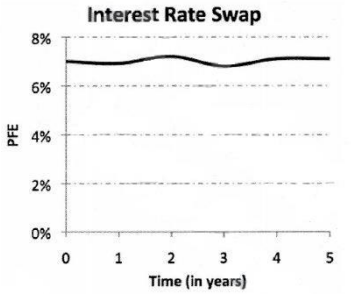
A



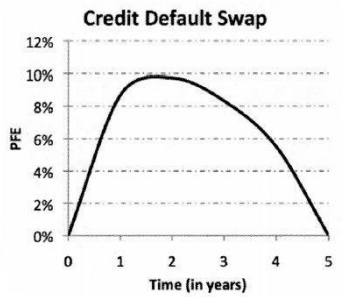
B.



C



D.



Correct answer: B

Explanation: The risk of cross-currency swaps is driven by a large final payoff, and thus the profile increases monotonically until the maturity of the trade. The FX risk of the notional exchange dominates the small contribution due to interest rate exposure.

Section: Credit Risk Measurement and Management
Reference: Jon Gregory, Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets, 2nd Edition (West Sussex, UK: John Wiley & Sons, 2012). Chapter 8, Credit Exposure.
Learning Objective: Identify typical credit exposure profiles for various derivative contracts and combination profiles.

59. A risk manager is examining a firm's equity index option price assumptions. The observed volatility skew for a particular equity index slopes downward to the right. Compared to the lognormal distribution, the distribution of option prices on this index implied by the Black-Scholes-Merton (BSM) model would have:

a. A fat left tail and a thin right tail.
b. A fat left tail and a fat right tail.
c. A thin left tail and a fat right tail.
d. A thin left tail and a thin right tail.

Correct answer: a

Explanation: A downward sloping volatility skew indicates that out of the money puts are more expensive than predicted by the Black-Scholes-Merton model and out of the money calls are cheaper than expected predicted by the Black-Scholes-Merton model. The implied distribution has fat left tails and thin right tails.

Section: Market Risk Measurement and Management
Reference: John Hull, Options, Futures, and Other Derivatives, 9th Edition. Chapter 20, Volatility Smiles.
Learning Objective: Compare the shape of the volatility smile (or skew) to the shape of the implied distribution of the underlying asset price and to the pricing of options on the underlying asset.

60. A money management firm has USD 33 billion in assets. The risk manager computes the daily VaR at various confidence levels as follows:

Confidence Level	VaR (USD)
95.0%	503,700,000
95.5%	511,550,000
96.0%	520,000,000
96.5%	542,750,000
97.0%	562,250,000
97.5%	581,750,000
98.0%	605,150,000
98.5%	636,350,000
99.0%	677,300,000
99.5%	740,350,000

What is the closest estimate of the daily expected shortfall at the 96.5% confidence level?

a. USD 543 million
b. USD 588 million
c. USD 621 million
d. USD 740 million

Correct answer: c

Explanation: An estimate of the expected shortfall (ES) can be obtained by taking the average of the VaRs for the various confidence levels that are greater than 96.5%. Therefore,

$$ES = \frac{562{,}250{,}000 + 581{,}750{,}000 + 605{,}150{,}000 + 636{,}350{,}000 + 677{,}300{,}000 + 740{,}350{,}000}{6} = USD\ 620{,}842{,}857$$

Section: Market Risk Measurement and Management
Reference: Kevin Dowd, Measuring Market Risk, 2nd Edition (West Sussex, England: John Wiley & Sons, 2005). Chapter 3, Estimating Market Risk Measures: An Introduction and Overview.
Learning Objective: Estimate the expected shortfall given P/L or return data.

61. You are backtesting a bank's VaR model. Currently, the bank calculates a 1-day VaR at the 99% confidence level, and you are recommending that it switch to a 95% confidence level. Which of the following statements concerning this switch is correct?

a. The 95% VaR model is less likely to be rejected using backtesting than the 99% VaR model.
b. When validating with backtesting at the 90% confidence level, there is a smaller probability of incorrectly rejecting a 95% VaR model than a 99% VaR model.
c. The decision to accept or reject a VaR model based on backtesting results is more reliable with a 95% confidence level VaR model than with a 99% confidence level model.
d. When backtesting using a 90% confidence level, there is a smaller probability of committing a type I error when backtesting a 95% VaR model than with a 99% VaR model.

Correct answer: c

Explanation: The concept tested here is the understanding of the difference between the VaR parameter for confidence (here, namely 95% vs. 99%) and the validation procedure confidence level, and how they interact with one another. Using a VaR confidence level creates a narrower rejection region by allowing a greater number of exceptions to be generated. This in turn increases the power of the backtesting process and makes for a more reliable test.

Section: Market Risk Measurement and Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition. (New York: McGraw-Hill, 2007). Chapter 6, Backtesting VaR.
Learning Objective: Define and identify type I and type II errors.

62. An analyst is looking at various models used to incorporate drift into term structure models. The Ho-Lee Model:

a. Incorporates no-risk premium to the interest rate model allowing rates to vary according to their volatility.
b. Incorporates drift as a premium to interest rates that remains constant over time.
c. Allows for a risk premium to be applied to interest rates that changes over time.
d. Incorporates drift into the model following the assumption that rates revert to the long-run equilibrium value.

Correct answer: c

Explanation: Choice c is correct: the Ho-Lee model incorporates a premium to each rate change that can be different at each point in time.

Section: Market Risk Measurement and Management
Reference: Bruce Tuckman, *Fixed Income Securities, 3rd Edition* (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 9, The Art of Term Structure Models: Drift.
Learning Objective: Construct a short-term rate tree under the Ho-Lee Model with time-dependent drift.

63. A risk manager wants to study the behavior of a portfolio that depends on only two economic variables, X and Y. X is uniformly distributed between 4 and 7, and Y is uniformly distributed between 5 and 8. The risk manager wants to model their joint distribution, H(X,Y). The theorem of Sklar proves that, for any joint distribution H, there is a copula C such that:

a. H(3X + 4, 3Y + 5) is equal to C[X,Y].
b. H(X,Y) is equal to C[u,d] where u is the density marginal distribution of X and d is the density marginal distribution of Y.
c. H(X,Y) is equal to C[(X – 4)/3, (Y – 5)/3].
d. H[(X – 4)/3, (Y – 5)/3] is equal to C(X,Y).

Correct answer: c

Explanation: Sklar's theorem proves that if F(x,y) is a joint distribution function with continuous marginals $F_x(x) = u$ and $F_y(y) = v$, then F(x,y) can be written in terms of a unique function C(u,v) such as F(x,y) = C(u,v). In this case u = (X – 4)/3 (the cumulative marginal function of X, which is uniformly distributed between 4 and 7) and
v = (Y – 5)/3.

Note: The candidate is not responsible for knowing the properties of the uniform distribution.

Section: Market Risk Measurement and Management
Reference: Gunter Meissner, *Correlation Risk Modeling and Management* (New York: John Wiley & Sons, 2014). Chapter 4, Financial Correlation Modeling—Bottom-Up Approaches.
Learning Objective: Explain the purpose of copula functions and the translation of the copula equation.

64. A committee of risk management practitioners discusses the difference between pricing deep out-of-the-money call options on FBX stock and pricing deep out-of-the-money call options on the EUR/JPY foreign exchange rate using the Black-Scholes-Merton (BSM) model. The practitioners price these options based on two distinct probability distributions of underlying asset prices at the option expiration date:

- A lognormal probability distribution
- An implied risk-neutral probability distribution obtained from the volatility smile for options of the same maturity

Using the lognormal, instead of the implied risk-neutral probability distribution, will tend to:

a. Price the option on FBX relatively high and price the option on EUR/JPY relatively low.
b. Price the option on FBX relatively low and price the option on EUR/JPY relatively high.
c. Price the option on FBX relatively low and price the option on EUR/JPY relatively low.
d. Price the option on FBX relatively high and price the option on EUR/JPY relatively high.

Correct answer: a

Explanation: The implied distribution of the underlying equity prices derived using the general volatility smile of equity options has a heavier left tail and a less heavy right tail than a lognormal distribution of underlying prices. Therefore, using the lognormal distribution of prices causes deep-out-of-the-money call options on the underlying to be priced relatively high.

The implied distribution of underlying foreign currency prices derived using the general volatility smile of foreign currency options has heavier tails than a lognormal distribution of underlying prices. Therefore, using the lognormal distribution of prices causes deep-out-of-the-money call options on the underlying to be priced relatively low.

Section: Market Risk Measurement and Management
Reference: John Hull, Options, Futures, and Other Derivatives, 9th Edition. Chapter 20, Volatility Smiles.
Learning Objective: Describe characteristics of foreign exchange rate distributions and their implications on option prices and implied volatility.

65. According to extreme value theory (EVT), when examining distributions of losses exceeding a threshold value, which of the following is correct?

a. To apply EVT, the underlying loss distribution must be either normal or lognormal.
b. The threshold value is typically chosen near the estimated mean of the underlying loss distribution.
c. The number of exceedances decreases as the threshold value decreases, which causes the reliability of the parameter estimates to increase.
d. As the threshold value is increased, the distribution of exceedances converges to a generalized Pareto distribution.

Correct answer: d

Explanation: A key foundation of EVT is that as the threshold value is increased, the distribution of loss exceedances converges to a generalized Pareto distribution. Assuming the threshold is high enough, excess losses can be modeled using the Generalized Pareto distribution.

To apply EVT, the underlying loss distribution can be any of the commonly used distributions: normal, lognormal, t, etc., and will usually be unknown. Choosing the threshold value near the estimated mean of the underlying loss distribution is arbitrary and this method is not typically employed. As the threshold value is decreased, the number of exceedances increases.

Section: Market Risk Measurement and Management
Reference: Kevin Dowd, Measuring Market Risk, 2nd Edition (West Sussex, England: John Wiley & Sons, 2005). Chapter 7, Parametric Approaches (II): Extreme Value
Learning Objective: Describe extreme value theory (EVT) and its use in risk management.

66. Based on Basel II rules for backtesting, a penalty is given to banks that have more than four exceptions to their 1-day 99% VaR over the course of 250 trading days. The supervisor gives these penalties based on four criteria. Which of the following causes of exceptions is most likely to lead to a penalty?

a. The bank increases its intraday trading activity.
b. A large move in interest rates was combined with a small move in correlations.
c. The bank's model calculates interest rate risk based on the median duration of the bonds in the portfolio.
d. A sudden market crisis in an emerging market leads to losses in the equity positions in that country.

Correct answer: c

Explanation: In the case of a bank that changed positions more frequently during the day, a penalty should be considered, but it is not necessarily given. In the case of bad luck, no penalty is given, as would be the case for a bank affected by unpredictable movements in rates or markets. However, when risk models are not precise enough, a penalty is typically given since model accuracy could have easily been improved.

Section: Market Risk Measurement and Management

Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition. (New York: McGraw-Hill, 2007). Chapter 6, Backtesting VaR.

Learning Objective: Describe the Basel rules for backtesting.

67. A portfolio manager owns a portfolio of options on a non-dividend paying stock LTM. The portfolio is made up of 5,000 deep in-the-money call options on LTM and 25,000 deep out-of-the-money call options on LTM. The portfolio also contains 10,000 forward contracts on LTM. LTM is trading at USD 84. Assuming 250 trading days in a year and the volatility of LTM is 23% per year, which of the following amounts would be closest to the 1-day VaR of the portfolio at the 99 percent confidence level?

a. USD 2,701
b. USD 14,235
c. USD 30,151
d. USD 42,706

Correct answer: d

Explanation: We need to map the portfolio to a position in the underlying stock LTM. A deep in-the-money call has a delta of approximately 1, a deep out-of-the-money call has a delta of approximately zero and forwards have a delta of 1. The net portfolio has a delta of about 1*5,000 + 0*25,000 + 1*10,000 = 15,000 and is approximately gamma neutral.

Let: a = 2.33 (99% confidence level)
S = price per share of stock LTM = USD 84
Δ = delta of the position = 15,000
σ = volatility of LTM = 0.23

Therefore, the 1-day VaR estimate at 99 percent confidence level is computed as follows:

a * S * Δ * σ * sqrt(1/T) = 2.33 * 84 * 15,000 * 0.23/sqrt(250) = USD 42,706

Section: Market Risk Measurement and Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition. (New York: McGraw-Hill, 2007). Chapter 11, VaR Mapping.
Learning Objective: Describe the method of mapping forwards, forward rate agreements, interest rate swaps, and options.

68. Consider the following two asset portfolios under management at an investment company:

Asset	Position Value (in millions of EUR)	Return Standard Deviation (%)	Beta
XYZ	560	4.20	0.7
ABC	640	7.85	1.5
Portfolio	1,200	5.10	1.0

What is the Component VaR of asset XYZ and the Marginal VaR of asset ABC, respectively, at the 95% confidence level?

a. Component VaR = USD 32,886,840; and Marginal VaR = 0.0587
b. Component VaR = USD 32,886,840; and Marginal VaR = 0.1258
c. Component VaR = USD 80,539,200; and Marginal VaR = 0.0587
d. Component VaR = USD 80,539,200; and Marginal VaR = 0.1258

Correct answer: c

Explanation:
$VaR_p = \alpha$*portfolio standard deviation*portfolio value = 1.645*0.051*USD 1,200,000,000 = USD 100,674,000

Component VaR of Asset XYZ = $VaR_p*\beta_{xyz}*W_{xyz}$ = USD 100,674,000*0.7*(560/1,200) = USD 32,886,840

Marginal VaR of Asset ABC = $VaR_p*\beta_{abc}$ /portfolio value = USD 100,674,000*1.5/USD 1,200,000,000 = 0.1258

Section: Risk Management and Investment Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition, Chapter 7: Portfolio Risk — Analytical Methods, pp. 161-164.
Learning Objective: Define, calculate, and distinguish between the following portfolio VaR measures: individual VaR, incremental VaR, marginal VaR, component VaR, undiversified portfolio VaR, and diversified portfolio VaR.

69. Which of the following statements about risk management in the pension fund industry is correct?

a. A pension plan's total VaR is equal to the sum of its policy-mix VaR and active management VaR.
b. Pension fund risk analysis does not consider performance relative to a benchmark.
c. In most defined-benefit pension plans, if liabilities exceed assets, the shortfall does not create a risk for the plan sponsor.
d. From the plan sponsor's perspective, nominal pension obligations are similar to a short position in a bond.

Correct answer: d

Explanation: Liabilities at a pension fund are typically composed of accumulated benefit obligations, measured by the present value of all pension benefits owed to employees discounted by an approximate interest rate. When liabilities consist mostly of nominal payments, their value in general will behave like a short position in a long-term bond.

Section: Risk Management and Investment Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition. Chapter 17, VaR and Risk Budgeting in Investment Management.
Learning Objective: Describe the investment process of large investors such as pension funds.

Questions 70 and 71 are based on the following information.

A risk manager assumes that the joint distribution of returns is multivariate normal and calculates the following risk measures for a two-asset portfolio:

Asset	Position	Individual VaR	Marginal VaR	VaR Contribution
1	USD 180	USD 41.94	0.396	USD 39.6
2	USD 180	USD 83.88	0.792	USD 79.2
Portfolio	USD 360	USD 110.72		USD 110.72

70. If Asset 1 is dropped from the portfolio, what will be the reduction in portfolio VaR?

a. USD 26.84
b. USD 41.94
c. USD 46.94
d. USD 83.88

Correct answer: a

Explanation: If Asset 1 is dropped, the portfolio will contain only Asset 2. Then the new portfolio VaR is that of Asset 2 alone (USD 83.88), which implies that dropping Asset 1 will result in a reduction in portfolio VaR of USD 110.72 - USD 83.88 = USD 26.84.

71. Let $\beta_i = \rho_{ip}*\sigma_i/\sigma_p$, where ρ_{ip} denotes the correlation between the return of asset i and the return of the portfolio, σ_i is the volatility of the return of asset i and σ_p is the volatility of the return of the portfolio. What is β_2?

a. 0.644
b. 1.288
c. 2.575
d. Cannot determine from information provided.

Correct answer: c

Explanation: Marginal $VaR_i = \beta_i*$(Portfolio VaR)/(Portfolio Value). So,
β_i = Marginal VaR_i*Portfolio Value /Portfolio VaR = β_2 = 0.792 * 360 / 110.72 = 2.575

Section: Risk Management and Investment Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition, Chapter 7: Portfolio Risk — Analytical Methods, pp. 161-164.
Learning Objective: Define, calculate, and distinguish between the following portfolio VaR measures: individual VaR, incremental VaR, marginal VaR, component VaR, undiversified portfolio VaR, and diversified portfolio VaR.

72. An analyst regresses the returns of 100 stocks against the returns of a major market index. The resulting pool of 100 alphas has a residual risk of 18% and an information coefficient of 9%. If the alphas are normally distributed with a mean of 0%, roughly how many stocks have an alpha greater than 4% or less than -4%?

a. 5
b. 10
c. 20
d. 25

Correct answer: a

Explanation: The standard deviation (std) of the alphas = Residual Risk (volatility) x Information Coefficient (IC) = 0.20 * 0.10 = 0.02. So, 4% is twice the standard deviation of the alphas. The alphas follow normal distribution with mean 0, so about 5% of the alphas are out of the interval [-4%, 4%]. The total number of stocks is 100, so roughly there are 5 alphas that are out of the range.

Section: Risk Management and Investment Management
Reference: Richard Grinold and Ronald Kahn, Active Portfolio Management: A Quantitative Approach for Producing Superior Returns and Controlling Risk, 2nd Edition (New York: McGraw-Hill, 2000). Chapter 14, Portfolio Construction.
Learning Objective: Assess the impact of practical issues in portfolio construction such as determination of risk aversion, incorporation of specific risk aversion, and proper alpha coverage.

73. A significant percentage of hedge funds stop trading each year and drop out of hedge fund databases. Which of the following best describes the impact this has historically had on hedge fund analyses performed using these databases?

a. The average performance of hedge funds is overstated.
b. The average volatility of hedge funds is overstated.
c. The average correlation of hedge fund returns is overstated.
d. The average Sharpe ratio of hedge fund returns is understated.

Correct answer: a

Explanation: As poor performers drop out of the database, the average performance increases. The removal of poor performers could actually reduce average volatility and the correlation of returns. The Sharpe ratio tends to get inflated due to survivorship bias.

Section: Risk Management and Investment Management
Reference: Zvi Bodie, Alex Kane, and Alan J. Marcus, Investments, 10th Edition (New York: McGraw-Hill, 2014). Chapter 24, Portfolio Performance Evaluation.
Learning Objective: Explain the difficulties in measuring the performance of hedge funds.

74. A portfolio manager wants to invest a small amount of new money that has recently come into a fund. The fund is benchmarked to an index and, rather than adding a new holding, the manager is considering increasing the holdings of one of the four assets described in the following table:

Asset	Portfolio Weight	Expected Return	Beta to the Index	Beta to the Portfolio
A	1.2%	12%	1.2	0.90
B	0.8%	10%	0.7	0.90
C	0.75	10%	0.6	0.85
D	0.35	8%	0.3	1.10

The portfolio manager wants to select the asset that has the lowest marginal VaR as long as its Treynor ratio is at least 0.1. Assuming the risk free rate is 2%, which asset should the portfolio manager select?

a. Asset A
b. Asset B
c. Asset C
d. Asset D

Correct answer: c

Explanation:
The Treynor measure is calculated as (Expected Return – Risk Free Rate)/Beta to Index. Assets B, C, D have Treynor measures greater than 0.1. Of these, C has the lowest marginal VaR as its Beta to the portfolio is the lowest.

Asset	Portfolio Weight	Expected Return	Beta to the Index	Beta to the Portfolio	Correct Treynor	Incorrect Treynor
A	1.2%	12%	1.2	0.90	0.083	0.111
B	0.8%	10%	0.7	0.90	0.114	0.089
C	0.75	10%	0.6	0.85	0.133	0.094
D	0.35	8%	0.3	1.10	0.200	0.055

Section: Risk Management and Investment Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition. Chapter 7 - Portfolio Risk: Analytical Methods.
Learning Objective: Explain the difference between risk management and portfolio management, and describe how to use marginal VaR in portfolio management.

75. A risk officer of a bank is evaluating the four rules for credit scoring model performance measurement. Which of the following is correct?

a. The "Minimum-Risk" Decision Rule tries to minimize both type I and type II errors.
b. The Neyman-Pearson rule minimizes type II error with type I error remaining constant.
c. The Neyman-Pearson rule minimizes type I error with type II error remaining constant.
d. The "Minimum-Risk" Decision Rule tries to minimize both credit and market risks.

Correct answer: c

Explanation: The Neyman-Pearson rule minimizes type I error with type II error remaining constant. There are four rules "Minimum-Error", "Minimum-Risk", Neyman-Pearson, and Minimax. The "Minimum-Risk" Decision Rule tries to minimize the risk of misclassification. It has nothing to do with market risk. Hence d is wrong.

Section: Credit Risk Measurement and Management
Reference: Arnaud de Servigny and Olivier Renault, Measuring and Managing Credit Risk. Chapter 3, Default Risk: Quantitative Methodologies.
Learning Objective: Differentiate between the following decision rules: minimum error, minimum risk, Neyman-Pearson and Minimax.

76. A major regional bank has determined that a counterparty has a constant default probability of 5.5% per year. What is the probability of this counterparty defaulting in the fourth year?

a. 4.39%
b. 4.64%
c. 4.91%
d. 5.50%

Correct answer: b

Explanation:
The probability of default in year 4 = (1–0.055)(1–0.055)(1–0.055)(0.055) = 0.06054 = 4.64%.
Choice a is incorrect. It is the probability of default in year five = (1–0.055)(1–0.055) (1–0.055)(1–0.055)(0.055) = 0.0439 = 4.39%.
Choice c is incorrect. It is the probability of default in year three = (1–0.055)(1–0.055)(0.055) = 0.0491 = 4.91%. Choice d is incorrect. It is simply the default probability per year, which equals 5.5%.

Section: Credit Risk Measurement and Management
Reference: Jon Gregory, Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets, 2nd Edition (West Sussex, UK: John Wiley & Sons, 2012). Chapter 10. Default Probability, Credit Spreads, and Credit Derivatives
Learning Objective: Calculate risk-neutral default probabilities, and compare the use of risk-neutral and real-world default probabilities in pricing derivative contracts.

77. A company's pension fund is established as a defined benefit plan, and therefore the board must consider funding risk. Which of the following statements about the pension fund's funding risk is correct?

a. The longer the horizon for expected payouts, the lower the funding risk.
b. Decreases in interest rates will reduce funding risk.
c. The funding risk has been effectively transferred to the employees.
d. Funding risk represents the true long-term risk to the plan sponsor.

Correct answer: d

Explanation: The time horizon of payouts does not eliminate funding risk. In fact it is the mismatch between assets and liabilities that creates funding risk. In an low interest rate environment the value of equities will rise, however the value of the liabilities are likely to increase more thereby exacerbating funding risk. Funding risk is transferred to employees with a defined contribution plan. Immunizing the portfolio, essentially matching duration of assets and liabilities, will reduce funding risk.

Section: Risk Management and Investment Management
Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition (New York: McGraw Hill, 2007). Chapter 17, VaR and Risk Budgeting in Investment Management.
Learning Objective: Distinguish among the following types of risk: absolute risk, relative risk, policy-mix risk, active management risk, funding risk, and sponsor risk.

78. A risk manager is evaluating the risk profile for a portfolio of stocks. Currently, the portfolio is valued at JPY 128 billion and contains JPY 25 billion in stock XYZ. The standard deviation of returns of stock XYZ is 11% annually and that of the overall portfolio is 18% annually. The correlation of returns between stock XYZ and the portfolio is 0.6. Assuming the risk analyst uses a 1-year 95% VaR and that returns are normally distributed, what is the estimated component VaR of stock XYZ?

a. JPY 2.714 billion
b. JPY 3.838 billion
c. JPY 4.524 billion
d. JPY 6.397 billion

Correct answer: a

Explanation: Let $\alpha(95\%)$ represent the 95% confidence factor for the VaR estimate, which is 1.645, and w_{XYZ} represent the value of stock XYZ. Therefore,

$VaR_{XYZ} = w_{XYZ} * \sigma_{XYZ} * \alpha(95\%)$ = JPY 25 million x 0.11 x 1.645 = JPY 4.524 billion

Component $VaR_{XYZ} = \rho * VaR_{XYZ}$ = 0.6 x 4.524 = JPY 2.714 billion.

Section: Risk Management and Investment Management
Reference: Philippe Jorion, *Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition*. (New York: McGraw-Hill, 2007). Chapter 7: Portfolio Risk: Analytical Methods.
Learning Objective: Define, calculate, and distinguish between the following portfolio VaR measures: individual VaR, incremental VaR, marginal VaR, component VaR, undiversified portfolio VaR, and diversified portfolio VaR.

79. A risk team in the investment banking subsidiary of a bank holding company is setting up a Monte Carlo simulation methodology to estimate the subsidiary's aggregate loss distribution. Which of the following loss severity and loss frequency distribution pairs is the most appropriate to use?

a. Binomial distribution for severity, lognormal distribution for frequency.
b. Binomial distribution for frequency, normal distribution for severity.
c. Poisson distribution for severity, normal distribution for frequency.
d. Poisson distribution for frequency, lognormal distribution for severity.

Correct answer: d

Rationale: Pareto and lognormal distributions (fat-tailed) are generally used for loss severity, Poisson and Negative Binomial distributions are appropriate for loss frequency.

Section: Operational and Integrated Risk Management
Reference: Philippa X. Girling, *Operational Risk Management: A Complete Guide to a Successful Operational Risk Framework* (Hoboken: John Wiley & Sons, 2013). Chapter 12. Capital Modeling**.**
Learning Objective: Explain how frequency and severity distributions of operational losses are obtained, including commonly used distributions and suitability guidelines for probability distributions.

80. The risk management department at a bank is trying to assess the impact of the capital conservation and countercyclical buffers defined in the Basel III framework. They consider a scenario in which the bank's capital and risk-weighted assets are as shown in the table below (all values are in EUR millions):

Item	Value
Risk-weighted assets	3,480
Common equity Tier 1 (CET1) capital	145
Additional Tier 1 capital	50
Total Tier 1 capital	195
Tier 2 capital	98
Tier 3 capital	0
Total capital	293

Assuming that all Basel III phase-ins have occurred and that the bank's required countercyclical buffer is 0.95%, which of the capital ratios does the bank satisfy?

a. The CET1 capital ratio only.

b. The CET1 capital ratio plus the capital conservation buffer only.

c. The CET1 capital ratio plus the capital conservation buffer and the countercyclical buffer.

d. None of the above.

Correct answer: d

Rationale: The bank has CET1 capital ratio of (195/3,480) = 4.2%. This ratio does not meet the 4.5% minimum CET1 capital requirement; does not meet the additional 2.5% capital conservation buffer; and does not meet the additional countercyclical buffer of 0.95% (= 4.5% + 2.5% + 0.95 = 7.95%).

Section: Operational and Integrated Risk Management
Reference: John Hull, Risk Management and Financial Institutions, 4rd Edition (New York: John Wiley & Sons, 2015). Chapter 16. Basel 2.5, Basel III, and Dodd-Frank.
Learning Objective: Define in the context of Basel III and calculate where appropriate:

- Tier 1 capital and its components
- Tier 2 capital and its components
- Required Tier 1 equity capital, total Tier 1 capital, and total capital.