GARP | FRM

FINANCIAL RISK MANAGER

2019

FRM®

Practice Exams Part II

Including Pre-Study Practice Exam

Updated 02/05/19

FRM PRE-STUDY PRACTICE EXAM PART II

Table of Contents

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 2019 FRM Pre-Study Part I and Part II Practice Exams have been developed to aid candidates in their preparation for the FRM Exam in May and November 2019. These Practice Exams are based on a sample of questions from prior FRM Exams and are suggestive of the questions that will be on the 2019 FRM Exam.

The 2019 FRM Pre-Study Part I Practice Exam contains 25 multiple-choice questions and the 2019 FRM Pre-Study Part II Practice Exam contains 20 multiple-choice questions.

The 2019 FRM Practice Exams do not necessarily cover all topics to be tested in the 2019 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 2019 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 2019 FRM Exam Study Guide and 2019 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.

Reference Table: Let Z be a standard normal random variable.

z	P(Z<z)	z	P(Z<z)	z	P(Z<z)	z	P(Z<z)	z	P(Z<z)	z	P(Z<z)
-3	0.0013	-2.50	0.0062	-2.00	0.0228	-1.50	0.0668	-1.00	0.1587	-0.50	0.3085
-2.99	0.0014	-2.49	0.0064	-1.99	0.0233	-1.49	0.0681	-0.99	0.1611	-0.49	0.3121
-2.98	0.0014	-2.48	0.0066	-1.98	0.0239	-1.48	0.0694	-0.98	0.1635	-0.48	0.3156
-2.97	0.0015	-2.47	0.0068	-1.97	0.0244	-1.47	0.0708	-0.97	0.1660	-0.47	0.3192
-2.96	0.0015	-2.46	0.0069	-1.96	0.0250	-1.46	0.0721	-0.96	0.1685	-0.46	0.3228
-2.95	0.0016	-2.45	0.0071	-1.95	0.0256	-1.45	0.0735	-0.95	0.1711	-0.45	0.3264
-2.94	0.0016	-2.44	0.0073	-1.94	0.0262	-1.44	0.0749	-0.94	0.1736	-0.44	0.3300
-2.93	0.0017	-2.43	0.0075	-1.93	0.0268	-1.43	0.0764	-0.93	0.1762	-0.43	0.3336
-2.92	0.0018	-2.42	0.0078	-1.92	0.0274	-1.42	0.0778	-0.92	0.1788	-0.42	0.3372
-2.91	0.0018	-2.41	0.0080	-1.91	0.0281	-1.41	0.0793	-0.91	0.1814	-0.41	0.3409
-2.9	0.0019	-2.40	0.0082	-1.90	0.0287	-1.40	0.0808	-0.90	0.1841	-0.40	0.3446
-2.89	0.0019	-2.39	0.0084	-1.89	0.0294	-1.39	0.0823	-0.89	0.1867	-0.39	0.3483
-2.88	0.0020	-2.38	0.0087	-1.88	0.0301	-1.38	0.0838	-0.88	0.1894	-0.38	0.3520
-2.87	0.0021	-2.37	0.0089	-1.87	0.0307	-1.37	0.0853	-0.87	0.1922	-0.37	0.3557
-2.86	0.0021	-2.36	0.0091	-1.86	0.0314	-1.36	0.0869	-0.86	0.1949	-0.36	0.3594
-2.85	0.0022	-2.35	0.0094	-1.85	0.0322	-1.35	0.0885	-0.85	0.1977	-0.35	0.3632
-2.84	0.0023	-2.34	0.0096	-1.84	0.0329	-1.34	0.0901	-0.84	0.2005	-0.34	0.3669
-2.83	0.0023	-2.33	0.0099	-1.83	0.0336	-1.33	0.0918	-0.83	0.2033	-0.33	0.3707
-2.82	0.0024	-2.32	0.0102	-1.82	0.0344	-1.32	0.0934	-0.82	0.2061	-0.32	0.3745
-2.81	0.0025	-2.31	0.0104	-1.81	0.0351	-1.31	0.0951	-0.81	0.2090	-0.31	0.3783
-2.8	0.0026	-2.30	0.0107	-1.80	0.0359	-1.30	0.0968	-0.80	0.2119	-0.30	0.3821
-2.79	0.0026	-2.29	0.0110	-1.79	0.0367	-1.29	0.0985	-0.79	0.2148	-0.29	0.3859
-2.78	0.0027	-2.28	0.0113	-1.78	0.0375	-1.28	0.1003	-0.78	0.2177	-0.28	0.3897
-2.77	0.0028	-2.27	0.0116	-1.77	0.0384	-1.27	0.1020	-0.77	0.2206	-0.27	0.3936
-2.76	0.0029	-2.26	0.0119	-1.76	0.0392	-1.26	0.1038	-0.76	0.2236	-0.26	0.3974
-2.75	0.0030	-2.25	0.0122	-1.75	0.0401	-1.25	0.1056	-0.75	0.2266	-0.25	0.4013
-2.74	0.0031	-2.24	0.0125	-1.74	0.0409	-1.24	0.1075	-0.74	0.2296	-0.24	0.4052
-2.73	0.0032	-2.23	0.0129	-1.73	0.0418	-1.23	0.1093	-0.73	0.2327	-0.23	0.4090
-2.72	0.0033	-2.22	0.0132	-1.72	0.0427	-1.22	0.1112	-0.72	0.2358	-0.22	0.4129
-2.71	0.0034	-2.21	0.0136	-1.71	0.0436	-1.21	0.1131	-0.71	0.2389	-0.21	0.4168
-2.7	0.0035	-2.20	0.0139	-1.70	0.0446	-1.20	0.1151	-0.70	0.2420	-0.20	0.4207
-2.69	0.0036	-2.19	0.0143	-1.69	0.0455	-1.19	0.1170	-0.69	0.2451	-0.19	0.4247
-2.68	0.0037	-2.18	0.0146	-1.68	0.0465	-1.18	0.1190	-0.68	0.2483	-0.18	0.4286
-2.67	0.0038	-2.17	0.0150	-1.67	0.0475	-1.17	0.1210	-0.67	0.2514	-0.17	0.4325
-2.66	0.0039	-2.16	0.0154	-1.66	0.0485	-1.16	0.1230	-0.66	0.2546	-0.16	0.4364
-2.65	0.0040	-2.15	0.0158	-1.65	0.0495	-1.15	0.1251	-0.65	0.2578	-0.15	0.4404
-2.64	0.0041	-2.14	0.0162	-1.64	0.0505	-1.14	0.1271	-0.64	0.2611	-0.14	0.4443
-2.63	0.0043	-2.13	0.0166	-1.63	0.0516	-1.13	0.1292	-0.63	0.2643	-0.13	0.4483
-2.62	0.0044	-2.12	0.0170	-1.62	0.0526	-1.12	0.1314	-0.62	0.2676	-0.12	0.4522
-2.61	0.0045	-2.11	0.0174	-1.61	0.0537	-1.11	0.1335	-0.61	0.2709	-0.11	0.4562
-2.6	0.0047	-2.10	0.0179	-1.60	0.0548	-1.10	0.1357	-0.60	0.2743	-0.10	0.4602
-2.59	0.0048	-2.09	0.0183	-1.59	0.0559	-1.09	0.1379	-0.59	0.2776	-0.09	0.4641
-2.58	0.0049	-2.08	0.0188	-1.58	0.0571	-1.08	0.1401	-0.58	0.2810	-0.08	0.4681
-2.57	0.0051	-2.07	0.0192	-1.57	0.0582	-1.07	0.1423	-0.57	0.2843	-0.07	0.4721
-2.56	0.0052	-2.06	0.0197	-1.56	0.0594	-1.06	0.1446	-0.56	0.2877	-0.06	0.4761
-2.55	0.0054	-2.05	0.0202	-1.55	0.0606	-1.05	0.1469	-0.55	0.2912	-0.05	0.4801
-2.54	0.0055	-2.04	0.0207	-1.54	0.0618	-1.04	0.1492	-0.54	0.2946	-0.04	0.4840
-2.53	0.0057	-2.03	0.0212	-1.53	0.0630	-1.03	0.1515	-0.53	0.2981	-0.03	0.4880
-2.52	0.0059	-2.02	0.0217	-1.52	0.0643	-1.02	0.1539	-0.52	0.3015	-0.02	0.4920
-2.51	0.0060	-2.01	0.0222	-1.51	0.0655	-1.01	0.1562	-0.51	0.3050	-0.01	0.4960

Special Instructions and Definitions

1. Unless otherwise indicated, interest rates are assumed to be continuously compounded.
2. Unless otherwise indicated, option contracts are assumed to be on one unit of the underlying asset.
3. bp(s) = basis point(s)
4. CAPM = capital asset pricing model
5. CCP = central counterparty or central clearing counterparty
6. CDO = collateralized debt obligation(s)
7. CDS = credit default swap(s)
8. CEO, CFO, CIO, and CRO are: chief executive, financial, investment, and risk officers, respectively
9. CVA = credit value adjustment
10. ERM = enterprise risk management
11. ES = expected shortfall
12. EWMA = exponentially weighted moving average
13. GARCH = generalized auto-regressive conditional heteroskedasticity
14. LIBOR = London interbank offered rate
15. MBS = mortgage-backed-security(securities)
16. OIS = overnight indexed swap
17. OTC = over-the-counter
18. RAROC = risk-adjusted return on capital
19. VaR = value-at-risk
20. The following acronyms are used for selected currencies:

Acronym	Currency
AUD	Australian dollar
BRL	Brazilian real
CAD	Canadian dollar
CNY	Chinese yuan
EUR	euro

Acronym	Currency
GBP	British pound sterling
INR	Indian rupee
JPY	Japanese yen
SGD	Singapore dollar
USD	US dollar

2019 FRM Part II Pre-Study Practice Exam – Candidate Answer Sheet

1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	
19.	
20.	

1. A due diligence specialist at an asset management firm is evaluating the risk management process of a hedge fund in which the firm is considering making an investment. Which of the following statements best describes appropriate criteria the specialist should use for such an evaluation?

A. The firm should ensure that the hedge fund allows direct, in-person communications with the fund's senior management or key decision makers at the fund.
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 investing in a leveraged fund, the company should not invest in the fund unless the fund's gross leverage ratio is above the peer group average.
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.

2. Three months ago, Valtemp Construction Company (VCC) entered into a 9-month forward contract with Millenia Steel Products (MSP) to purchase 6,000 tons of stainless steel from MSP. At the time the forward was entered into, 6,000 tons of stainless steel was priced at EUR 20.3 million but is currently priced at EUR 23.5 million. The continuously compounded risk-free rate has remained stable at 4.0% per year and is not expected to change during the remainder of the contract period. Assuming the forward is fairly priced, what is the current potential credit risk exposure on the forward contract and who bears the risk?

A. EUR 2.790 million; MSP bears the potential credit risk
B. EUR 2.790 million; VCC bears the potential credit risk
C. EUR 2.996 million; MSP bears the potential credit risk
D. EUR 2.996 million; VCC bears the potential credit risk

3. A market risk manager seeks to calculate the price of a 2-year zero-coupon bond. The 1-year interest rate today is 8.0%. There is a 50% probability that the 1-year interest rate will be 10.0% in 1 year and a 50% probability that it will be 6.0% in 1 year. Assuming the risk premium of duration risk is 40 bps each year, and the bond's face value is EUR 1,000, which of the following should be the price of the zero-coupon bond?

A. EUR 822.98
B. EUR 854.47
C. EUR 905.30
D. EUR 921.66

4. The CEO of a large bank has reported that the bank's tools and processes for managing operational risk are consistent with Basel II and Basel III guidelines for operational risk governance. Which of the following actions and principles of the bank is correct?

A. The bank uses outsourcing to mitigate the operational risk that should be addressed by the management.
B. As the highest level executive of senior management, the CEO approves the bank's risk appetite and tolerance statement for operational risk.
C. The operational risk management framework established by the bank is subject to independent review.
D. Department managers monitor their departments' operational risk profiles and losses and enforce compliance with company risk policies.

5. A mid-sized investment bank 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 0.27. The firm believes that it can improve upon the diversification benefit of netting by revising the current agreement. Assuming values of future trade positions are normally distributed with zero mean and equal variance, 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
L	5	0.29
M	8	0.20
P	12	-0.05
Q	14	-0.04

A. Trade combination L
B. Trade combination M
C. Trade combination P
D. Trade combination Q

6. A packaging materials manufacturer is considering a project that has an estimated RAROC of 12%. Suppose that the risk-free rate is 4% per year, the expected market rate of return is 10% per year, and the company's equity beta is 1.6. Using the criterion of adjusted RAROC for the risk of returns, the company should:

A. Reject the project because the adjusted RAROC is higher than the market expected excess return.
B. Accept the project because the adjusted RAROC is higher than the market expected excess return.
C. Reject the project because the adjusted RAROC is lower than the risk-free rate.
D. Accept the project because the adjusted RAROC is lower than the risk-free rate.

7. A credit manager who is well versed in lessons learned from the 2007–2009 subprime mortgage crisis in the US is overseeing the structured credit book of a bank in order to identify potential problems of information flow (frictions) among the parties involved in the securitization process. Which of the following is a correct combination of a potential friction in the securitization process and an appropriate mechanism to mitigate that friction?

A. Friction between the asset manager and the investor: Principal-Agent problem. This problem can be mitigated by establishing investment mandates and evaluating the asset manager's performance.
B. Friction between the arranger and the originator: Model error problem. This problem can be mitigated by the arranger providing a credit enhancement to the securitized products with its own funding.
C. Friction between the investor and credit rating agencies: Moral hazard problem. This problem can be mitigated by requiring credit rating agencies to be paid by originators and not by investors for their rating services.
D. Friction between the servicer and the mortgagor: Adverse selection problem. This problem can be mitigated by the mortgagor applying due diligence on the servicer.

8. Large dealer banks have often financed significant fractions of their assets using short-term (overnight) repurchase agreements in which creditors hold bank securities as collateral against default losses. The table below shows the quarter-end financing of four A-rated broker-dealer banks (all values are in USD billion):

	Bank P	**Bank Q**	**Bank R**	**Bank S**
Financial Instruments Owned	339	656	835	750
Pledged as collateral	139	258	209	472
Not pledged	200	398	626	278

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 P
B. Bank Q
C. Bank R
D. Bank S

9. A fixed-income portfolio manager at a financial institution has observed the price of one of the corporate bonds that the financial institution currently holds and wants to estimate the premium the financial institution needs to accept the default risk of the bond. The manager has determined that the bond's real-world default probability is 2.3%, its liquidity risk premium is 1.7%, and its risk-neutral default probability is 5.9%. Ignoring any other risk premiums that might affect the bond's pricing, what is the bond's default risk premium?

A. 1.9%
B. 3.6%
C. 4.0%
D. 4.2%

10. A hedge fund risk manager plans to adopt an interest rate term structure model whose risk neutral dynamics display mean reversion and a time-varying drift and consider Vasicek model as one of the candidates. Which of the following is correct about the Vasicek model?

A. It gives rise to a downward-sloping term structure of volatility and allows for a time dependent drift.
B. The short-term rates tend toward a long run equilibrium value and the expected value of the change in short-term rates is always zero over time.
C. Shocks to short-term rates affect all rates equally, giving rise to parallel shifts.
D. There is no mean reversion and the risk premium corresponds to a constant drift in Vasicek model.

11. A risk manager is evaluating the risks of a portfolio of stocks. Currently, the portfolio is valued at CAD 248 million and contains CAD 15 million in stock T. The annualized standard deviations of returns of the overall portfolio and of stock T are 16% and 13%, respectively. The correlation of returns between the portfolio and stock T is 0.45. Assuming the risk analyst uses a 1-year 95% VaR and the returns are normally distributed, what is the component VaR of stock T?

A. CAD 0.096 million
B. CAD 1.444 million
C. CAD 2.041 million
D. CAD 3.948 million

12. A risk analyst constructs a binomial interest rate tree by using the Ho-Lee model. The time step is monthly, and the annualized drift is 60 bps in the first month and 130 bps in the second month. Assuming the current annualized short-term rate is 2.7% and the annual basis point-volatility is 1.9%, what is the interest rate in the lowest node after 2 months?

A. 1.44%
B. 1.76%
C. 2.31%
D. 2.54%

13. 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 use its own estimates of recovery rates?

A. The standardized measurement approach for operational risk
B. The advanced internal ratings-based approach for credit risk
C. The foundation internal ratings-based approach for credit risk
D. The fundamental review of the trading book (FRTB) approach for securitized products

14. A regional commercial bank is considering a loan to be fully funded by deposits, with the following parameters:

- Loan amount: CNY 3.8 billion
- Average annual interest rate paid on deposits: 0.6%
- Annual interest rate received on loan: 4.1%
- Expected loss: 3.0% of face value of loan
- Annual operating costs: 0.3% of face value of loan
- Economic capital required to support the loan: 15.0%
- Average pre-tax return on economic capital: 2.0%
- Effective tax rate: 38%
- Other transfer costs: CNY 0

What is the after-tax RAROC for this loan?

A. 0.31%
B. 2.07%
C. 3.33%
D. 10.07%

15. A CRO of a hedge fund asks the risk team to develop a term-structure model that is appropriate for fitting interest rates for use in the fund's options pricing practice. The risk team evaluates several interest rate models with drift and volatility functions. Which of the following is a correct description of the specified model?

A. In the Ho-Lee model, the drift of the interest rate process is presumed to be constant.
B. In the Ho-Lee model, short term rates are presumed to have a mean-reversion function.
C. In the Cox-Ingersoll-Ross model, short term rates are presumed to have a lognormal distribution.
D. In the Cox-Ingersoll-Ross model, the basis-point volatility of the short term rate is presumed to be proportional to the square root of the rate.

16. The director of an equity mutual fund is reviewing a portfolio construction technique proposed by a new portfolio manager who has recently been allocated capital to manage. The fund typically grants its portfolio managers flexibility in selecting and implementing appropriate portfolio construction procedures but requires that any methodology adopted fulfills key risk control objectives set by the firm. Which of the following portfolio construction techniques and its capability for 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 portfolio construction techniques 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.

17. A risk manager has asked a junior analyst to estimate the implied default probability for a BBB-rated discount corporate bond. The continuously compounded annual yields of other fixed-income securities are given below:

- 3-year Treasury note (a risk-free bond): 2%
- 1-year BBB-rated discount bond: 4%
- 2-year BBB-rated discount bond: 7%
- 3-year BBB-rated discount bond: 10%

If the recovery rate on the 3-year BBB-rated bond is expected to be 0% in the event of default, which of the following is the best estimate of the risk-neutral probability that the BBB-rated discount bond defaults within the next 3 years?

A. 6.55%
B. 14.55%
C. 21.34%
D. 25.92%

18. A bank is using the VaR and stressed VaR market risk framework in line with the Basel II.5 guidelines. The bank's internal models for market risk have 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%	289	501	271	572
99.0%	513	993	489	1,187
99.9%	607	1,347	564	1,412

Assuming the supervisory authority has set the multiplication factors for both the VaR and the stressed VaR values to 3, what is the correct capital requirement for general market risk for the bank under Basel II.5?

A. USD 1,248 million
B. USD 1,533 million
C. USD 4,557 million
D. USD 5,028 million

19. Bank HJK has written puts on Bank PQR stock to a hedge fund and sold CDS protection on Bank PQR to a manufacturer. Bank HJK and Bank PQR operate in several of the same businesses and geographies and their performances are highly correlated. Many in the market are concerned that rising interest rates could negatively impact the credit quality of Bank HJK's numerous borrowers, which in turn would increase the credit spread of Bank HJK. From the perspectives of the hedge fund and the manufacturer, which of the following is correct with respect to their counterparty risk exposure to Bank HJK?

	Hedge Fund	Manufacturer
A.	Right-way risk	Right-way risk
B.	Right-way risk	Wrong-way risk
C.	Wrong-way risk	Right-way risk
D.	Wrong-way risk	Wrong-way risk

20. A wealth management firm has JPY 86 billion in assets under management. The portfolio manager computes the daily VaR at various confidence levels as follows:

Confidence Level	VaR (JPY)
95.0%	397,463,000
95.5%	401,682,500
96.0%	406,224,500
96.5%	418,453,000
97.0%	428,934,000
97.5%	439,415,500
98.0%	451,993,000
98.5%	468,763,000
99.0%	490,773,000
99.5%	524,663,000

What is the closest estimate of the daily ES at the 97.5% confidence level?

A. JPY 398 million
B. JPY 400 million
C. JPY 484 million
D. JPY 497 million

2019 FRM Part II Pre-Study Practice Exam – Answer Key

1.	A.
2.	D.
3.	B.
4.	C.
5.	D.
6.	C.
7.	A.
8.	D.
9.	A.
10.	A.
11.	B.
12.	B.
13.	B.
14.	B.
15.	D.
16.	A.
17.	C.
18.	D.
19.	D.
20.	C.

1. A due diligence specialist at an asset management firm is evaluating the risk management process of a hedge fund in which the firm is considering making an investment. Which of the following statements best describes appropriate criteria the specialist should use for such an evaluation?

A. The firm should ensure that the hedge fund allows direct, in-person communications with the fund's senior management or key decision makers at the fund.
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 investing in a leveraged fund, the company should not invest in the fund unless the fund's gross leverage ratio is above the peer group average.
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.

Correct Answer: A

Explanation: A is correct. Investors should make sure they have access to the people at the top of the firm; the actual risk takers and decision makers, so that they have a better sense of what is really going on at that firm. Direct access to founders or senior management is preferred as part of continuing due diligence but if they are not available then the fund should strive to communicate with managers who perform day-to-day investment tasks at the fund. Communication with investor relations is not sufficient.

B is incorrect. Many funds employ independent risk service providers to report risks to investors, but these firms do not get involved in risk related decision making.

C is incorrect. Investors should evaluate the considered fund's current and historical leverage figures but also understand how and why these figures might deviate from the fund's peers.

D is incorrect. 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, 2nd Edition (Hoboken, NJ: Wiley Finance, 2016). Chapter 12 - Performing Due Diligence on Specific Managers and Funds

Learning Objective: Describe criteria that can be evaluated in assessing a fund's risk management process.

2. Three months ago, Valtemp Construction Company (VCC) entered into a 9-month forward contract with Millenia Steel Products (MSP) to purchase 6,000 tons of stainless steel from MSP. At the time the forward was entered into, 6,000 tons of stainless steel was priced at EUR 20.3 million but is currently priced at EUR 23.5 million. The continuously compounded risk-free rate has remained stable at 4.0% per year and is not expected to change during the remainder of the contract period. Assuming the forward is fairly priced, what is the current potential credit risk exposure on the forward contract and who bears the risk?

A. EUR 2.790 million; MSP bears the potential credit risk
B. EUR 2.790 million; VCC bears the potential credit risk
C. EUR 2.996 million; MSP bears the potential credit risk
D. EUR 2.996 million; VCC bears the potential credit risk

Correct Answer: D

Explanation: D is correct. Given the risk-free rate of 4.0%, we can estimate the forward price (at maturity, in nine months) of the contract as:

Forward price = Spot*exp(r*t) = 20.3*exp(0.04*0.75) = EUR 20.9182 million.

Today, after 3 months (6 months remaining to maturity), the forward contract price estimate

= 20.9182/exp(0.04*0.5) = EUR 20.5040 million.

Note that, Forward Contract Value = Credit Risk Exposure.

Therefore, given that the current (with 6 months remaining to maturity) underlying asset price of EUR 23.5 million, the long forward contract's exposure value is given by:

Current Potential Exposure Value of Forward Contract = (Market Price – Contract Price)

= 23.5 – 20.5040 = EUR 2.996 million.

Because the contract value of EUR 2.996 million is positive, the long counterparty (VCC) bears the credit risk exposure.

Positive exposure = Max(value, 0), Negative exposure = Min(value, 0)

and for long forward contracts: Contract Value = (Market Price – Contract Price).

For forwards, while there is no current credit risk (loss), because payment is only made at expiration, there is always positive potential exposure so long as market price > contract price, and negative potential exposure if market price < contract price. At origination (time 0), there is neither current credit risk nor potential credit exposure (since market price = contract price).

A and B are incorrect. They compute the contract price incorrectly by discounting the forward value over 3 months and not 6 months as follows:

The forward contract price = 20.9182*exp(-0.04*0.25) = EUR 20.7101 million. Therefore, Current Value of Forward Contract = (Market Price – Contract Price) = 23.5 – 20.7101 = EUR 2.7899 million.

C is incorrect (see explanation for D above).

Section: Credit Risk Measurement and Management

Reference: Jon Gregory, The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, 3rd Edition (West Sussex, UK: John Wiley & Sons, 2015). Chapter 7 - Credit Exposure and Funding

Learning Objective: Describe and calculate the following metrics for credit exposure: expected mark-to-market, expected exposure, potential future exposure, expected positive exposure and negative exposure, effective exposure, and maximum exposure.

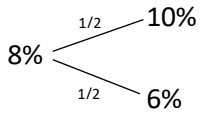
3. A market risk manager seeks to calculate the price of a 2-year zero-coupon bond. The 1-year interest rate today is 8.0%. There is a 50% probability that the 1-year interest rate will be 10.0% in 1 year and a 50% probability that it will be 6.0% in 1 year. Assuming the risk premium of duration risk is 40 bps each year, and the bond's face value is EUR 1,000, which of the following should be the price of the zero-coupon bond?

A. EUR 822.98
B. EUR 854.47
C. EUR 905.30
D. EUR 921.66

Correct Answer: B

Explanation: B is correct.

We can find the price of the 2-year zero-coupon bond by using a binomial tree as follows:



To find the value at date 0, we must first find the expected value of the price on date 1:

$$\frac{1}{2}\left(\frac{1000}{1.104}+\frac{1000}{1.064}\right)=\text{EUR } 922.8234,$$

and then discount this by the rate at date 0:

$$\frac{\frac{1}{2}\left(\frac{1000}{1.104}+\frac{1000}{1.064}\right)}{1.08}=\text{EUR } 854.4661.$$

Section: Market Risk Measurement and Management

Reference: Bruce Tuckman and Angel Serrat, Fixed Income Securities, 3rd Edition (Hoboken, NJ: John Wiley & Sons, 2011), Chapter 8 - The Evolution of Short Rates and the Shape of the Term Structure

Learning Objective: Calculate the price and return of a zero coupon bond incorporating a risk premium.

4. The CEO of a large bank has reported that the bank's tools and processes for managing operational risk are consistent with Basel II and Basel III guidelines for operational risk governance. Which of the following actions and principles of the bank is correct?

A. The bank uses outsourcing to mitigate the operational risk that should be addressed by the management.
B. As the highest level executive of senior management, the CEO approves the bank's risk appetite and tolerance statement for operational risk.
C. The operational risk management framework established by the bank is subject to independent review.
D. Department managers monitor their departments' operational risk profiles and losses and enforce compliance with company risk policies.

Correct Answer: C

Explanation: C is correct. The board of directors of banks should ensure that the bank's Framework is subject to independent review by audit or other appropriately trained parties.

A is incorrect. . "Banks should view risk transfer tools as complementary to, rather than a replacement for, thorough internal operational risk control". Risk transfer via outsourcing should not be used to relieve management of their responsibility to manage operational risk, and outsourcing can actually introduce additional operational risks to the bank.

B is incorrect. The board of directors should approve and review the risk appetite of the bank.

D is incorrect. Staff responsible for monitoring and enforcing compliance with the institution's risk policy should have authority independent from the units they oversee.

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.

5. A mid-sized investment bank 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 0.27. The firm believes that it can improve upon the diversification benefit of netting by revising the current agreement. Assuming values of future trade positions are normally distributed with zero mean and equal variance, 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
L	5	0.29
M	8	0.20
P	12	-0.05
Q	14	-0.04

A. Trade combination L
B. Trade combination M
C. Trade combination P
D. Trade combination Q

Correct Answer: D

Explanation: D is correct. The netting factor represents the ratio of net to gross exposure and is expressed as: $Netting\ Factor = \frac{\sqrt{n + n(n-1)\rho}}{n}$

where n represents the number of exposures and ρ represents the average correlation.

Therefore, a lower netting factor implies higher netting benefits.

For the current position, when n = 10 and ρ = 0.27:

$$Netting\ Factor = \frac{\sqrt{n + n(n-1)\rho}}{n} = \frac{\sqrt{10 + 10(10-1)(0.27)}}{10} = 0.5857 = 58.57\%$$

When n = 14 and ρ = -0.04, there is the most reduction in netting factor (the most increase in netting benefit for combination Q):

$$Netting\ Factor = \frac{\sqrt{n + n(n-1)\rho}}{n} = \frac{\sqrt{14 + 14(14-1)(-0.04)}}{14} = 0.1852 = 18.52\%$$

A is incorrect. When n = 5 and ρ = 0.29, there is deterioration in netting benefit:

$$Netting\ Factor = \frac{\sqrt{n + n(n-1)\rho}}{n} = \frac{\sqrt{5 + 5(5-1)(0.29)}}{5} = 0.6573 = 65.73\%$$

B is incorrect. When n = 8 and ρ = 0.20, there is a modest improvement in netting benefit but not as much as for trade combination Q:

$$Netting\ Factor = \frac{\sqrt{n + n(n-1)\rho}}{n} = \frac{\sqrt{8 + 8(8-1)(0.20)}}{8} = 0.5477 = 54.77\%$$

C is incorrect. When n = 12 and ρ = –0.05, there is a reasonable increase in netting benefit but not as large as for trade combination Q:

$$Netting\ Factor = \frac{\sqrt{n + n(n-1)\rho}}{n} = \frac{\sqrt{12 + 12(12-1)(-0.05)}}{12} = 0.1936 = 19.36\%$$

Section:	Credit Risk Measurement and Management
Reference:	Jon Gregory, The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, 3rd Edition (West Sussex, UK: John Wiley & Sons, 2015). Chapter 7 - Credit Exposure and Funding
Learning Objective:	Explain the impact of netting on exposure, the benefit of correlation, and calculate the netting factor.

6. A packaging materials manufacturer is considering a project that has an estimated RAROC of 12%. Suppose that the risk-free rate is 4% per year, the expected market rate of return is 10% per year, and the company's equity beta is 1.6. Using the criterion of adjusted RAROC for the risk of returns, the company should:

A. Reject the project because the adjusted RAROC is higher than the market expected excess return.
B. Accept the project because the adjusted RAROC is higher than the market expected excess return.
C. Reject the project because the adjusted RAROC is lower than the risk-free rate.
D. Accept the project because the adjusted RAROC is lower than the risk-free rate.

Correct Answer: C

Explanation: C is correct. Consider the adjusted RAROC for the risk of returns:

Adjusted RAROC = RAROC - β_E*(R_m – R_f),

where:

β_E = Beta of the equity of the firm

$R_{m.}$= Expected market rate of return

R_f = Risk-free rate of interest

β_E*(R_m – R_f) = Risk premium of the project.

Adjusted RAROC is simply "RAROC adjusted for the systematic riskiness of the returns". Adjusted RAROC can be used in evaluating the project in the following way: if the project's "RAROC less the project's risk premium" is greater than the risk-free rate, then the firm's shareholders are compensated for the non-diversifiable systematic risk they bear when investing in the activity, assuming the investors hold a well-diversified portfolio (i.e., the project adds value). That is, if the project's adjusted RAROC exceeds the risk-free rate, it should be accepted by the firm. Otherwise, if it is less than the risk-free rate, the project should be rejected.

Given RAROC = 12%, β_E = 1.6, R_m = 10% and R_f = 4%, one can compute Adjusted RAROC = 0.12-1.6*(0.10- 0.04) = 0.024 = 2.4% and is less that R_f = 4%. Thus, the project is rejected.

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 - Risk Capital Attribution and Risk-Adjusted Performance Measurement.

Learning Objective: Compute the adjusted RAROC for a project to determine its viability.

7. A credit manager who is well versed in lessons learned from the 2007–2009 subprime mortgage crisis in the US is overseeing the structured credit book of a bank in order to identify potential problems of information flow (frictions) among the parties involved in the securitization process. Which of the following is a correct combination of a potential friction in the securitization process and an appropriate mechanism to mitigate that friction?

A. Friction between the asset manager and the investor: Principal-Agent problem. This problem can be mitigated by establishing investment mandates and evaluating the asset manager's performance.
B. Friction between the arranger and the originator: Model error problem. This problem can be mitigated by the arranger providing a credit enhancement to the securitized products with its own funding.
C. Friction between the investor and credit rating agencies: Moral hazard problem. This problem can be mitigated by requiring credit rating agencies to be paid by originators and not by investors for their rating services.
D. Friction between the servicer and the mortgagor: Adverse selection problem. This problem can be mitigated by the mortgagor applying due diligence on the servicer.

Correct Answer: A

Explanation: A is correct. Friction between the asset manager and the investor is a principal-agent problem. The investor is less sophisticated than the asset manager, does not fully understand the investment strategy of the asset manager, has uncertainty about the manager's ability, and does not observe any effort that the manager makes to conduct due diligence. Some of the ways to mitigate this friction is through the use of investment mandate, and the evaluation of manager performance relative to its peers or a peer benchmark.

B is incorrect. Friction between the arranger and originator is a predatory borrowing and lending problem.

C is incorrect. Friction between the investor and credit rating agencies is a model error problem.

D is incorrect. Friction between the servicer and the mortgagor is a moral hazard problem.

Section: Credit Risk Measurement and Management

Reference: Adam Ashcraft 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.

8. Large dealer banks have often financed significant fractions of their assets using short-term (overnight) repurchase agreements in which creditors hold bank securities as collateral against default losses. The table below shows the quarter-end financing of four A-rated broker-dealer banks (all values are in USD billion):

	Bank P	Bank Q	Bank R	Bank S
Financial Instruments Owned	339	656	835	750
Pledged as collateral	139	258	209	472
Not pledged	200	398	626	278

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 P
B. Bank Q
C. Bank R
D. Bank S

Correct Answer: D

Explanation:

	Bank P	Bank Q	Bank R	Bank S
Financial Instruments Owned	339	656	835	750
Pledged as collateral	139	258	209	472
Not pledged	200	398	626	278
Fraction Pledged	41%	39%	25%	63%

D is correct. 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. The bank may therefore be forced to sell its assets in a hurry to buyers that know it needs to sell quickly. This leads to the potential for a fire sale, and supports using the proportion of assets covered by repos as a signal of liquidity risk. Also, low prices recorded in a fire sale could lower the market valuation of securities not sold, and thus reduce the amount of cash that could be raised through repurchase agreements collateralized by those securities. Overall, this vulnerability is directly related to the proportion of assets a bank has pledged as collateral.

Bank S 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 (see additional discussions in the 2018 FRM Reading [OR-19], pages 353-358).

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.

9. A fixed-income portfolio manager at a financial institution has observed the price of one of the corporate bonds that the financial institution currently holds and wants to estimate the premium the financial institution needs to accept the default risk of the bond. The manager has determined that the bond's real-world default probability is 2.3%, its liquidity risk premium is 1.7%, and its risk-neutral default probability is 5.9%. Ignoring any other risk premiums that might affect the bond's pricing, what is the bond's default risk premium?

A. 1.9%
B. 3.6%
C. 4.0%
D. 4.2%

Correct Answer: A

Explanation: A is correct. Risk-neutral default probability = Real-world default probability + Default risk premium + Liquidity risk premium.

Therefore,

Default risk premium = Risk-neutral default probability - Real-world default probability - Liquidity risk premium

= 5.9% - 2.3% - 1.7% = 1.9%.

B is incorrect. 3.6% is the difference between the risk-neutral default probability and the real-world default probability.

C is incorrect. 4.0% is the sum of the real-world default probability and the liquidity risk premium.

D is incorrect. 4.2% is the difference between the risk-neutral default probability and the liquidity risk premium.

Section: Credit Risk Measurement and Management

Reference: Jon Gregory, The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, 3rd Edition (West Sussex, UK: John Wiley & Sons, 2015). Chapter 12 - Default Probabilities, Credit Spreads, and Funding Costs

Learning Objective: Calculate risk-neutral default probabilities, and compare the use of risk-neutral and real-world default probabilities in pricing derivative contracts.

10. A hedge fund risk manager plans to adopt an interest rate term structure model whose risk neutral dynamics display mean reversion and a time-varying drift and consider Vasicek model as one of the candidates. Which of the following is correct about the Vasicek model?

A. It gives rise to a downward-sloping term structure of volatility and allows for a time dependent drift.
B. The short-term rates tend toward a long run equilibrium value and the expected value of the change in short-term rates is always zero over time.
C. Shocks to short-term rates affect all rates equally, giving rise to parallel shifts.
D. There is no mean reversion and the risk premium corresponds to a constant drift in Vasicek model.

Correct Answer: A

Explanation: A is correct. The Vasicek model incorporates mean reversion. The flexibility of the model also allows for risk premium, which enters into the model as constant drift or a drift that changes over time. In a model with mean reversion, shocks to the short rate affect short-term rates more than longer-term rates and give rise to a downward-sloping term structure of volatility.

B is incorrect as the drift of Vasicek model is not always zero.

C is incorrect because shocks to the short rate affect short-term rates more than longer-term rates as Vasicek model comes with mean reversion.

D is incorrect. The Vasicek model incorporates mean reversion. The flexibility of the model also allows for risk premium, which enters into the model as a constant drift or a drift that changes over time.

Section: Market Risk Measurement and Management

Reference: Bruce Tuckman and Angel Serrat, Fixed Income Securities: Tools for Today's Markets, 3rd Edition (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 9 - The Art of Term Structure Models: Drift.

Learning Objective: Describe the process of constructing a simple and recombining tree for a short term rate under the Vasicek Model with mean reversion.

11. A risk manager is evaluating the risks of a portfolio of stocks. Currently, the portfolio is valued at CAD 248 million and contains CAD 15 million in stock T. The annualized standard deviations of returns of the overall portfolio and of stock T are 16% and 13%, respectively. The correlation of returns between the portfolio and stock T is 0.45. Assuming the risk analyst uses a 1-year 95% VaR and the returns are normally distributed, what is the component VaR of stock T?

A. CAD 0.096 million
B. CAD 1.444 million
C. CAD 2.041 million
D. CAD 3.948 million

Correct Answer: B

Explanation: B is correct. The component VaR for stock T ($CVaR_T$) can be presented as:

$CVaR_T = \rho_{T,p} * VaR_{T,}$

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

Let w_T represent the value of stock T; σ_T represent the standard deviation of stock T returns; $\alpha(95\%)$ represent the 95% confidence factor for the VaR estimate, which is 1.645. Hence,

$VaR_T = w_T * \sigma_T * \alpha(95\%)$ = CAD 15 million x 0.13 x 1.645 = CAD 3.2078 million.

Therefore,

$CVaR_T = \rho_{T,p} * VaR_T$ = 0.45 x 3.2078 = CAD 1.4435 million.

A is incorrect. 0.096 is the marginal VaR of stock T, calculated as follows: (0.45*0.13/0.16)*1.645*0.16. Marginal VaR measure is unitless.

C is incorrect. CAD 2.041 million is the component VaR of stock T if the manager incorrectly uses the 99% VaR, i.e. 15*0.13*2.326*0.45.

D is incorrect. CAD 3.948 million is the incremental VaR of stock T (assuming that the volatility of the portfolio without stock T remains 16% and the correlation of returns between stock T and the portfolio without stock T is 0.45). It is simply the weight of stock T in the portfolio multiplied by the portfolio VaR, i.e. (15/248)*(248*1.645*0.16).

Section: Risk Management and Investment Management

Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition. (New York, NY: 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.

12. A risk analyst constructs a binomial interest rate tree by using the Ho-Lee model. The time step is monthly, and the annualized drift is 60 bps in the first month and 130 bps in the second month. Assuming the current annualized short-term rate is 2.7% and the annual basis point-volatility is 1.9%, what is the interest rate in the lowest node after 2 months?

A. 1.44%
B. 1.76%
C. 2.31%
D. 2.54%

Correct Answer: B

Explanation: B is correct. The interest rate in the lowest node based on the Ho-Lee model is:

$$r_0 + (\lambda_1 + \lambda_2)dt - 2\sigma\sqrt{dt}$$

$$= 2.7\% + \frac{(0.6\% + 1.3\%)}{12} - 2 * 1.9\% * \sqrt{\frac{1}{12}}$$

$$= 0.017614 = 1.76\%$$

A is incorrect. This uses the incorrect formula $r_0 - (\lambda_1 + \lambda_2)dt - 2\sigma\sqrt{dt}$ dt to calculate the interest rate, subtracting instead of adding the second term in the formula.

C Is incorrect. This uses the incorrect formula $r_0 + (\lambda_1 + \lambda_2)dt - \sigma\sqrt{dt}$ to calculate the interest rate, forgetting to multiply by 2 in the third term.

D Is incorrect. This uses the incorrect formula $r_0 - (\lambda_1 + \lambda_2)dt$ to calculate the interest rate, omitting the third term entirely.

Section: Market Risk Measurement and Management

Reference: Bruce Tuckman and Angel Serrat, Fixed Income Securities: Tools for Today's Markets, 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.

13. 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 use its own estimates of recovery rates?

A. The standardized measurement approach for operational risk
B. The advanced internal ratings-based approach for credit risk
C. The foundation internal ratings-based approach for credit risk
D. The fundamental review of the trading book (FRTB) approach for securitized products

Correct Answer: B

Explanation: B is correct. Under the advanced internal ratings-based (Advanced IRB) approach banks supply their own estimates of probability of default (PD), loss given default (LGD) and exposure at default (EAD). Since LGD is dependent on recovery rates, this also implies that the recovery rates are modelled. On the other hand, under the foundation ratings based approach, they supply only PD, while LGD and EAD are set by the Basel Committee. So, C is incorrect.

A is incorrect. The standardized measurement approach for operational risk has eliminated the use of internal models for modelling operational risk.

D is incorrect. Basel II.5 introduced a Comprehensive Risk Measure for credit sensitive instruments dependent on credit correlation. Banks could use their internal models to calculate the CRM, with supervisory approval, and these models included the estimation of recovery rates. However, the FRTB withdrew the use of the CRM for securitized products due to there being too much volatility between different banks' models in modeling securitizations. Banks are now required to use the standardized approach for these products.

Section: Operational and Integrated Risk Management

Reference: John Hull, Risk Management and Financial Institutions, 5th Edition, (Hoboken, NJ: John Wiley & Sons, 2018). Chapter 15 - Basel I, Basel II, and Solvency II and Chapter 18 - Fundamental Review of the Trading Book.

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 capital: Standardized Measurement Method and Internal Models Approach.

Describe the changes to the Basel framework for calculating market risk capital under the Fundamental Review of the Trading Book (FRTB), and motivations for these changes

14. A regional commercial bank is considering a loan to be fully funded by deposits, with the following parameters:

- Loan amount: CNY 3.8 billion
- Average annual interest rate paid on deposits: 0.6%
- Annual interest rate received on loan: 4.1%
- Expected loss: 3.0% of face value of loan
- Annual operating costs: 0.3% of face value of loan
- Economic capital required to support the loan: 15.0%
- Average pre-tax return on economic capital: 2.0%
- Effective tax rate: 38%
- Other transfer costs: CNY 0

What is the after-tax RAROC for this loan?

A. 0.31%
B. 2.07%
C. 3.33%
D. 10.07%

Correct Answer: B

Explanation: B is correct. The risk-adjusted after-tax return on capital (RAROC) is computed by:

$$RAROC = \frac{After\_tax\ expected\ risk - adjusted\ net\ income}{Economic\ capital}$$

$$= \frac{ER + ROEC - IC - OC - EL - Taxes \pm Transfers}{Economic\ capital}$$

where,

Economic capital = CNY 3,800,000,000 x 0.15 = CNY 570,000,000,

ER = expected revenue = CNY 3,800,000,000 x 0.041 = CNY 155,800,000,

ROEC = pre-tax return on invested economic capital =

= Economic capital x 0.02 = CNY 570,000,000 x 0.02 = CNY 11,400,000,

IC = interest expense = CNY 3,800,000,000 x 0.006 = CNY 22,800,000,

OC = Operating Cost = CNY 3,800,000,000 x 0.003 = CNY 11,400,000,

EL = expected loss = CNY 3,800,000,000 x 0.03 = CNY 114,000,000,

Taxes = (Revenue + Income – Interest – Operating Cost – Loss)*(Tax rate)

= (155,800,000 + 11,400,000 – 22,800,000 – 11,400,000 – 114,000,000)*(0.38)

= (CNY 19,000,000)*(0.38) = CNY 7,220,000.

Therefore, numerator = 155,800,000 + 11,400,000 – 22,800,000 – 11,400,000 – 114,000,000 – 7,220,000 = CNY 11,780,000.

Thus,

$$RAROC = \frac{11{,}780{,}000}{570{,}000{,}000} = 0.0207 = 2.07\%$$

A is incorrect. 0.31% is the result obtained when the denominator is incorrectly taken to be CNY 3.8 billion instead of being 15% of the loan amount.

C is incorrect. 3.33% is the result obtained when taxes are ignored.

D is incorrect. 10.07% is the result obtained when IC is added instead of subtracting in the numerator.

Section: Operational and Integrated Risk Management

Reference: Michel Crouhy, Dan Galai and Robert Mark, The Essentials of Risk Management, 2nd Edition (New York, NY: McGraw-Hill, 2014). Chapter 17, Risk Capital Attribution and Risk-Adjusted Performance Measurement.

Learning Objective: Compute and interpret the RAROC for a project, loan, or loan portfolio, and use RAROC to compare business unit performance.

15. A CRO of a hedge fund asks the risk team to develop a term-structure model that is appropriate for fitting interest rates for use in the fund's options pricing practice. The risk team evaluates several interest rate models with drift and volatility functions. Which of the following is a correct description of the specified model?

A. In the Ho-Lee model, the drift of the interest rate process is presumed to be constant.
B. In the Ho-Lee model, short term rates are presumed to have a mean-reversion function.
C. In the Cox-Ingersoll-Ross model, short term rates are presumed to have a lognormal distribution.
D. In the Cox-Ingersoll-Ross model, the basis-point volatility of the short term rate is presumed to be proportional to the square root of the rate.

Correct Answer: D

Explanation: D is correct. In the CIR model, the basis-point volatility of the short rate equals σ*sqrt(r) and therefore increases as a function of the square root of the rate.

A is incorrect. In the Ho-Lee model, the drift of the interest rate process is presumed to be time-varying.

B is incorrect. The Ho-Lee model does not incorporate mean reversion

C is incorrect. The distribution of the short rate in the Cox-Ingersoll-Ross model is not lognormal.

Section: Market Risk Measurement and Management

Reference: Bruce Tuckman and Angel Serrat, Fixed Income Securities, 3rd Edition (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 9 - The Art of Term Structure Models: Drift.

Bruce Tuckman and Angel Serrat, Fixed Income Securities, 3rd Edition (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 10 - The Art of Term Structure Models: Volatility and Distribution.

Learning Objective: Describe methods for addressing the possibility of negative short-term rates in term structure models.

Construct a short-term rate tree under the Ho-Lee Model with time-dependent drift.

Describe the short-term rate process under the Cox-Ingersoll-Ross (CIR) and lognormal models.

16. The director of an equity mutual fund is reviewing a portfolio construction technique proposed by a new portfolio manager who has recently been allocated capital to manage. The fund typically grants its portfolio managers flexibility in selecting and implementing appropriate portfolio construction procedures but requires that any methodology adopted fulfills key risk control objectives set by the firm. Which of the following portfolio construction techniques and its capability for 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 portfolio construction techniques 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: A is correct. 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 and the less than perfect nature of most data, it introduces the potential for noise and poor calibration.

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 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, NY: 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.

17. A risk manager has asked a junior analyst to estimate the implied default probability for a BBB-rated discount corporate bond. The continuously compounded annual yields of other fixed-income securities are given below:

- 3-year Treasury note (a risk-free bond): 2%
- 1-year BBB-rated discount bond: 4%
- 2-year BBB-rated discount bond: 7%
- 3-year BBB-rated discount bond: 10%

If the recovery rate on the 3-year BBB-rated bond is expected to be 0% in the event of default, which of the following is the best estimate of the risk-neutral probability that the BBB-rated discount bond defaults within the next 3 years?

A. 6.55%
B. 14.55%
C. 21.34%
D. 25.92%

Correct Answer: C

Explanation: C is correct. The continuously compounded 3-year spread for the BBB-rated discount bond is 0.10 - 0.02 = 0.08 per year. Note that hazard rate = λ = spread/(1 – recovery rate) = spread = 8% per year (given that recovery rate is zero).

Thus, the risk-neutral probability that the corporate bond will default within the next 3 years is: 1 – exp(-λ*t) = 1 - exp(-0.08*3) = 21.34%.

A is incorrect. 6.55% is the marginal probability of default in year 3 for the 3-year BBB-rated bond.

B is incorrect. 14.55% is the 3-year cumulative probability of default of the 3-year BBB-rated bond while incorrectly using the credit spreads of the 1-year, 2-year, and 3-year BBB-rated bonds, and also failing to scale the hazard rates (credit spreads) by the factor of time, i.e., 1-exp(-0.02) + 1-exp(-0.05) + 1 – exp(-0.08).

D is incorrect. 25.92% is the result obtained if the hazard rate for the 3-year BBB-rated bond is taken as equal to its annual yield of 10%.

Section: Credit Risk Measurement and Management

Reference: Jon Gregory, The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, 3rd Edition (West Sussex, UK: John Wiley & Sons, 2015). Chapter 12 - Default Probabilities, Credit Spreads, and Funding Costs

Learning Objective: Calculate risk-neutral default probabilities, and compare the use of risk-neutral and real-world default probabilities in pricing derivative contracts.

18. A bank is using the VaR and stressed VaR market risk framework in line with the Basel II.5 guidelines. The bank's internal models for market risk have 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%	289	501	271	572
99.0%	513	993	489	1,187
99.9%	607	1,347	564	1,412

Assuming the supervisory authority has set the multiplication factors for both the VaR and the stressed VaR values to 3, what is the correct capital requirement for general market risk for the bank under Basel II.5?

A. USD 1,248 million
B. USD 1,533 million
C. USD 4,557 million
D. USD 5,028 million

Correct Answer: D

Explanation: D is correct. The revised market risk capital requirement (at 99.0% level) is:

Market Risk Capital

$= \max(VaR_{t-1}, m_c * VaR_{60\text{-day Avg}}) + \max(sVaR_{t-1}, m_s * sVaR_{60\text{-day Avg}})$

= max(513, 3*489) + max(993, 3*1,187)
= USD 1,467 million + USD 3,561 million
= USD 5,028 million

Section: Operational and Integrated Risk Management

Reference: John Hull, Risk Management and Financial Institutions, 5th Edition (New York, NY: John Wiley & Sons, 2018). Chapter 16 - Basel II.5, Basel III, and Other Post-Crisis Changes.

Learning Objective: Describe and calculate the stressed VaR introduced in Basel 2.5, and calculate the market risk capital charge.

19. Bank HJK has written puts on Bank PQR stock to a hedge fund and sold CDS protection on Bank PQR to a manufacturer. Bank HJK and Bank PQR operate in several of the same businesses and geographies and their performances are highly correlated. Many in the market are concerned that rising interest rates could negatively impact the credit quality of Bank HJK's numerous borrowers, which in turn would increase the credit spread of Bank HJK. From the perspectives of the hedge fund and the manufacturer, which of the following is correct with respect to their counterparty risk exposure to Bank HJK?

	Hedge Fund	Manufacturer
A.	Right-way risk	Right-way risk
B.	Right-way risk	Wrong-way risk
C.	Wrong-way risk	Right-way risk
D.	Wrong-way risk	Wrong-way risk

Correct Answer: D

Explanation: The hedge fund has wrong-way risk. As interest rates rise, both Bank HJK's and Bank PQR's equity value would decline since the performances of the two banks are highly correlated. Therefore, the value of the long put option on PQR would increase, resulting in a higher exposure to bank HJK for the hedge fund. This is a wrong-way risk since the hedge fund's exposure to HJK would be increasing as the credit quality of HJK is declining.

The manufacturer also has wrong-way risk. Since the credit spread of Bank HJK is increasing and credit spreads of different banks in the same market tend to be positively correlated, the credit spread of Bank PQR should also increase. Therefore, the value of the manufacturer's long CDS position on Bank PQR is increasing at the same time the credit quality of Bank HJK is decreasing; thus, that is wrong-way risk.

Section: Credit Risk Measurement and Management

Reference: Jon Gregory, The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, 3rd Edition (West Sussex, UK: John Wiley & Sons, 2015). Chapter 17 - Wrong-way Risk.

Learning Objective: Identify examples of wrong-way risk and examples of right-way risk.

Describe wrong-way risk and contrast it with right-way risk.

20. A wealth management firm has JPY 86 billion in assets under management. The portfolio manager computes the daily VaR at various confidence levels as follows:

Confidence Level	VaR (JPY)
95.0%	397,463,000
95.5%	401,682,500
96.0%	406,224,500
96.5%	418,453,000
97.0%	428,934,000
97.5%	439,415,500
98.0%	451,993,000
98.5%	468,763,000
99.0%	490,773,000
99.5%	524,663,000

What is the closest estimate of the daily ES at the 97.5% confidence level?

A. JPY 398 million
B. JPY 400 million
C. JPY 484 million
D. JPY 497 million

Correct Answer: C

Explanation: C is correct. 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 97.5%. Therefore,

ES = (451,993,000+468,763,000+490,773,000+524,663,000)/4 = JPY 484,048,000

Section: Market Risk Measurement and Management

Reference: Kevin Dowd, Measuring Market Risk, 2nd Edition (West Sussex, UK: 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.

The remainder of this page is intentionally left blank.

FRM PRACTICE EXAM PART II

Table of Contents

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 2019 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 2019. These Practice Exams are based on a sample of questions from prior FRM Exams and are suggestive of the questions that will be on the 2019 FRM Exam.

The 2019 FRM Part I Practice Exam contains 100 multiple-choice questions and the 2019 FRM Part II Practice Exam contains 80 multiple-choice questions, the same number of questions that the actual 2019 FRM Exam Part I and 2019 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 2019 FRM Practice Exams do not necessarily cover all topics to be tested in the 2019 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 2019 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 2019 FRM Exam Study Guide and 2019 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 2019 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.

Reference Table: Let Z be a standard normal random variable.

z	P(Z<z)	z	P(Z<z)	z	P(Z<z)	z	P(Z<z)	z	P(Z<z)	z	P(Z<z)
-3	0.0013	-2.50	0.0062	-2.00	0.0228	-1.50	0.0668	-1.00	0.1587	-0.50	0.3085
-2.99	0.0014	-2.49	0.0064	-1.99	0.0233	-1.49	0.0681	-0.99	0.1611	-0.49	0.3121
-2.98	0.0014	-2.48	0.0066	-1.98	0.0239	-1.48	0.0694	-0.98	0.1635	-0.48	0.3156
-2.97	0.0015	-2.47	0.0068	-1.97	0.0244	-1.47	0.0708	-0.97	0.1660	-0.47	0.3192
-2.96	0.0015	-2.46	0.0069	-1.96	0.0250	-1.46	0.0721	-0.96	0.1685	-0.46	0.3228
-2.95	0.0016	-2.45	0.0071	-1.95	0.0256	-1.45	0.0735	-0.95	0.1711	-0.45	0.3264
-2.94	0.0016	-2.44	0.0073	-1.94	0.0262	-1.44	0.0749	-0.94	0.1736	-0.44	0.3300
-2.93	0.0017	-2.43	0.0075	-1.93	0.0268	-1.43	0.0764	-0.93	0.1762	-0.43	0.3336
-2.92	0.0018	-2.42	0.0078	-1.92	0.0274	-1.42	0.0778	-0.92	0.1788	-0.42	0.3372
-2.91	0.0018	-2.41	0.0080	-1.91	0.0281	-1.41	0.0793	-0.91	0.1814	-0.41	0.3409
-2.9	0.0019	-2.40	0.0082	-1.90	0.0287	-1.40	0.0808	-0.90	0.1841	-0.40	0.3446
-2.89	0.0019	-2.39	0.0084	-1.89	0.0294	-1.39	0.0823	-0.89	0.1867	-0.39	0.3483
-2.88	0.0020	-2.38	0.0087	-1.88	0.0301	-1.38	0.0838	-0.88	0.1894	-0.38	0.3520
-2.87	0.0021	-2.37	0.0089	-1.87	0.0307	-1.37	0.0853	-0.87	0.1922	-0.37	0.3557
-2.86	0.0021	-2.36	0.0091	-1.86	0.0314	-1.36	0.0869	-0.86	0.1949	-0.36	0.3594
-2.85	0.0022	-2.35	0.0094	-1.85	0.0322	-1.35	0.0885	-0.85	0.1977	-0.35	0.3632
-2.84	0.0023	-2.34	0.0096	-1.84	0.0329	-1.34	0.0901	-0.84	0.2005	-0.34	0.3669
-2.83	0.0023	-2.33	0.0099	-1.83	0.0336	-1.33	0.0918	-0.83	0.2033	-0.33	0.3707
-2.82	0.0024	-2.32	0.0102	-1.82	0.0344	-1.32	0.0934	-0.82	0.2061	-0.32	0.3745
-2.81	0.0025	-2.31	0.0104	-1.81	0.0351	-1.31	0.0951	-0.81	0.2090	-0.31	0.3783
-2.8	0.0026	-2.30	0.0107	-1.80	0.0359	-1.30	0.0968	-0.80	0.2119	-0.30	0.3821
-2.79	0.0026	-2.29	0.0110	-1.79	0.0367	-1.29	0.0985	-0.79	0.2148	-0.29	0.3859
-2.78	0.0027	-2.28	0.0113	-1.78	0.0375	-1.28	0.1003	-0.78	0.2177	-0.28	0.3897
-2.77	0.0028	-2.27	0.0116	-1.77	0.0384	-1.27	0.1020	-0.77	0.2206	-0.27	0.3936
-2.76	0.0029	-2.26	0.0119	-1.76	0.0392	-1.26	0.1038	-0.76	0.2236	-0.26	0.3974
-2.75	0.0030	-2.25	0.0122	-1.75	0.0401	-1.25	0.1056	-0.75	0.2266	-0.25	0.4013
-2.74	0.0031	-2.24	0.0125	-1.74	0.0409	-1.24	0.1075	-0.74	0.2296	-0.24	0.4052
-2.73	0.0032	-2.23	0.0129	-1.73	0.0418	-1.23	0.1093	-0.73	0.2327	-0.23	0.4090
-2.72	0.0033	-2.22	0.0132	-1.72	0.0427	-1.22	0.1112	-0.72	0.2358	-0.22	0.4129
-2.71	0.0034	-2.21	0.0136	-1.71	0.0436	-1.21	0.1131	-0.71	0.2389	-0.21	0.4168
-2.7	0.0035	-2.20	0.0139	-1.70	0.0446	-1.20	0.1151	-0.70	0.2420	-0.20	0.4207
-2.69	0.0036	-2.19	0.0143	-1.69	0.0455	-1.19	0.1170	-0.69	0.2451	-0.19	0.4247
-2.68	0.0037	-2.18	0.0146	-1.68	0.0465	-1.18	0.1190	-0.68	0.2483	-0.18	0.4286
-2.67	0.0038	-2.17	0.0150	-1.67	0.0475	-1.17	0.1210	-0.67	0.2514	-0.17	0.4325
-2.66	0.0039	-2.16	0.0154	-1.66	0.0485	-1.16	0.1230	-0.66	0.2546	-0.16	0.4364
-2.65	0.0040	-2.15	0.0158	-1.65	0.0495	-1.15	0.1251	-0.65	0.2578	-0.15	0.4404
-2.64	0.0041	-2.14	0.0162	-1.64	0.0505	-1.14	0.1271	-0.64	0.2611	-0.14	0.4443
-2.63	0.0043	-2.13	0.0166	-1.63	0.0516	-1.13	0.1292	-0.63	0.2643	-0.13	0.4483
-2.62	0.0044	-2.12	0.0170	-1.62	0.0526	-1.12	0.1314	-0.62	0.2676	-0.12	0.4522
-2.61	0.0045	-2.11	0.0174	-1.61	0.0537	-1.11	0.1335	-0.61	0.2709	-0.11	0.4562
-2.6	0.0047	-2.10	0.0179	-1.60	0.0548	-1.10	0.1357	-0.60	0.2743	-0.10	0.4602
-2.59	0.0048	-2.09	0.0183	-1.59	0.0559	-1.09	0.1379	-0.59	0.2776	-0.09	0.4641
-2.58	0.0049	-2.08	0.0188	-1.58	0.0571	-1.08	0.1401	-0.58	0.2810	-0.08	0.4681
-2.57	0.0051	-2.07	0.0192	-1.57	0.0582	-1.07	0.1423	-0.57	0.2843	-0.07	0.4721
-2.56	0.0052	-2.06	0.0197	-1.56	0.0594	-1.06	0.1446	-0.56	0.2877	-0.06	0.4761
-2.55	0.0054	-2.05	0.0202	-1.55	0.0606	-1.05	0.1469	-0.55	0.2912	-0.05	0.4801
-2.54	0.0055	-2.04	0.0207	-1.54	0.0618	-1.04	0.1492	-0.54	0.2946	-0.04	0.4840
-2.53	0.0057	-2.03	0.0212	-1.53	0.0630	-1.03	0.1515	-0.53	0.2981	-0.03	0.4880
-2.52	0.0059	-2.02	0.0217	-1.52	0.0643	-1.02	0.1539	-0.52	0.3015	-0.02	0.4920
-2.51	0.0060	-2.01	0.0222	-1.51	0.0655	-1.01	0.1562	-0.51	0.3050	-0.01	0.4960

Special Instructions and Definitions

1. Unless otherwise indicated, interest rates are assumed to be continuously compounded.
2. Unless otherwise indicated, option contracts are assumed to be on one unit of the underlying asset.
3. bp(s) = basis point(s)
4. CAPM = capital asset pricing model
5. CCP = central counterparty or central clearing counterparty
6. CDO = collateralized debt obligation(s)
7. CDS = credit default swap(s)
8. CEO, CFO, CIO, and CRO are: chief executive, financial, investment, and risk officers, respectively
9. CVA = credit value adjustment
10. ERM = enterprise risk management
11. ES = expected shortfall
12. EWMA = exponentially weighted moving average
13. GARCH = generalized auto-regressive conditional heteroskedasticity
14. LIBOR = London interbank offered rate
15. MBS = mortgage-backed-security(securities)
16. OIS = overnight indexed swap
17. OTC = over-the-counter
18. RAROC = risk-adjusted return on capital
19. VaR = value-at-risk
20. The following acronyms are used for selected currencies:

Acronym	Currency
AUD	Australian dollar
BRL	Brazilian real
CAD	Canadian dollar
CNY	Chinese yuan
EUR	euro

Acronym	Currency
GBP	British pound sterling
INR	Indian rupee
JPY	Japanese yen
SGD	Singapore dollar
USD	US dollar

2019 FRM Part II Practice Exam – Candidate Answer Sheet

1.		21.		41.		61.	
2.		22.		42.		62.	
3.		23.		43.		63.	
4.		24.		44.		64.	
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. A regional bank is formalizing its policies and procedures to help identify and analyze the risk of potential money laundering transactions. Of special interest is accounting for customers' backgrounds when determining customer acceptance policies. According to Basel Committee guidelines, which of the following correctly describes a best practice that the bank should use in identifying, verifying and profiling customers to help mitigate money laundering risk?

A. The bank does not need to apply due diligence on a customer if the bank receives funds from that customer's account at another bank that is subject to the same customer due diligence standards.
B. The bank should apply the same due diligence measures to all customers regardless of their jurisdiction and the nature of their relationship with the bank to prevent discrimination.
C. The bank should apply its due diligence process not just to potential customers but also to beneficial owners of the proposed customer accounts and persons acting on their behalf.
D. The bank should not open an account for or conduct business with a customer who wants to remain anonymous to the bank except for confidential "numbered accounts" that function as anonymous.

2. A risk manager is estimating the market risk of a portfolio using both the arithmetic returns with normal distribution assumptions and the geometric returns with lognormal distribution assumptions. The manager gathers the following data on the portfolio:

• Annualized average of arithmetic returns: 12%

• Annualized standard deviation of arithmetic returns: 30%

• Annualized average of geometric returns: 11%

• Annualized standard deviation of geometric returns: 41%

• Current portfolio value: EUR 5,200,000

• Trading days in a year: 252

Assuming both daily arithmetic returns and daily geometric returns are serially independent, which of the following statements is correct?

A. 1-day normal 95% VaR = 3.06% and 1-day lognormal 95% VaR = 4.12%
B. 1-day normal 95% VaR = 3.57% and 1-day lognormal 95% VaR = 4.41%
C. 1-day normal 95% VaR = 4.12% and 1-day lognormal 95% VaR = 3.57%
D. 1-day normal 95% VaR = 4.46% and 1-day lognormal 95% VaR = 4.49%

3. A credit manager in the counterparty risk division of a large bank uses a simplified version of the Merton model to monitor the relative vulnerability of its largest counterparties to changes in their valuation and financial conditions. To assess the risk of default of three particular counterparties, the manager calculates the distance to default assuming a 1-year horizon (t=1). The counterparties: Company P, Company Q, and Company R, belong to the same industry, and are non-dividend-paying firms. Selected information on the companies is provided in the table below:

Company	**P**	**Q**	**R**
Market value of assets (EUR million)	100	150	250
Face value of debt (EUR million)	60	100	160
Annual volatility of asset values	10.0%	7.0%	8.0%

Using the information above with the assumption that a zero-coupon bond maturing in 1 year is the only liability for each company, and the approximation formula of the distance to default, what is the correct ranking of the counterparties, from most likely to least likely to default?

A. P; R; Q
B. Q; P; R
C. Q; R; P
D. R; Q; P

4. Bank HJK has written puts on Bank PQR stock to a hedge fund and sold CDS protection on Bank PQR to a manufacturer. Bank HJK and Bank PQR operate in several of the same businesses and geographies and their performances are highly correlated. Many in the market are concerned that rising interest rates could negatively impact the credit quality of Bank HJK's numerous borrowers, which in turn would increase the credit spread of Bank HJK. From the perspectives of the hedge fund and the manufacturer, which of the following is correct with respect to their counterparty risk exposure to Bank HJK?

	Hedge Fund	Manufacturer
A.	Right-way risk	Wrong-way risk
B.	Wrong-way risk	Right-way risk
C.	Right-way risk	Right-way risk
D.	Wrong-way risk	Wrong-way risk

5. Bank JJQ, a member of a CCP, sells credit protection on a GBP 100 million counterparty position using CDS. The reference entity is a gold mining company. Which of the following trades by Bank JJQ on the same reference entity would be a hedge to transfer credit risk with minimal increase in counterparty risk?

A. Buy a credit-linked note
B. Buy a total return swap
C. Sell a credit-linked note
D. Sell a total return swap

6. An investment bank has a one-way credit support annex (CSA) on a bilateral transaction with a hedge fund counterparty. Under the terms of the CSA, the mark-to-market value of the transaction forms the basis of the hedge fund's collateral requirements, which are provided below:

	Value (CNY)
Mark-to-market value of net exposure	25,000,000
Mark-to-market value of collateral posted	10,800,000
Threshold amount	14,000,000
Minimum transfer amount	2,500,000
Rounding amount	10,000

Assuming the net exposure increases to CNY 27,000,000 and the mark-to-market value of collateral posted has not changed, how much additional collateral will the hedge fund have to post?

A. CNY 0
B. CNY 1,990,000
C. CNY 2,000,000
D. CNY 2,500,000

7. The board of directors of an insurance company has identified a number of potential growth opportunities for the company to consider. To help assess these opportunities and determine an optimal risk structure to use across the organization, the risk committee has recommended that the company implement an ERM program. Which of the following would best represent an appropriate goal for the firm to state as part of the ERM program?

A. Determine a risk-return trade-off that reflects the company's target credit rating and ensure that business unit managers evaluate new projects with this firm-wide target in mind.
B. Attempt to eliminate the company's probability of financial distress to maximize company value.
C. Maximize the firm's leverage ratio within its risk tolerance to ensure the highest expected return on equity.
D. Establish a target minimum level of annual earnings and guarantee to shareholders that it will maintain this level.

8. A US pension fund had assets and liabilities valued at USD 840 million and USD 450 million, respectively, at the end of 2017. The fund's assets were fully invested in equities and commodities while its liabilities consisted entirely of fixed-income obligations. The fund reported that by the end of 2018 the value of assets decreased by 14.0% and the value of liabilities increased by 3.5%. Assuming no changes were made to the composition of the assets and liabilities during the year, what was the change in the pension fund's surplus over the 1-year period?

A. USD -133.4 million
B. USD -117.6 million
C. USD 256.7 million
D. USD 390.0 million

9. A wealth management firm has a portfolio consisting of USD 37 million invested in US equities and USD 48 million invested in emerging markets equities. The US equities and emerging markets equities both have a 1-day 95% VaR of USD 1.3 million. The correlation between the returns of the US equities and emerging markets equities is 0.25. While rebalancing the portfolio, the manager in charge decides to sell USD 7 million of the US equities to buy USD 7 million of the emerging markets equities. At the same time, the CRO of the firm advises the portfolio manager to change the risk measure from 1-day 95% VaR to 10-day 99% VaR. Assuming that returns are normally distributed and that the rebalancing does not affect the volatility of the individual equity positions, by how much will the portfolio VaR increase due to the combined effect of portfolio rebalancing and change in risk measure?

A. USD 4.373 million
B. USD 6.428 million
C. USD 7.034 million
D. USD 9.089 million

10. An operational risk manager is asked to report a bank's operational risk capital under the Standardized Measurement Approach (SMA) proposed by the Basel Committee in March 2016. The treasury department produces the following data for the bank, calculated according to the SMA guidelines:

- Business Indicator (BI): EUR 1,200 million
- Internal Loss Multiplier: 1

In addition, the manager uses the Business Indicator buckets in the Business Component presented in the table below:

Bucket	BI Range	BI Component
1	EUR 0 to EUR 1 billion	0.12*BI
2	EUR 1 billion to EUR 30 billion	EUR 120 million + 0.15(BI – EUR 1 billion)
3	EUR 30 billion to infinity	EUR 4.47 billion + 0.18(BI – EUR 30 billion)

What is the correct operational risk capital that the bank should report under the SMA?

A. EUR 120 million

B. EUR 150 million

C. EUR 158 million

D. EUR 180 million

11. A credit manager who is well versed in lessons learned from the 2007–2009 subprime mortgage crisis in the US is overseeing the structured credit book of a bank in order to identify potential problems of information flow (frictions) between the parties involved in the securitization process. Which of the following is a correct combination of a potential friction in the securitization process and an appropriate mechanism to mitigate that friction?

A. Friction between the asset manager and the investor: Adverse selection problem. This problem can be mitigated by the asset manager charging due diligence fees to the investor.

B. Friction between the arranger and the originator: Model error problem. This problem can be mitigated by the arranger providing a credit enhancement to the securitized products with its own funding.

C. Friction between the investor and credit rating agencies: Principal-agent conflict. This problem can be mitigated by requiring credit rating agencies to be paid by originators and not by investors for their rating services.

D. Friction between the servicer and the mortgagor: Moral hazard problem. This problem can be mitigated by requiring the mortgagor to escrow funds for insurance and tax payments.

12. A risk manager is backtesting a company's 1-day 99.5% VaR model over a 10-year horizon at the 95% confidence level. Assuming 250 trading days in a year and the daily returns are independently and identically distributed, which of the following is closest to the maximum number of daily losses exceeding the 1-day 99.5% VaR in 10 years that is acceptable to conclude that the model is calibrated correctly?

A. 19
B. 25
C. 35
D. 39

13. A portfolio manager is mapping a fixed-income portfolio into exposures on selected risk factors. The manager is analyzing the comparable mechanics and risk measurement outputs of principal mapping, duration mapping, and cash-flow mapping. Which of the following is correct?

A. Cash-flow mapping groups cash flows into buckets based on their size.
B. Cash-flow mapping uses the average rates in each risk group as a discount factor.
C. Principal mapping incorporates correlations among zero-coupon bonds.
D. Duration mapping replaces the portfolio with a zero-coupon bond with maturity equal to the duration of the portfolio.

14. A CRO of a hedge fund is asking the risk team to develop a term-structure model that is appropriate for fitting interest rates for use in the fund's options pricing practice. The risk team is evaluating several interest rate models with time-dependent drift and time-dependent volatility functions. Which of the following is a correct description of the specified model?

A. In the Ho-Lee model, the drift of the interest rate process is presumed to be constant.
B. In the Ho-Lee model, when the short-term rate is above its long-run equilibrium value, the drift is presumed to be negative.
C. In the Cox-Ingersoll-Ross model, the basis-point volatility of the short-term rate is presumed to be proportional to the square root of the rate, and short-term rates cannot be negative.
D. In the Cox-Ingersoll-Ross model, the volatility of the short-term rate is presumed to decline exponentially to a constant long-run level.

15. Six months ago, Textile Manufacturing Inc. (TMI) entered into a 9-month forward contract with Spin Mills Company (SMC) to purchase 36,000 tons of yarn from SMC. At the time the forward was entered into, 36,000 tons of yarn was priced at EUR 92.0 million but is currently priced at EUR 94.0 million. The continuously compounded risk-free rate has remained stable at 3.0% per year and is not expected to change during the remainder of the contract period. Assuming the forward is fairly priced, what is the current potential credit risk exposure on the forward contract and who bears the risk?

A. EUR 0.610 million; TMI bears the potential credit risk
B. EUR 0.610 million; SMC bears the potential credit risk
C. EUR 1.308 million; TMI bears the potential credit risk
D. EUR 1.308 million; SMC bears the potential credit risk

16. A mid-sized investment bank conducts several trades. As part of its risk control, it has entered into netting agreements on 8 equity trade positions with an average correlation of 0.28. The firm believes that it can improve upon the diversification benefit of netting by revising the current agreement. Assuming values of future trade positions are normally distributed, 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
ABC	4	0.25
LMN	7	0.15
PQR	13	-0.06
TUV	15	-0.04

A. Trade combination ABC
B. Trade combination LMN
C. Trade combination PQR
D. Trade combination TUV

17. A portfolio manager is interested in liquidating Stock ASX from an existing portfolio. However, the manager is concerned about the level of liquidity risk and proceeds to estimate LVaR for the stock. The manager observes a quote for Stock ASX and reports that the midpoint of its current best bid and best ask prices is AUD 47. Stock ASX has an estimated daily return volatility of 0.32% and an average bid-ask spread of AUD 0.18. Using the constant spread approach on a position of 15,000 shares of Stock ASX, and assuming the returns of the stock are normally distributed, which is closest to the correct estimate for the stock's liquidity-adjusted 1-day 99% VaR?

A. AUD 2,700
B. AUD 6,600
C. AUD 12,400
D. AUD 15,100

18. A manager is evaluating the risks of a portfolio of stocks. Currently, the portfolio is valued at CNY 124 million and contains CNY 14 million in stock Y. The annualized standard deviations of returns of the overall portfolio and of stock Y are 16% and 12%, respectively. The correlation of returns between the portfolio and stock Y is 0.52. Assuming the risk analyst uses a 1-year 95% VaR and the returns are normally distributed, what is the component VaR of stock Y?

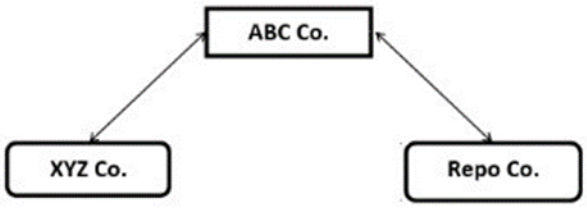
A. CNY 0.103 million
B. CNY 1.437 million
C. CNY 2.032 million
D. CNY 3.685 million

QUESTIONS 19 AND 20 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 XYZ also has a large line of credit with. ABC 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 of credit had been frozen. XYZ learned that ABC had been defrauded by Repo Co., another of its repo borrowers, 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:



19. 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.

20. By using a clearinghouse to handle the repo transactions between ABC Co. 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.

21. A risk manager at a fund management company is discussing potential weaknesses in the company's risk measurement system with the risk team. Among the areas suggested for improvement is the ability to better anticipate the company's cash flow needs, so the manager recommends implementation of a liquidity-at-risk (LaR) measurement system into the firm's risk management framework. Which of the following statements concerning LaR is correct?

A. A firm's LaR tends to increase as its credit quality declines.
B. For a hedged portfolio, the LaR will typically be smaller than the VaR.
C. Hedging using futures has the same impact on LaR as hedging using long options.
D. Entering into collateralized financial contracts such as swaps decreases the LaR of a firm.

22. 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 basic indicator approach for operational risk
B. The standardized approach for market risk
C. The internal models approach for market risk
D. The standardized approach for operational risk

23. The risk audit committee of an equity mutual fund is reviewing a portfolio construction technique proposed by a new portfolio manager who has recently been allocated capital to manage. The fund typically grants its portfolio managers flexibility in selecting and implementing appropriate portfolio construction procedures but requires that any methodology adopted fulfills key risk control objectives set by the firm. Which of the following portfolio construction techniques and its capability for 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 portfolio construction techniques 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.

24. 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 40 million:

Pension	Assets	Liabilities
Amount (USD million)	180	140
Expected annual growth rate	6%	10%
Annual volatility of growth rates	25%	12%

To evaluate the sufficiency of the fund's surplus, the advisor estimates the possible surplus values at the end of 1 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 0.68. Assuming that the volatility of surplus in dollar is USD 35.76 million, what is the lower bound of the 95% confidence interval for the expected end-of-year surplus that the advisor can report?

A. USD -76.4 million
B. USD -58.2 million
C. USD -33.3 million
D. USD -22.0 million

25. 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 appropriate criteria the specialist should use 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.

26. A packaging materials manufacturer is considering a project that has an estimated risk-adjusted return on capital (RAROC) of 15%. Suppose that the risk-free rate is 3% per year, the expected market rate of return is 11% per year, and the company's equity beta is 1.8. 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 risk-free rate.
D. Accept the project because the ARAROC is lower than the risk-free rate.

27. A derivative trading firm 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

28. HIP Bank (HIP) often enters into interest rate swaps with ADB Banking Corporation (ADB) on terms that reflect appropriate counterparty risk. Earlier in the year, HIP and ADB entered into a 3-year swap in which ADB agreed to pay HIP a fixed rate of 5% in return for 6-month LIBOR plus a spread. Since the swap was entered into, both banks were downgraded. As a result of the ratings changes, the credit spread for HIP has increased from 36 bps to 144 bps, while the credit spread for ADB has increased from 114 bps to 156 bps. Assuming no change in the LIBOR curve, if an identical 3-year swap was entered into today, which of the following is the most likely to be correct?

A. Since HIP's spread increased more than ADB's spread, HIP's DVA will increase and ADB's DVA will decrease.
B. Since HIP's spread increased more than ADB's spread, HIP's CVA will increase and ADB's CVA will decrease.
C. Since both banks' spreads increased, the CVA on both sides of the contract will be higher.
D. Since both banks' spreads increased, the DVA on both sides of the contract will be lower.

29. A risk analyst estimates that the hazard rate for a company is 0.12 per year. Assuming a constant hazard rate model, what is the probability that the company will survive in the first year and then default before the end of the second year?

A. 8.9%
B. 10.0%
C. 11.3%
D. 21.3%

30. 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 mapping technique for the given positions is the most appropriate?

A. USD/EUR forward contracts are mapped to the USD/EUR spot exchange rate.
B. Each position in a corporate bond portfolio is mapped to the bond with the closest maturity among a set of government bonds.
C. Zero-coupon government bonds are mapped to government bonds paying regular coupons.
D. A position in the stock market index is mapped to a position in a stock within that index.

31. A market risk manager seeks to calculate the price of a 2-year zero-coupon bond. The 1-year interest rate today is 10.0%. There is a 50% probability that the 1-year interest rate will be 12.0% and a 50% probability that it will be 8.0% in 1 year. Assuming that the risk premium of duration risk is 50 bps each year, and that the bond's face value is EUR 1,000, which of the following should be the price of the zero-coupon bond?

A. EUR 822.98
B. EUR 826.74
C. EUR 905.30
D. EUR 921.66

32. A financial analyst is pricing a 5-year call option on a 5-year Treasury note using a successfully validated pricing model. Current interest rate volatility is high and the analyst 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. When short-term rates are negative, the financial analyst adjusts the risk-neutral probabilities.
B. When short-term rates are negative, the financial analyst increases the volatility.
C. When short-term rates are negative, the financial analyst sets the rate to zero.
D. When short-term rates are negative, the financial analyst sets the mean-reverting parameter to 1.

33. An investment bank has been using VaR as its main risk measurement tool. 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. For the same confidence level, ES is always greater than VaR.
B. If a VaR backtest at a specified confidence level is accepted, then the corresponding ES will always be accepted.
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. While ES is more complicated to calculate than VaR, it is easier to backtest than VaR.

34. A derivative 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 3-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 4 years using the RiskMetrics EWMA method.

For testing purposes, the new model is used in parallel with the existing model for 6 weeks to estimate the 1-day 99% VaR. After 6 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.

Which of the following statements is a correct conclusion for this replacement?

A. Delta-normal VaR is more appropriate than historical simulation VaR for assets with non-linear payoffs.
B. Changing the look-back period and weighting scheme from 3 years, equally weighted, to 4 years, exponentially weighted, will understate the risk in the portfolio.
C. Overnight examination by the junior analyst increased the desk's exposure to model risk due to the potential for incorrect calibration and programming errors.
D. A 99% VaR model that generates no exceedances in 6 weeks is necessarily conservative.

35. The senior management team of a small regional bank has established a committee to review procedures and implement best practices related to entering into significant contracts with third-party vendors. The committee is reviewing one proposed relationship with a third-party vendor who would have a significant responsibility for marketing the bank's financial products to potential customers. In establishing policies to reduce the operational risk associated with this potential vendor contract, which of the following recommendations would be most appropriate?

A. The bank should review all third-party audit reports of the vendor that are publicly available.
B. The bank should ensure that the vendor's sales representatives are compensated mainly with commissions from the sale of the bank's products.
C. The bank should prevent the third-party vendor from having access to any of its critical processes.
D. The bank should be responsible for developing the vendor's contingency planning process to mitigate risk exposure to the vendor.

36. 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. Credit rating upgrade
B. Increased asset diversification
C. Rapid growth in the leverage ratio with significant dependence on short-term repo financing
D. Decreased collateral haircuts applied to the bank's collateralized exposures

37. Large dealer banks have often financed significant fractions of their assets using short-term (overnight) repurchase agreements in which creditors hold bank securities as collateral against default losses. The table below shows the quarter-end financing of four A-rated broker-dealer banks. All values are in USD billion.

Financial instruments	Bank P	Bank Q	Bank R	Bank S
Owned	656	750	339	835
Pledged as collateral	258	472	139	209
Not pledged	398	278	200	626

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 P
B. Bank Q
C. Bank R
D. Bank S

38. During a training seminar, a supervisor at Firm W discusses different types of operational risk that the firm may face, which could be in the short-term or over a longer-term period. Which of the following is an example of a loss caused by an operational risk of Firm W?

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

39. An information technology analyst at a large global bank is preparing a plan to aggregate the bank's risk data and increase the quality of the firm's data governance practices. The bank has several business divisions that represent product lines that are offered across multiple regions. To effectively aggregate the risk data and ensure a strong data governance process, which of the following conditions would the analyst point out as posing the greatest information technology challenge to the bank?

A. Most of the risk data are located on spreadsheets at the individual business units.
B. The bank rapidly integrates the information technology systems of each company that it acquires into its own technology platform.
C. The product lines are divided into legal entities by geographic region, but data from each entity is aggregated in a centralized data warehouse.
D. The bank installs technology platforms before investing in approved strategic initiatives that require those platforms.

40. A risk analyst is implementing an enterprise risk management system at a bank. During the process, the analyst takes an inventory of risks faced by the bank and categorizes these risks as market, credit, or operational risks. 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 many 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 symmetric.

41. A regional commercial bank is considering a 1-year loan to be fully funded by deposits, with the following parameters:

- Loan amount: JPY 4.2 billion
- Average annual interest rate paid on deposits: 0.4%
- Annual interest rate received on loan: 3.2%
- Expected loss: 2.0% of face value of loan
- Annual operating costs: 0.5% of face value of loan
- Economic capital required to support the loan: 10.0%
- Average pre-tax return on economic capital: 1.4%
- Effective tax rate: 38%
- Other transfer costs: JPY 0

What is the after-tax RAROC for this loan?

A. 0.27%
B. 2.73%
C. 4.40%
D. 10.73%

42. A bank is using the VaR and stressed VaR market risk framework in line with the Basel II.5 guidelines. The bank's internal models for market risk have 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%	238	484	252	546
99.0%	451	995	413	1,106
99.9%	578	1,281	528	1,372

Assuming the supervisory authority has set the multiplication factors for both the VaR and the stressed VaR values to 3, what is the correct capital requirement for general market risk for the bank under Basel II.5?

A. USD 1,248 million
B. USD 1,533 million
C. USD 4,557 million
D. USD 4,799 million

43. Company PQR has an outstanding zero-coupon bond with 1 year remaining to maturity. The bond has a face value of USD 2,000,000 and a recovery rate of 0% in the event of default. The bond is currently trading at 75% of face value. Assuming the excess spread only captures credit risk and that the continuously compounding risk-free rate is 3% per year, and using risk-neutral binomial pricing tree methodology, what is the approximate risk-neutral 1-year probability of default of Company PQR?

A. 13.3%
B. 16.5%
C. 19.2%
D. 22.7%

44. A portfolio manager at an insurance company has observed the price of one of the corporate bonds that the company currently holds and wants to estimate the premium the company needs to accept the default risk of the bond. The manager has determined that the bond's real-world default probability is 2.0%, its liquidity risk premium is 1.8%, and its risk-neutral default probability is 6.1%. Ignoring any other risk premiums that might affect the bond's pricing, what is the bond's default risk premium?

A. 2.0%
B. 2.3%
C. 3.8%
D. 4.1%

45. A financial institution has four open derivative positions with an investment company. A description of the positions and their current market values are displayed in the table below:

Position	Exposure (USD)
Long swaptions	32 million
Long credit default swaps	12 million
Long currency derivatives	-16 million
Long futures contracts	-8 million

If the investment company defaults, what would be the loss to the financial institution if netting is used compared to the loss if netting is not used?

A. Loss of USD 20 million if netting is used; loss of USD 24 million if netting is not used
B. Loss of USD 20 million if netting is used; loss of USD 44 million if netting is not used
C. Loss of USD 24 million if netting is used; loss of USD 32 million if netting is not used
D. Loss of USD 24 million if netting is used; loss of USD 44 million if netting is not used

46. A derivative trading firm sells a European-style call option on stock JKJ with a time to expiration of 9 months, a strike price of EUR 45, an underlying asset price of EUR 67, and implied annual volatility of 27%. The annual risk-free interest rate is 2.5%. What is the firm's counterparty credit exposure from this transaction?

A. EUR 0
B. EUR 9.45
C. EUR 19.63
D. EUR 22.00

47. A financial firm has sold default protection on the most senior tranche of a CDO. If the default correlation between assets held in the CDO decreases sharply from the correlation used in pricing the CDO tranches, assuming everything else is unchanged, how will the position of the financial firm be impacted?

A. It will either increase or decrease, depending on the pricing model used and the market conditions.
B. It will gain significant value, since the probability of exercising the protection falls.
C. It will lose significant value, since the protection will gain value.
D. It will neither gain nor lose value, since only expected default losses matter and correlation does not affect expected default losses.

48. A risk analyst constructs a binomial interest rate tree by using the Ho-Lee model. The time step is monthly and the annualized drift is 80 bps in the first month and 120 bps in the second month. Assuming the current annualized short-term rate is 3.2% and the annual basis point-volatility is 2.1%, what is the interest rate in the lowest node after 2 months?

A. 1.82%
B. 2.15%
C. 2.76%
D. 3.03%

49. Four derivative counterparties have entered into bilateral netting arrangements. The exhibit below presents a summary of their bilateral mark-to-market (MtM) trades.

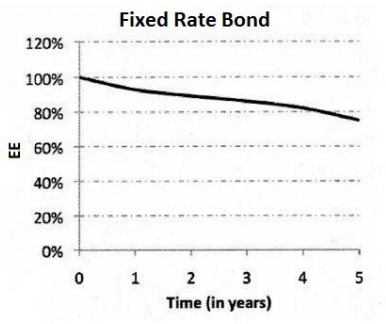
Mark-to-Market Trades for Four Counterparties (USD million)				
		Opposing Counterparty		
Counterparty P	Trades with positive MtM	Q 8	R 10	S 4
	Trades with negative MtM	-6	-2	-4
Counterparty Q	Trades with positive MtM	P 15	R 6	S 7
	Trades with negative MtM	-16	0	-8
Counterparty R	Trades with positive MtM	P 6	Q 4	S 8
	Trades with negative MtM	-6	-5	-12
Counterparty S	Trades with positive MtM	P 2	Q 13	R 1
	Trades with negative MtM	-2	-10	-1

If netting agreements exist between all pairs of counterparties shown, what is the correct order of net exposure per counterparty, from highest to lowest?

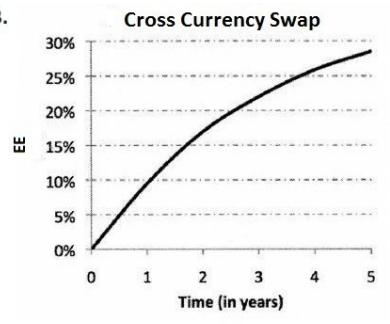
A. P, Q, S, R
B. Q, R, S, P
C. R, Q, P, S
D. S, P, Q, R

50. Interest rate and currency swaps display differing profiles of expected exposure (EE) over time. Assuming each instrument matures in 5 years, which of the following graphs is an accurate representation of a typical EE profile for the corresponding instrument?

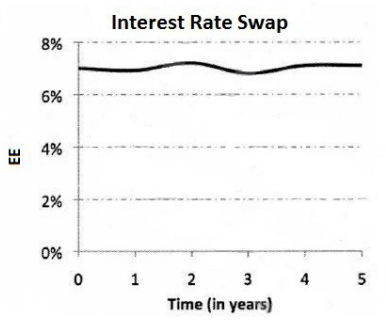
A



B.



C



D.

51. A risk analyst is examining a firm's foreign currency option price assumptions. The implied volatility is relatively low for an at-the-money option and it becomes progressively higher as the option moves either into the money or out of the money. Compared to the lognormal distribution with the same mean and standard deviation, the distribution of option prices on this foreign currency implied by the Black-Scholes-Merton model would have:

A. A heavier left tail and a less heavy right tail.
B. A heavier left tail and a heavier right tail.
C. A less heavy left tail and a heavier right tail.
D. A less heavy left tail and a less heavy right tail.

52. A wealth management firm has JPY 72 billion in assets under management. The portfolio manager computes the daily VaR at various confidence levels as follows:

Confidence Level	VaR (JPY)
95.0%	332,760,000
95.5%	336,292,500
96.0%	340,095,000
96.5%	350,332,500
97.0%	359,107,500
97.5%	367,882,500
98.0%	378,412,500
98.5%	392,452,500
99.0%	410,880,000
99.5%	439,252,500

What is the closest estimate of the daily ES at the 97.5% confidence level?

A. JPY 398 million
B. JPY 400 million
C. JPY 405 million
D. JPY 497 million

53. A newly hired risk analyst is backtesting a firm's VaR model. Previously, the firm calculated a 1-day VaR at the 95% confidence level. Following the Basel framework, the risk analyst is recommending that the firm switch to a 99% VaR confidence level. Which of the following statements concerning this switch is correct?

A. The decision to accept or reject a VaR model based on backtesting results at the two-tailed 95% confidence level is less reliable with a 99% VaR model than with a 95% VaR model.
B. The 95% VaR model is less likely to be rejected using backtesting than the 99% VaR model.
C. When backtesting using a two-tailed 90% confidence level test, there is a smaller probability of incorrectly rejecting a 95% VaR model than a 99% VaR model.
D. Using a 99% VaR model will lower the probability of committing both type 1 and type 2 errors.

54. A hedge fund risk manager is looking at various models that are flexible enough to incorporate mean reversion and risk premium into term structure modeling. Which of the following is correct about the Vasicek model?

A. It incorporates the mean reversion feature and its drift is always zero.
B. It incorporates the mean reversion feature and models the risk premium as a component of a constant or changing drift.
C. It cannot incorporate risk premium and its drift is always zero.
D. It cannot capture the mean reversion feature but can be used to model the time-varying risk premium.

55. A hedge fund that runs a distressed securities strategy is evaluating the solvency conditions of two potential investment targets. Currently firm RST is rated BB and firm WYZ is rated B. The hedge fund is interested in determining the joint default probability of the two firms over the next 2 years using the Gaussian default time copula under the assumption that a 1-year Gaussian default correlation is 0.36. The fund reports that x_{BB} and x_B are abscise values of the bivariate normal distribution presented in the table below where $x_{BB} = N^{-1}(Q_{BB}(t_{BB}))$ and $x_B = N^{-1}(Q_B(t_B))$ with t_{BB} and t_B being the time-to-default of BB-rated and B-rated companies respectively; and Q_{BB} and Q_B being the cumulative distribution functions of t_{BB} and t_B, respectively; and N denotes the standard normal distribution:

Default Time in Year	Firm RST Default Probability	Firm RST Cumulative Default Probability $Q_{BB}(t)$	Firm RST Cumulative Standard Normal Percentiles $N^{-1}(Q_{BB}(t))$	Firm WYZ Default Probability	Firm WYZ Cumulative Default Probability $Q_B(t)$	Firm WYZ Cumulative Standard Normal Percentiles $N^{-1}(Q_B(t))$
1	5.21%	5.21%	-1.625	19.06%	19.06%	-0.876
2	6.12%	11.33%	-1.209	10.63%	29.69%	-0.533
3	5.50%	16.83%	-0.961	8.24%	37.93%	-0.307
4	4.81%	21.64%	-0.784	6.10%	44.03%	-0.150
5	4.22%	25.86%	-0.648	4.03%	48.06%	-0.049

Applying the Gaussian copula, which of the following corresponds to the joint probability that firm RST and firm WYZ will both default before the end of year 2?

A. M(xBB = 0.0612) + M(xB = 0.1063) – M(xBB = 0.0612)*M(xB = 0.1063)
B. M(xBB = 0.1133) + M(xB = 0.2969) – M(xBB = 0.1133)*M(xB = 0.2969)
C. M(xBB ≤ 0.1133 ∩ xB ≤ 0.2969)
D. M(xBB ≤ – 1.209 ∩ xB ≤ –0.533)

56. A risk committee of the board of company ABC is discussing the difference between pricing deep out-of-the-money call options on ABC stock and pricing deep out-of-the-money call options on the USD/GBP foreign exchange (FX) rate using the Black-Scholes-Merton model. The committee considers pricing each of these two options based on two distinct probability distributions of underlying asset prices at the option expiration date: a lognormal probability distribution, and an implied risk-neutral probability distribution obtained from the volatility smile for each aforementioned option of the same maturity and the same moneyness. If the implied risk-neutral probability distribution is used instead of the lognormal distribution, which of the following is correct?

A. The price of the option on ABC stock would be relatively high and the price of the option on USD/GBP FX rate would be relatively low compared to those computed from the lognormal counterparts.
B. The price of the option on ABC stock would be relatively low and the price of the option on USD/GBD FX rate would be relatively high compared to those computed from the lognormal counterparts.
C. The price of the option on ABC stock would be relatively low and the price of the option on USD/GBD FX rate would be relatively low compared to those computed from the lognormal counterparts.
D. The price of the option on ABC stock would be relatively high and the price of the option on USD/GBD FX rate would be relatively high compared to those computed from the lognormal counterparts.

57. A CRO is concerned that a firm's existing internal risk models are not adequate in addressing potential random extreme losses of the firm. The CRO then recommends the use of extreme value theory (EVT). When applying EVT and examining distributions of losses exceeding a threshold value, which of the following is correct?

A. As the threshold value is increased, the distribution of losses over a fixed threshold value converges to a generalized Pareto distribution.
B. If the tail parameter value of the generalized extreme-value (GEV) distribution goes to infinity, then the GEV essentially becomes a normal distribution.
C. To apply EVT, the underlying loss distribution must be either normal or lognormal.
D. The number of exceedances decreases as the threshold value decreases, which causes the reliability of the parameter estimates to increase.

58. In the Basel framework, a penalty is given to banks that have more than four exceptions to their 1-day 99% VaR over the course of the last 250 trading days. Which of the following causes of exceptions is most likely to lead to a penalty?

A. A large move in interest rates occurs in conjunction with a small move in correlations.
B. The bank's model calculates interest rate risk based on the median duration of the bonds in the portfolio.
C. A sudden market crisis in an emerging market, which leads to losses in the equity positions in that country.
D. A sudden devastating earthquake that causes major losses in the bank's key area of operation.

59. A fund manager owns a portfolio of options on TUV, a non-dividend-paying stock. The portfolio is made up of 5,000 deep in-the-money call options on TUV and 20,000 deep out-of-the-money call options on TUV. The portfolio also contains 10,000 forward contracts on TUV. Currently, TUV is trading at USD 52. Assuming 252 trading days in a year, the volatility of TUV is 12% per year, and that each of the option and forward contracts is on one share of TUV, which of the following amounts would be closest to the 1-day 99% VaR of the portfolio?

A. USD 11,557
B. USD 12,627
C. USD 13,715
D. USD 32,000

60. When measuring risk in hedge funds that hold illiquid assets using monthly data, certain biases can create a misleading picture. For example, these hedge funds might have the appearance of low systematic risk. Which of the following represents an appropriate means of correction?

A. Account for negative serial correlation of returns by first differencing the data when extrapolating risk to longer time horizons.
B. Account for positive serial correlation of returns by aggregating the data.
C. Use regressions with fewer lags of the market factors and sum the coefficients across lags.
D. Use regressions with additional lags of the market factors and sum the coefficients across lags.

QUESTIONS 61 AND 62 REFER TO THE FOLLOWING INFORMATION:

A financial risk consultant assumes that the joint distribution of returns is multivariate normal and calculates the following risk measures for a two-asset portfolio managed by a mid-size insurance company:

Asset	Position (JPY)	Individual VaR (JPY)	Marginal VaR
Financial	20,000,000	4,787,400	0.316
Real-Estate	20,000,000	7,299,300	0.562
Portfolio	40,000,000	11,562,450	

61. If the real-estate asset is dropped from the portfolio and the proceeds from liquidating the asset are not reinvested in the portfolio, what will be the reduction in portfolio VaR?

A. JPY 2,252,250
B. JPY 3,494,700
C. JPY 5,746,950
D. JPY 6,775,050

62. What is the closest to the correct estimate for the component VaR of the financial asset?

A. JPY 4,787,000
B. JPY 6,322,000
C. JPY 7,299,000
D. JPY 11,240,000

63. An analyst regresses the returns of 400 stocks against the returns of a major market index. The resulting pool of alphas has a residual risk of 13.78% and an information coefficient of 0.12. If the alphas are normally distributed with a mean of 0%, roughly how many stocks have an alpha greater than 3.24% or less than -3.24%?

A. 5
B. 15
C. 20
D. 45

64. A risk analyst at an investment bank is conducting performance analyses of hedge funds and real estate funds. Each year, whenever a hedge fund stops reporting its performance, the hedge fund is removed from the database of hedge funds. Assets owned by the real estate funds are valued only once a year due to the infrequent trading. Which of the following best describes the impacts on the hedge fund and real estate fund analyses performed using these databases?

A. The average Sharpe ratio of hedge funds is understated and the average Sharpe ratio of real estate funds is overstated.
B. The average Sharpe ratio of hedge funds is overstated and the average Sharpe ratio of real estate funds is also overstated.
C. The average volatility of hedge funds is overstated and the average volatility of real estate funds is overstated.
D. The average volatility of hedge funds is overstated and the average volatility of real estate funds is understated.

65. A money manager wants to invest a small amount of new capital 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 whose performances, during the most recent evaluation period, are described in the following table:

Asset	Portfolio Weight	Actual Return	Volatility of Return	Beta to the portfolio
BDE	0.35	14%	19%	1.20
JKL	0.30	13%	18%	0.90
MNO	0.25	13%	16%	1.00
STU	0.10	10%	10%	0.80

The portfolio manager wants to select the asset that has the lowest marginal VaR as long as its Jensen's alpha is greater than or equal to the market risk premium. Assuming the risk-free rate is 3% and the market return is 8%, which asset should the portfolio manager select?

A. Asset BDE
B. Asset JKL
C. Asset MNO
D. Asset STU

66. A risk analyst at an insurance company has determined that a counterparty to the company has a constant default probability of 5% per year. What is the probability that this counterparty survives the first 2 years and defaults in year 3?

A. 4.51%
B. 5.00%
C. 9.50%
D. 15.00%

67. The board of directors of a manufacturing company is considering the funding risk of the defined benefit plan of the company's pension fund. Which of the following statements about the pension fund's funding risk is correct?

A. Decreases in interest rates will reduce funding risk.
B. Funding risk represents the true long-term risk to the plan sponsor.
C. Funding risk is effectively transferred to the employees of the manufacturing company.
D. The longer the horizon for expected payouts, the lower the funding risk.

68. A portfolio manager is evaluating the risk profile for a portfolio of stocks. Currently, the portfolio is valued at CAD 20 million and contains CAD 5 million in stock XYZ. The standard deviation of returns of stock XYZ is 15% annually and that of the overall portfolio is 12% annually. The correlation of returns between stock XYZ and the portfolio is 0.3. Assuming the portfolio manager uses a 1-year 99% VaR and that returns are normally distributed, what is the estimated component VaR of stock XYZ?

A. CAD 162,972
B. CAD 234,906
C. CAD 523,350
D. CAD 632,152

69. The risk management division of a financial institution is using a loss distribution approach to model its operational risk exposure for economic capital purposes. This approach requires that the bank model both the frequency and severity of operational loss events. Which of the following loss frequency and loss severity distribution pairs is the most appropriate to use?

A. Beta distribution for frequency, and Weibull distribution for severity.
B. Generalized Pareto distribution for frequency, and normal distribution for severity.
C. Lognormal distribution for frequency, and Generalized Gamma distribution for severity.
D. Poisson distribution for frequency, and lognormal distribution for severity.

QUESTIONS 70 AND 71 REFER TO THE FOLLOWING INFORMATION:

The CRO of Bank LGX, a non-dividend-paying US-based bank is preparing a report to the board of directors on the bank's capital adequacy and planning. Bank LGX is subject to both the Basel framework and the US banking rules governing global systemically important banks (G-SIBs). The bank claims that it was in compliance with all the capital requirements in January 2016 as all Basel III phase-ins have already occurred. The CRO is conducting the analysis for January 2017 using selected and most recent annual performance data, which are shown in the table below:

Item	Value (USD million) as of January 2017
Common equity Tier 1 (CET1) capital	1,515
Preferred stock (noncumulative)	100
Tier 2 capital	827
Risk-weighted assets	26,395
Total assets	42,828
Total exposure	47,460

The CRO also reports the minimum regulatory capital requirements under the revised capital framework as presented in the table below. The capital ratios also include the capital conservation buffer of 2.5% (phased-in at an annual increment of 0.75%, starting January 2016) and a G-SIB surcharge of 3.0% (phased-in at an annual increment of 0.625%, starting January 2016) of risk-weighted assets to be reached by January 2019:

	January 2016 Minimum Ratio	January 2017 Minimum Ratio	January 2018 Minimum Ratio	January 2019 Minimum Ratio
Capital conservation buffer	0.625%	1.25%	1.875%	2.5%
G-SIB surcharge	0.75%	1.5%	2.25%	3.0%
CET 1 ratio	4.5%	5.25%	6.5%	10.0%
Tier 1 capital ratio	6.0%	6.75%	8.0%	11.5%
Total capital ratio	8.0%	8.75%	11.5%	13.5%
Leverage ratio	4.0%	4.0%	4.0%	4.0%

70. Given the regulatory benchmarks and the bank's performance, which of the capital requirements does Bank LGX satisfy as of January 2017?

A. CET1 capital ratio only
B. Leverage ratio only
C. Tier 1 capital ratio and Leverage ratio only
D. Total capital ratio and CET1 capital ratio only

71. In viewing the results of this capital analysis report and other considerations for Bank LGX's capital planning, which of the following conclusions is correct?

A. The capital conservation buffer can be met by an increase in Tier 2 capital.
B. If the exposure on derivative asset positions decreases, holding other factors constant, the total capital ratio would decrease.
C. An increase in the CVA due to the bank's asset counterparty positions would tend to raise the bank's risk-weighted assets.
D. If the bank raises additional CET 1 capital and invests the same amount in gold, Bank LGX's net stable funding ratio will not change.

QUESTIONS 72 THROUGH 74 REFER TO THE FOLLOWING INFORMATION:

In a surprise monetary policy action on August 10, 2015, the People's Bank of China cut its daily currency reference rate against the USD, resulting in a large devaluation of the CNY per the USD. Immediately after the announcement, the CRO of CMM Bank (CMM), an international bank with headquarters in Shanghai, began evaluating the impact of this and other events on the bank's position.

CMM had outstanding long-term debt denominated in USD and deposits denominated in CNY. A significant portion of CMM's lending portfolio was also denominated in CNY and consisted largely of loans and lines of credit to Chinese manufacturers who were heavily dependent on imported raw materials. Other loans to non-Chinese firms with exposure to China were denominated in USD. The bank's portfolio investments included CNY-denominated Chinese Treasury securities and other sovereign debt.

A portion of CMM's retail customer base had invested on margin in the Chinese equity markets. Over the next few weeks, local stock markets experienced declines in share prices. Many of CMM's larger retail depositors experienced margin calls and had begun to draw down demand deposits to meet them. Offsetting these outflows, however, were increases in the 3-month, 6-month and 9-month term deposit balances at CMM of several large corporate customers. The result was that CMM's overall net deposit flow had been approximately zero.

Because of credit developments elsewhere in the world, several of CMM's sovereign debt holdings were downgraded, some from AA to A and some from A to BBB. One of the noticeable outcomes was that the bid-ask spreads on many of the sovereign bonds held and traded by CMM widened. Despite these developments, CMM's sovereign debt portfolio remained exclusively investment grade with a weighted average rating of A+.

72. CMM's CRO was concerned about the bank's liquidity position and decided to review the impact of the devaluation and other capital market events on its net stable funding ratio (NSFR). Ignoring any changes in the market value of CMM's sovereign debt holdings, which of the following is correct?

A. The NSFR will not be impacted by the sovereign credit rating changes because the overall sovereign debt portfolio remains investment grade.
B. The NSFR will be reduced by the sovereign credit rating changes but this effect can be offset by selling A-rated sovereign debt and investing the proceeds in gold.
C. The NSFR will not be impacted by the change in demand deposits because the bank's overall deposit level is unchanged.
D. The NSFR will be reduced by the change in demand deposits but this effect can be offset by issuing common stock.

73. Before the devaluation of CNY, CMM's trading desk had established a short call options position on the USD-CNY (CNY per USD) exchange rate that was made delta-neutral through a spot USD transaction. The position was no longer delta-neutral after the devaluation came into effect and the desk wanted to take steps to make it delta-neutral again. The bank was concerned about whether this would involve buying or selling USD and what impact this might have on liquidity. The trader who initiated the position suggested that, once it was made delta-neutral, the short call options position would be an effective way to hedge the bank's long CNY exposure against further devaluations and that the bank should consider increasing the size of the position accordingly. In considering this situation, what should the CRO conclude?

A. The bank will have to buy USD to make the position delta neutral, but the delta-neutral short call options position is not an effective way to hedge an underlying long CNY exposure against further devaluations.
B. The bank will have to sell USD to make the position delta neutral, but the delta-neutral short call options position is not an effective way to hedge an underlying long CNY exposure against further devaluations.
C. The bank will have to buy USD to make the position delta neutral, and the delta-neutral short call options position is an effective way to hedge an underlying long CNY exposure against further devaluations.
D. The bank will have to sell USD to make the position delta neutral, and the delta-neutral short call options position is an effective way to hedge an underlying long CNY exposure against further devaluations.

74. CMM had CNY-denominated loans outstanding to TVR, a foreign manufacturing firm that generated its revenue in CNY. To hedge some of its risk, CMM had bought CDS protection on TVR from a bank from the same country as TVR, Bank EP. Assuming the default probability of TVR increases unexpectedly, and the default correlation between TVR and Bank EP is positive and remains constant, which of the following is correct?

A. The value of the CDS will increase and CMM has a wrong-way risk with Bank EP.
B. The value of the CDS will decrease and CMM has a wrong-way risk with Bank EP.
C. The value of the CDS will increase and CMM has a right-way risk with Bank EP.
D. The value of the CDS will decrease and CMM has a right-way risk with Bank EP.

75. A large bank is reviewing its processes and procedures to manage operational risk in accordance with best practices established by the Basel Committee. In implementing the three lines of defense model, which of the following statements is correct?

A. The internal audit function should serve as the first line of defense and continually validate operational procedures used by the business lines.
B. Business line managers, as part of the first line of defense, should provide a credible challenge to the internal audit function.
C. The corporate operational risk function, as part of the second line of defense, should challenge risk inputs from business line managers.
D. The corporate operational risk function should serve as the third line of defense and validate model assumptions made by senior management.

76. A CRO at an investment bank has asked the risk department to evaluate the bank's 3-year derivative exposure position with a counterparty. The risk department assumes that the counterparty's default probability follows a constant hazard rate process. The table below presents trade and forecast data on the CDS spread, the expected exposure, and the recovery rate on the counterparty:

	Year 1	Year 2	Year 3
Expected exposure (AUD million)	14	14	14
CDS spread (bps)	200	300	400
Recovery rate (%)	80	70	60

Additionally, the CRO has presented the risk team with the following set of assumptions to use in conducting the analysis:

• The investment bank and the counterparty have signed a credit support annex to cover this exposure, which requires collateral posting of AUD 11 million.

• The current risk-free rate of interest is 3% and the term structure of interest rates remains flat over the 3-year horizon.

• Collateral and exposure values remain stable as projected over the 3-year life of the contract.

Given the information and the assumptions above, what is the correct estimate for the CVA for this position?

A. AUD 0.214 million
B. AUD 0.253 million
C. AUD 0.520 million
D. AUD 0.998 million

77. The CEO of a large bank has reported that the bank's framework for managing operational risk is consistent with the Basel II and Basel III guidelines for operational risk governance. Which of the following actions and principles of the bank is correct?

A. The bank considers identification and management of risk as the second line of defense.
B. The bank considers independent review and audit of the risk processes and systems as the third line of defense.
C. The bank includes damaged reputation due to a failed merger in its measurement of operational risk.
D. The bank excludes destruction by fire or other external catastrophes from its measurement of operational risk.

78. A risk manager has asked a junior analyst to estimate the implied default probability for a BBB-rated discount corporate bond. The continuously compounded annual yields of other fixed-income securities are given below:

- 3-year Treasury note (a risk-free bond): 3%
- 1-year BBB-rated discount bond: 5%
- 2-year BBB-rated discount bond: 8%
- 3-year BBB-rated discount bond: 9%

If the recovery rate on that BBB-rated bond is expected to be 0% in the event of default, which of the following is the best estimate of the risk-neutral probability that the BBB-rated discount bond defaults within the next 3 years?

A. 12.29%
B. 13.76%
C. 14.61%
D. 16.47%

79. Pension fund managers must deal with a range of policy, risk, and return requirements. 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.

80. A financial institution has a two-way credit support annex (CSA) with a counterparty covering a portfolio valued at JPY 400 million. The margining terms of the collateralized portfolio include a threshold of JPY 180 million, a minimum transfer amount of JPY 30 million, and a margin period of risk of 10 days. Which of the following is correct?

A. A lower threshold value implies that a larger portion of exposure is protected by collateral.
B. A shorter margin period of risk implies that a smaller portion of exposure is protected by collateral.
C. A lower independent amount implies that a larger portion of exposure is protected by collateral.
D. The protection from collateral specified in the CSA is uniform throughout the life of the exposure profile.

2019 FRM Part II Practice Exam – Answer Key

1.	C	21.	A	41.	B	61.	D
2.	A	22.	C	42.	C	62.	B
3.	A	23.	A	43.	D	63.	C
4.	D	24.	C	44.	B	64.	B
5.	C	25.	C	45.	B	65.	B
6.	A	26.	C	46.	A	66.	A
7.	A	27.	A	47.	B	67.	B
8.	A	28.	C	48.	B	68.	C
9.	C	29.	B	49.	A	69.	D
10.	B	30.	A	50.	B	70.	D
11.	D	31.	A	51.	B	71.	C
12.	A	32.	C	52.	C	72.	D
13.	D	33.	A	53.	A	73.	A
14.	C	34.	C	54.	B	74.	A
15.	A	35.	A	55.	D	75.	C
16.	C	36.	C	56.	B	76.	A
17.	B	37.	B	57.	A	77.	B
18.	B	38.	B	58.	B	78.	D
19.	D	39.	A	59.	C	79.	D
20.	C	40.	B	60.	D	80.	A

1. A regional bank is formalizing its policies and procedures to help identify and analyze the risk of potential money laundering transactions. Of special interest is accounting for customers' backgrounds when determining customer acceptance policies. According to Basel Committee guidelines, which of the following correctly describes a best practice that the bank should use in identifying, verifying and profiling customers to help mitigate money laundering risk?

A. The bank does not need to apply due diligence on a customer if the bank receives funds from that customer's account at another bank that is subject to the same customer due diligence standards.

B. The bank should apply the same due diligence measures to all customers regardless of their jurisdiction and the nature of their relationship with the bank to prevent discrimination.

C. The bank should apply its due diligence process not just to potential customers but also to beneficial owners of the proposed customer accounts and persons acting on their behalf.

D. The bank should not open an account for or conduct business with a customer who wants to remain anonymous to the bank except for confidential "numbered accounts" that function as anonymous.

Correct Answer: C

Explanation: C is correct. Due diligence should be applied not only to customers but also to persons acting on their behalf and beneficial owners. (Cf: Principle 35)

A is not correct. Banks should still conduct their own due diligence on the customer in this case, as the previous account manager may have already closed the account because of concerns of illicit activity. (Cf. Principle 43)

B is not correct. Due diligence should specifically be increased for customers with higher risk profiles. (Cf. Principle 38)

D is not correct. Banks should not open an account under any circumstances if the client insists on remaining anonymous. Confidential "numbered accounts" do not function as anonymous accounts and should be subject to the same customer due diligence standards as other accounts.

Section: Operational Risk Measurement and Management

Reference: "Sound management of risks related to money laundering and financing of terrorism", (Basel Committee on Banking Supervision, June 2017)(pages 1-32 only)

Learning Objective: Describe recommended practices for the acceptance, verification and identification of customers at a bank.

2. A risk manager is estimating the market risk of a portfolio using both the arithmetic returns with normal distribution assumptions and the geometric returns with lognormal distribution assumptions. The manager gathers the following data on the portfolio:

- Annualized average of arithmetic returns: 12%
- Annualized standard deviation of arithmetic returns: 30%
- Annualized average of geometric returns: 11%
- Annualized standard deviation of geometric returns: 41%
- Current portfolio value: EUR 5,200,000
- Trading days in a year: 252

Assuming both daily arithmetic returns and daily geometric returns are serially independent, which of the following statements is correct?

A. 1-day normal 95% VaR = 3.06% and 1-day lognormal 95% VaR = 4.12%
B. 1-day normal 95% VaR = 3.57% and 1-day lognormal 95% VaR = 4.41%
C. 1-day normal 95% VaR = 4.12% and 1-day lognormal 95% VaR = 3.57%
D. 1-day normal 95% VaR = 4.46% and 1-day lognormal 95% VaR = 4.49%

Correct Answer: A

Explanation: 1-day normal 95% VaR = -[(0.12/252)-1.645*0.30/sqrt(252)] = 3.06%

1-day lognormal 95% VaR = 1-exp[0.11/252-0.41*1.645/sqrt(252)] = 4.12%

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 VaR using a parametric approach for both normal and lognormal return distributions.

3. A credit manager in the counterparty risk division of a large bank uses a simplified version of the Merton model to monitor the relative vulnerability of its largest counterparties to changes in their valuation and financial conditions. To assess the risk of default of three particular counterparties, the manager calculates the distance to default assuming a 1-year horizon (t=1). The counterparties: Company P, Company Q, and Company R, belong to the same industry, and are non-dividend-paying firms. Selected information on the companies is provided in the table below:

Company	**P**	**Q**	**R**
Market value of assets (EUR million)	100	150	250
Face value of debt (EUR million)	60	100	160
Annual volatility of asset values	10.0%	7.0%	8.0%

Using the information above with the assumption that a zero-coupon bond maturing in 1 year is the only liability for each company, and the approximation formula of the distance to default, what is the correct ranking of the counterparties, from most likely to least likely to default?

A. P; R; Q
B. Q; P; R
C. Q; R; P
D. R; Q; P

Correct Answer: A

Explanation: A is correct.

Distance to Default (DtD) approximates the number of standard deviations to reach the default threshold; thus, the higher the DtD, the least likely to default.

$$DtD = \frac{\ln V_a - \ln F + \left(\mu - \frac{\sigma_a^2}{2}\right)(t)}{\sigma_a \sqrt{t}}$$

DtD can be simplified by reducing the forward time periods to 1 (t=1) and minimizing the drift factors ($\mu - \sigma^2/2$) that tend to be small (assumed to equal 0) over one period to yield:

$$DtD \cong \frac{\ln V_a - \ln F}{\sigma_a}$$

Using this formula results in:

DtD for Company P = ln(100/60)/0.10 = 5.11

DtD for Company Q = ln(150/100)/0.07 = 5.79

DtD for Company R = ln(250/160)/0.08 = 5.58

Q is least likely to default; R is in the middle; P is most likely to default.

Section: Credit Risk Measurement and Management

Reference: Giacomo De Laurentis, Renato Maino, and Luca Molteni, Developing, Validating and Using Internal Ratings (West Sussex, United Kingdom: John Wiley & Sons, 2010). Chapter 3 - Rating Assignment Methodologies.

Learning Objective: Apply the Merton model to calculate default probability and the distance to default and describe the limitations of using the Merton model.

4. Bank HJK has written puts on Bank PQR stock to a hedge fund and sold CDS protection on Bank PQR to a manufacturer. Bank HJK and Bank PQR operate in several of the same businesses and geographies and their performances are highly correlated. Many in the market are concerned that rising interest rates could negatively impact the credit quality of Bank HJK's numerous borrowers, which in turn would increase the credit spread of Bank HJK. From the perspectives of the hedge fund and the manufacturer, which of the following is correct with respect to their counterparty risk exposure to Bank HJK?

	Hedge Fund	Manufacturer
A.	Right-way risk	Wrong-way risk
B.	Wrong-way risk	Right-way risk
C.	Right-way risk	Right-way risk
D.	Wrong-way risk	Wrong-way risk

Correct Answer: D

Explanation: The hedge fund has wrong-way risk. As interest rates rise, both Bank HJK's and Bank PQR's equity value would decline since the performances of the two banks are highly correlated. Therefore, the value of the long put option on PQR would increase, resulting in a higher exposure to bank HJK for the hedge fund. This is a wrong-way risk since the hedge fund's exposure to HJK would be increasing as the credit quality of HJK is declining.

The manufacturer also has wrong-way risk. Since the credit spread of Bank HJK is increasing and credit spreads of different banks in the same market tend to be positively correlated, the credit spread of Bank PQR should also increase. Therefore, the value of the manufacturer's long CDS position on Bank PQR is increasing at the same time the credit quality of Bank HJK is decreasing; thus, that is wrong-way risk.

Section: Credit Risk Measurement and Management

Reference: Jon Gregory, The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, Third Edition (West Sussex, UK: John Wiley & Sons, 2015). Chapter 17. Wrong-way Risk [CR-16].

Learning Objective: Identify examples of wrong-way risk and examples of right-way risk.

Describe wrong-way risk and contrast it with right-way risk.

5. Bank JJQ, a member of a CCP, sells credit protection on a GBP 100 million counterparty position using CDS. The reference entity is a gold mining company. Which of the following trades by Bank JJQ on the same reference entity would be a hedge to transfer credit risk with minimal increase in counterparty risk?

A. Buy a credit-linked note
B. Buy a total return swap
C. Sell a credit-linked note
D. Sell a total return swap

Correct Answer: C

Explanation: C is correct. Selling/issuing a credit-linked note (CLN) transfers credit risk to the investors while there is no counterparty risk for the CLN issuer because CLNs are funded. Since CLN is essentially a funded version of CDS, it can be used to hedge the short position of CDS with minimal increase in counterparty risk. To explain further, a CLN trade means the buyer pays the seller the principal of the note and receives a regular coupon throughout the lifetime of that CLN. If there is no credit event happening to the reference entity, the principal will be paid back to the investor. Otherwise, the CLN buyer will receive the collateral (i.e., the defaulted referenced bond) and the coupon payment will stop. Thus, the CLN buyer is the protection seller and the issuer is the protection buyer. If the CDS and CLN are fairly priced, the seller of CDS can hedge his position by issuing CLN. Also, since the principal is kept by Bank JJQ in the beginning of the CLN trade, the increment in counterparty risk created by such hedge should be minimal.

A is incorrect. The CLN buyer, like a bond buyer, bears counterparty risk as the issuer can default on principal and interests.

B and D are incorrect. The total return swap (TRS) has counterparty risk. In general, TRS is not funded.

Section: Credit Risk Measurement and Management

Reference: Michel Crouhy, Dan Galai and Robert Mark, The Essentials of Risk Management, 2nd Edition (New York: McGraw-Hill, 2014). Chapter 12, The Credit Transfer markets and Their Implications.

Learning Objective: Describe the different types and structures of credit derivatives including credit default swap (CDS), first-to-default put, total return swaps (TRS), asset-backed credit-linked note (CLN), and their application.

6. An investment bank has a one-way credit support annex (CSA) on a bilateral transaction with a hedge fund counterparty. Under the terms of the CSA, the mark-to-market value of the transaction forms the basis of the hedge fund's collateral requirements, which are provided below:

	Value (CNY)
Mark-to-market value of net exposure	25,000,000
Mark-to-market value of collateral posted	10,800,000
Threshold amount	14,000,000
Minimum transfer amount	2,500,000
Rounding amount	10,000

Assuming the net exposure increases to CNY 27,000,000 and the mark-to-market value of collateral posted has not changed, how much additional collateral will the hedge fund have to post?

A. CNY 0
B. CNY 1,990,000
C. CNY 2,000,000
D. CNY 2,500,000

Correct Answer: A

Explanation: A is correct.

Additional collateral (C) required for posting can be explained from the mark-to-market value of collateral posted (X), mark-to-market value of net exposure (E), the threshold (K), and the minimum transfer amount (MTA) as follows:

(i) Collateral call (C) can be made if: E > (K + MTA + X)

(ii) The collateral amount required: C = E – K – X, and the amount is positive if (E – K – X) > MTA, otherwise it is zero.

In this example:

(K + MTA + X) = 14,000,000+2,500,000+10,800,000 = 27,300,00 > E = 27,000,000 which corresponds to no collateral call. Thus, A is correct.

B is incorrect. CNY 1,990,000 = new exposure – original exposure – rounding amount = 27,000,000 – 25,000,000 – 10,000, which is incorrect.

C is incorrect. CNY 2,000,000 is the difference between the new net exposure and the original net exposure (= 27,000,000 – 25,000,000 = CNY 2,000,000).

D is incorrect. CNY 2,500,000 is the minimum transfer amount.

Section: Credit Risk Measurement and Management

Reference: Jon Gregory, The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, 3rd Edition (West Sussex, UK: John Wiley & Sons, 2015). Chapter 6 - Collateral

Learning Objective: Explain the features of a collateralization agreement.

7. The board of directors of an insurance company has identified a number of potential growth opportunities for the company to consider. To help assess these opportunities and determine an optimal risk structure to use across the organization, the risk committee has recommended that the company implement an ERM program. Which of the following would best represent an appropriate goal for the firm to state as part of the ERM program?

A. Determine a risk-return trade-off that reflects the company's target credit rating and ensure that business unit managers evaluate new projects with this firm-wide target in mind.

B. Attempt to eliminate the company's probability of financial distress to maximize company value.

C. Maximize the firm's leverage ratio within its risk tolerance to ensure the highest expected return on equity.

D. Establish a target minimum level of annual earnings and guarantee to shareholders that it will maintain this level.

Correct Answer: A

Explanation: A is correct. Determining the right amount of risk is one of the key goals when implementing ERM. One way to do this is to hold an amount of capital (reflecting an ideal risk-return tradeoff) which would lower the probability of financial distress to a level that matches the target credit rating. A VaR model or other methods could be used to determine this level. Once this target is set, it is then crucial to ensure that business unit managers keep this target firm-wide risk-return tradeoff in mind when evaluating new projects.

B is incorrect. What management can accomplish through an ERM program is not to minimize or eliminate but rather to limit the probability of distress to an acceptable level. Maximizing shareholder value requires an appropriate trade-off between risk and reward; even if a risk-minimizing strategy was potentially feasible, any strategy taken to minimize risk would generally not maximize shareholder value.

C is incorrect. Maximizing leverage and operating on the high end of risk tolerance is not optimal as a small adverse market move or change in its risk profile could put the firm over its risk limits.

D is incorrect; as long as there is risk involved, the firm cannot offer a guaranteed minimum level of earnings.

Section: Operational and Integrated Risk Management

Reference: Brian Nocco and René Stulz, "Enterprise Risk Management: Theory and Practice," Journal of Applied Corporate Finance (2006): 18(4), 8–20

Learning Objective: Define enterprise risk management (ERM) and explain how implementing ERM practices and policies can create shareholder value, both at the macro and the micro level.

8. A US pension fund had assets and liabilities valued at USD 840 million and USD 450 million, respectively, at the end of 2017. The fund's assets were fully invested in equities and commodities while its liabilities consisted entirely of fixed-income obligations. The fund reported that by the end of 2018 the value of assets decreased by 14.0% and the value of liabilities increased by 3.5%. Assuming no changes were made to the composition of the assets and liabilities during the year, what was the change in the pension fund's surplus over the 1-year period?

A. USD -133.4 million
B. USD -117.6 million
C. USD 256.7 million
D. USD 390.0 million

Correct Answer: A

Explanation: A is correct. The change in the pension fund's surplus (ΔS) for the year 2018 is equal to the ending surplus (S_1) at the end of 2018 less the initial surplus (S_0) at the end of 2017. That is, $\Delta S = S_1 - S_0$.

The initial surplus is calculated as $S_0 = A_0 - L_0 = 840 - 450 =$ USD 390 million, where $A_0 =$ the firm's initial assets and $L_0 =$ the firm's initial liabilities.

Next, we must calculate S_1, the surplus at the end of 2018:

Given the 14.0% decline in asset value, the new level of assets A_1 at the end of 2018 is equal to:

$A_1 = (1 - 0.14) * 840 =$ USD 722.40 million.

Given the 3.5% increase in the value of liabilities, the new level of liabilities L_1 at the end of 2018 is equal to:

$L_1 = (1 + 0.035) * 450 =$ USD 465.75 million.

Thus, the ending surplus for 2018 = $S_1 = A_1 - L_1 = 722.40 - 465.75 =$ USD 256.65 million

Therefore, the change in surplus for 2018 = $\Delta S = S_1 - S_0 = 256.65 - 390 =$ USD –133.35 million.

B is incorrect. USD -117.6 million is the change in asset values (722.4 - 840 = USD 117.6 million)

C is incorrect. USD 256.7 million is the year-end 2018 surplus.

D is incorrect. USD 390.0 million is the year-end 2017 surplus.

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.

9. A wealth management firm has a portfolio consisting of USD 37 million invested in US equities and USD 48 million invested in emerging markets equities. The US equities and emerging markets equities both have a 1-day 95% VaR of USD 1.3 million. The correlation between the returns of the US equities and emerging markets equities is 0.25. While rebalancing the portfolio, the manager in charge decides to sell USD 7 million of the US equities to buy USD 7 million of the emerging markets equities. At the same time, the CRO of the firm advises the portfolio manager to change the risk measure from 1-day 95% VaR to 10-day 99% VaR. Assuming that returns are normally distributed and that the rebalancing does not affect the volatility of the individual equity positions, by how much will the portfolio VaR increase due to the combined effect of portfolio rebalancing and change in risk measure?

A. USD 4.373 million
B. USD 6.428 million
C. USD 7.034 million
D. USD 9.089 million

Correct Answer: C

Explanation: C is correct. The first step is to calculate the VaR of the original portfolio of two equities, US (u) and emerging markets (e). This can be derived by using the following equation:

$$VaR = \sqrt{VaR_u^2 + VaR_e^2 + 2 * \rho_{ue} * VaR_u * VaR_e}\,,$$

where ρ_{ue} is the correlation coefficient.

(i) Initial position: The portfolio 1-day 95% VaR (before the rebalancing) is therefore:

$$VaR_P = \sqrt{1.3^2 + 1.3^2 + 2 * 0.25 * 1.3 * 1.3} = USD\ 2.055\ \text{million}.$$

(ii) Since the rebalancing would not affect the volatilities of the two assets and their correlation, it is better to first determine the volatilities based on the original positions:

For US equities,

VaR(u) = USD 1.3 million = 1.645*σ(u)*USD37 million. Therefore, σ(u) = 1.3/(1.645*37) = 0.0214.

For emerging markets equities,

VaR(e) = USD 1.3 million = 1.645*σ(e)*USD 48 million. Therefore, σ(e) = 1.3/(1.645*48) = 0.0165.

(iii) Rebalanced position: After rebalancing, the US equities position amounts to V(u) = 37-7 = USD 30 million, and the emerging market equities position amounts to V(e) = 48 + 7 = USD 55 million. Hence, the new 1-day 95% VaRs are:

VaR(u) = α*σ(u)*V(u) = 1.645*0.0214*USD 30 million = USD 1.0561 million,

VaR(e) = α*σ(e)*V(e) = 1.645*0.0165*USD 55 million = USD 1.4928 million.

(iv) Hence, the 1-day 95% VaR of the rebalanced portfolio is derived as follows:

$VaR_P = \sqrt{1.0561^2 + 1.4928^2 + 2 * 0.25 * 1.0561 * 1.4928} = 2.0327$ million.

(v) Next, convert the 1-day 95% VaR to 10-day 95% VaR:

10-day 95% VaR = (1-day 95% VaR) * sqrt(10)/1 = 2.0327 x 3.1623 = USD 6.4279 million.

(vi) Finally, convert the 10-day 95% VaR to 10-day 99% VaR:

10-day 99% VaR = (10-day 95% VaR) * (2.326/1.645) = 6.4279 x 1.4140 = USD 9.0889 million.

The question is to compare the original 1-day 95% VaR (USD 2.055m) to the new rebalanced 10-day 99% VaR (USD 9.089m). Thus, VaR will increase by (9.089 – 2.055) million, or USD 7.034 million. Thus, C is correct.

A is incorrect. USD 4.373 million is the difference between the 10-day 95% VaR for the rebalanced portfolio and the 1-day 95% VaR for the original portfolio: 6.428 million – 2.055 million = 4.373 million.

B is incorrect. USD 6.428 million is the rebalanced portfolio 10-day 95% VaR.

D is incorrect. USD 9.089 million is the 10-day 99% VaR for the rebalanced portfolio.

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.

10. An operational risk manager is asked to report a bank's operational risk capital under the Standardized Measurement Approach (SMA) proposed by the Basel Committee in March 2016. The treasury department produces the following data for the bank, calculated according to the SMA guidelines:

- Business Indicator (BI): EUR 1,200 million
- Internal Loss Multiplier: 1

In addition, the manager uses the Business Indicator buckets in the Business Component presented in the table below:

Bucket	BI Range	BI Component
1	EUR 0 to EUR 1 billion	0.12*BI
2	EUR 1 billion to EUR 30 billion	EUR 120 million + 0.15(BI – EUR 1 billion)
3	EUR 30 billion to infinity	EUR 4.47 billion + 0.18(BI – EUR 30 billion)

What is the correct operational risk capital that the bank should report under the SMA?

A. EUR 120 million

B. EUR 150 million

C. EUR 158 million

D. EUR 180 million

Correct Answer: B

Explanation: B is correct. Under the revised Standardized Measurement Approach, operational risk capital is equal to the Business Indicator Component multiplied by the Internal Loss Multiplier.

The Business Indicator Component is determined by the Business Indicator (BI), which is made up of almost the same P&L items that are found in the composition of Gross Income (GI). The main difference relates to how the items are combined. The BI uses positive values of its components, thereby avoiding counterintuitive negative contributions from some of the bank's businesses to the capital charge (e.g. negative P&L on the trading book), which is possible under the GI. In addition, the BI includes income statement items related to activities that produce operational risk that are omitted (e.g. P&L on the banking book) or netted (e.g. fee expenses, other operating expenses) in the GI.

In this case, the BI is already given as EUR 1,200 million.

Therefore, with a BI of EUR 1,200 million falling into the BI range of Bucket 2, and given that the Internal Loss Multiplier is equal to 1, the calculation of the operational risk capital for the bank in Bucket 2 is calculated as follows:

SMA operational risk capital (Bucket 2) = BIC*1 = EUR 120 million + 0.15(BI – EUR 1 billion) = EUR 120 million + 0.15(EUR 1,200 million – EUR 1,000 million) = EUR 150 million.

Section: Operational and Integrated Risk Management

Reference: "Basel III: Finalising post-crisis reforms," (Basel Committee on Banking Supervision Publication, December 2017): 128–136.

Learning Objective: Explain the elements of the new standardized approach to measure operational risk capital, including the business indicator, internal loss multiplier, and loss component, and calculate the operational risk capital requirement for a bank using this approach.

11. A credit manager who is well versed in lessons learned from the 2007–2009 subprime mortgage crisis in the US is overseeing the structured credit book of a bank in order to identify potential problems of information flow (frictions) between the parties involved in the securitization process. Which of the following is a correct combination of a potential friction in the securitization process and an appropriate mechanism to mitigate that friction?

A. Friction between the asset manager and the investor: Adverse selection problem. This problem can be mitigated by the asset manager charging due diligence fees to the investor.
B. Friction between the arranger and the originator: Model error problem. This problem can be mitigated by
C. Friction between the investor and credit rating agencies: Principal-agent conflict. This problem can be mitigated by requiring credit rating agencies to be paid by originators and not by investors for their rating services.
D. Friction between the servicer and the mortgagor: Moral hazard problem. This problem can be mitigated by requiring the mortgagor to escrow funds for insurance and tax payments.

Correct Answer: D

Explanation: D is correct. The friction between the servicer and the mortgagor is a moral hazard problem. The servicer and the mortgagor do not share the full consequence of bad outcomes (e.g., loan foreclosure, delinquencies). The mortgagor typically has limited liability, and has little incentive to expend effort or resources to maintain a property close to foreclosure. On the other hand, the servicer strives to work in investors' best interest by keeping up with payment of property taxes and insurance, and generally maintaining the property. A way to mitigate this friction is to require the mortgagor to regularly escrow funds for insurance and tax payments in order to forestall the risk of foreclosure.

A is incorrect. Friction between the asset manager and the investor is a principal-agent problem. The investor is less sophisticated than the asset manager, does not fully understand the investment strategy of the asset manager, has uncertainty about the manager's ability, and does not observe any effort that the manager makes to conduct due diligence. Some of the ways to mitigate this friction is through the use of investment mandate, and the evaluation of manager performance relative to its peers or a peer benchmark.

B is incorrect. Friction between the arranger and originator is a predatory borrowing and lending problem. It is one of the key frictions in the process of securitization involving 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 collaborate 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). To mitigate the problem, the arranger should have safeguards in place, including carrying out a thorough due diligence on the originator and requiring the originator to have adequate capital to buy back problem loans.

C is incorrect. Friction between the investor and credit rating agencies is a model error problem. Investors are not able to assess the efficacy of rating agency models and, so, are susceptible to both honest and dishonest errors. Worse still, rating agencies are paid by the arranger and not by the investors for their opinion, which creates a potential conflict

of interest. This friction can be mitigated by requiring public disclosure of the criteria for ratings and downgrades, and for holding rating agencies accountable for their reputation.

Section: Credit Risk Measurement and Management

Reference: Adam Ashcroft and Til Schuermann, "Understanding the Securitization of Subprime Mortgage Credit," Federal Reserve 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 backtesting a company's 1-day 99.5% VaR model over a 10-year horizon at the 95% confidence level. Assuming 250 trading days in a year and the daily returns are independently and identically distributed, which of the following is closest to the maximum number of daily losses exceeding the 1-day 99.5% VaR in 10 years that is acceptable to conclude that the model is calibrated correctly?

A. 19
B. 25
C. 35
D. 39

Correct Answer: A

Explanation: A is correct. 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 1-0.995, or 0.5%; and T is the number of observations = 250*10=2500. And z = 1.96 is the two-tail confidence level quantile, given a confidence level of 95%.

If $\frac{x-0.005*2500}{\sqrt{0.005*(1-0.005)*2500}} = 1.96$ then, x = 19.4

So, the maximum number of exceedances would be 19 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. A portfolio manager is mapping a fixed-income portfolio into exposures on selected risk factors. The manager is analyzing the comparable mechanics and risk measurement outputs of principal mapping, duration mapping, and cash-flow mapping. Which of the following is correct?

A. Cash-flow mapping groups cash flows into buckets based on their size.
B. Cash-flow mapping uses the average rates in each risk group as a discount factor.
C. Principal mapping incorporates correlations among zero-coupon bonds.
D. Duration mapping replaces the portfolio with a zero-coupon bond with maturity equal to the duration of the portfolio.

Correct Answer: D

Explanation: D is correct. With duration mapping, a portfolio is replaced by a zero-coupon bond with maturity equal to the duration of the portfolio.

A is incorrect. Cash-flow mapping considers the present values of the cash flows placed to correspond to the maturities for which volatilities are provided. So, in cash-flow mapping, cash flows are grouped into maturity brackets.

B is incorrect. Cash-flow mapping considers the present values of the cash flows and uses the appropriate zero-coupon rate as the discount factor.

C is incorrect. Principal mapping is a simple method that considers the timing of redemption payments only. Correlations among zero-coupon bonds with different maturities are considered in cash-flow mapping.

Section: Market Risk Measurement and Management

Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition. (New York, NY: McGraw-Hill, 2007). Chapter 11 - VaR Mapping.

Learning Objective: Differentiate among the three methods of mapping portfolios of fixed income securities.

14. A CRO of a hedge fund is asking the risk team to develop a term-structure model that is appropriate for fitting interest rates for use in the fund's options pricing practice. The risk team is evaluating several interest rate models with time-dependent drift and time-dependent volatility functions. Which of the following is a correct description of the specified model?

A. In the Ho-Lee model, the drift of the interest rate process is presumed to be constant.
B. In the Ho-Lee model, when the short-term rate is above its long-run equilibrium value, the drift is presumed to be negative.
C. In the Cox-Ingersoll-Ross model, the basis-point volatility of the short-term rate is presumed to be proportional to the square root of the rate, and short-term rates cannot be negative.
D. In the Cox-Ingersoll-Ross model, the volatility of the short-term rate is presumed to decline exponentially to a constant long-run level.

Correct Answer: C

Explanation: C is correct. 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 σ*sqrt(r) and therefore increases as a function of the square root of the rate. Short-term rate in the CIR model cannot be negative because of the combined property that (i) basis-point volatility equals zero when short-term rate is zero, and (ii) the drift is positive when the short-term rate is zero.

A is incorrect. In the Ho-Lee model, the drift of the interest rate process is presumed to be time-varying.

B is incorrect. No long-run equilibrium value is defined in the Ho-Lee model.

D is incorrect. The volatility of the short-term rate is assumed to be proportional to the square root of the short-rate in CIR model.

Section: Market Risk Measurement and Management

Reference: Bruce Tuckman and Angel Serrat, Fixed Income Securities, 3rd Edition (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 9: The Art of Term Structure Models: Drift.

Bruce Tuckman and Angel Serrat, Fixed Income Securities, 3rd Edition (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 10: The Art of Term Structure Models: Volatility and Distribution.

Learning Objective: Describe methods for addressing the possibility of negative short-term rates in term structure models; Construct a short-term rate tree under the Ho-Lee Model with time-dependent drift.

Describe the short-term rate process under the Cox-Ingersoll-Ross (CIR) and lognormal models.

15. Six months ago, Textile Manufacturing Inc. (TMI) entered into a 9-month forward contract with Spin Mills Company (SMC) to purchase 36,000 tons of yarn from SMC. At the time the forward was entered into, 36,000 tons of yarn was priced at EUR 92.0 million but is currently priced at EUR 94.0 million. The continuously compounded risk-free rate has remained stable at 3.0% per year and is not expected to change during the remainder of the contract period. Assuming the forward is fairly priced, what is the current potential credit risk exposure on the forward contract and who bears the risk?

A. EUR 0.610 million; TMI bears the potential credit risk
B. EUR 0.610 million; SMC bears the potential credit risk
C. EUR 1.308 million; TMI bears the potential credit risk
D. EUR 1.308 million; SMC bears the potential credit risk

Correct Answer: A

Explanation: A is correct. Given the risk-free rate of 3.0%, we can estimate the forward price (at maturity, in nine months) of the contract as:

Forward price = Spot*exp(r*t) = 92.0*exp(0.03*0.75) = EUR 94.0935 million.

Today, after 6 months (3 months to maturity), the forward contract price estimate

= 94.0935/exp(0.03*0.25)

= EUR 93.3904 million.

Note that, Forward Contract Value = Credit Risk Exposure;

Therefore, given the current (with 3 months remaining to maturity) underlying asset price of EUR 94 million, the long forward contract's exposure value is given by:

Current Potential Exposure Value of Forward Contract = (Market Price – Contract Price)

= 94.0 – 93.3904 = EUR 0.6096 = EUR 0.610 million.

Because the contract value of EUR 0.610 million is positive, the long counterparty (TMI) bears the credit risk exposure.

Positive exposure = Max(value, 0), Negative exposure = Min(value, 0)

And for long forward contracts: Contract Value = (Market Price – Contract Price).

For forwards, while there is no current credit risk (loss), because payment is only made at expiration, there is always positive potential exposure so long as market price > contract price, and negative potential exposure if market price < contract price. At origination (time 0), there is neither current credit risk nor potential credit exposure (since market price = contract price).

B is incorrect (see explanation above).

C and D are incorrect. They compute the contract price incorrectly by discounting the forward value over 6 months and not 3 months:

The forward contract price = 94.093*exp(-0.03*0.5) = EUR 92.692 million. Therefore, Current Value of Forward Contract = (Market Price – Contract Price) = 94.0 – 92.692 = EUR 1.308 million.

Section: Credit Risk Measurement and Management

Reference: Jon Gregory, The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, 3rd Edition (West Sussex, UK: John Wiley & Sons, 2015). Chapter 7 - Credit Exposure and Funding

Learning Objective: Describe and calculate the following metrics for credit exposure: expected mark-to-market, expected exposure, potential future exposure, expected positive exposure and negative exposure, effective exposure, and maximum exposure.

16. A mid-sized investment bank conducts several trades. As part of its risk control, it has entered into netting agreements on 8 equity trade positions with an average correlation of 0.28. The firm believes that it can improve upon the diversification benefit of netting by revising the current agreement. Assuming values of future trade positions are normally distributed, 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
ABC	4	0.25
LMN	7	0.15
PQR	13	-0.06
TUV	15	-0.04

A. Trade combination ABC
B. Trade combination LMN
C. Trade combination PQR
D. Trade combination TUV

Correct Answer: C

Explanation: C is correct. Netting factor is expressed as:

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

where n represents the number of exposures and ρ represents the average correlation.

For the current position, when n = 8 and ρ = 0.28:

$$Netting\ \ Factor = \frac{\sqrt{n + n(n-1)\rho}}{n} = \frac{\sqrt{8 + 8(8-1)(0.28)}}{8} = 0.6083 = 60.83\%$$

When n = 13 and ρ = -0.06, there is the most reduction in netting factor (the most increase in netting benefit):

$$Netting\ \ Factor = \frac{\sqrt{n + n(n-1)\rho}}{n} = \frac{\sqrt{13 + 13(13-1)(-0.06)}}{13} = 0.1468 = 14.68\%$$

A is incorrect. When n = 4 and ρ = 0.25, there is deterioration in netting benefit:

$$Netting\ \ Factor = \frac{\sqrt{n + n(n-1)\rho}}{n} = \frac{\sqrt{4 + 4(4-1)(0.25)}}{4} = 0.6614 = 66.14\%$$

B is incorrect. When n = 7 and ρ = 0.15, there is a modest improvement in netting benefit but not as much as for trade combination PQR:

$$Netting\ \ Factor = \frac{\sqrt{n + n(n-1)\rho}}{n} = \frac{\sqrt{7 + 7(7-1)(0.15)}}{7} = 0.5210 = 52.10\%$$

D is incorrect. When n = 15 and ρ = –0.04, there is a reasonable increase in netting benefit but not as large as for trade combination PQR:

$$Netting\ \ Factor = \frac{\sqrt{n + n(n-1)\rho}}{n} = \frac{\sqrt{15 + 15(15-1)(-0.04)}}{15} = 0.1713 = 17.13\%$$

Section:	Credit Risk Measurement and Management
Reference:	Jon Gregory, The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, 3rd Edition (West Sussex, UK: John Wiley & Sons, 2015). Chapter 7 - Credit Exposure and Funding
Learning Objective:	Explain the impact of netting on exposure, the benefit of correlation, and calculate the netting factor.

17. A portfolio manager is interested in liquidating Stock ASX from an existing portfolio. However, the manager is concerned about the level of liquidity risk and proceeds to estimate LVaR for the stock. The manager observes a quote for Stock ASX and reports that the midpoint of its current best bid and best ask prices is AUD 47. Stock ASX has an estimated daily return volatility of 0.32% and an average bid-ask spread of AUD 0.18. Using the constant spread approach on a position of 15,000 shares of Stock ASX, and assuming the returns of the stock are normally distributed, which is closest to the correct estimate for the stock's liquidity-adjusted 1-day 99% VaR?

A. AUD 2,700
B. AUD 6,600
C. AUD 12,400
D. AUD 15,100

Correct Answer: B

Explanation: B is correct. The daily 99% VaR = 47 * 15,000 * [1 – exp(0 – 0.0032*2.326)] = AUD 5,227.98 (using lognormal VaR and assuming average daily return is zero)

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 price and P is the value of the position.

Therefore, the liquidity cost (LC) = 0.5 * (0.18/47) * (47 * 15,000) = AUD 1,350.00; and

Liquidity-adjusted VaR (LVaR) = VaR + LC = 5,227.98 + 1,350.00 = AUD 6,577.98 (under lognormal VaR).

Section: Operational and Integrated Risk Management

Reference: Kevin Dowd, Measuring Market Risk, 2nd 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

18. A manager is evaluating the risks of a portfolio of stocks. Currently, the portfolio is valued at CNY 124 million and contains CNY 14 million in stock Y. The annualized standard deviations of returns of the overall portfolio and of stock Y are 16% and 12%, respectively. The correlation of returns between the portfolio and stock Y is 0.52. Assuming the risk analyst uses a 1-year 95% VaR and the returns are normally distributed, what is the component VaR of stock Y?

A. CNY 0.103 million
B. CNY 1.437 million
C. CNY 2.032 million
D. CNY 3.685 million

Correct Answer: B

Explanation: B is correct. The component VaR for stock Y ($CVaR_Y$) can be presented as:

$CVaR_Y = \rho_{Y,p} * VaR_Y$

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

Let w_Y represent the value of stock Y; σ_Y represent the standard deviation of stock Y returns; $\alpha(95\%)$ represent the 95% confidence factor for the VaR estimate, which is 1.645. Hence,

$VaR_Y = w_Y * \sigma_Y * \alpha(95\%)$ = CNY 14 million x 0.12 x 1.645 = CNY 2.7636 million.

Therefore,

$CVaR_Y = \rho_{Y,p} * VaR_Y$ = 0.52 x 2.7636 = CNY 1.4371 million.

A is incorrect. 0.103 is the marginal VaR of stock Y.

C is incorrect. CNY 2.032 million is the component VaR of stock Y if the manager incorrectly uses the 99% VaR.

D is incorrect. CNY 3.685 million is the incremental VaR of stock Y (assuming that the volatility of the portfolio without stock Y remains 16% and the correlation of returns between stock Y and the portfolio without stock Y is 0.52).

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.

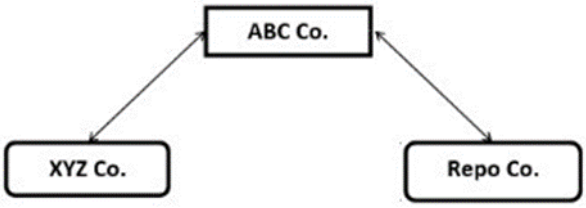
Learning Objective: Define, calculate, and distinguish between the following portfolio VaR measures: individual VaR, incremental VaR, marginal VaR, component VaR, undiversified portfolio VaR, and diversified portfolio VaR.

QUESTIONS 19 AND 20 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 XYZ also has a large line of credit with. ABC 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 of credit had been frozen. XYZ learned that ABC had been defrauded by Repo Co., another of its repo borrowers, 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:



19. 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: D is correct. 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 is incorrect. ABC is not funding from Repo Co.

B is incorrect. The use of a clearinghouse does not change Repo Co.'s default risk – just ABC's exposure to Repo Co. defaults.

C is incorrect. The use of a clearinghouse in this situation does not reduce XYZ's lending risk.

Section: Credit Risk Measurement and Management

Reference: Jon Gregory, The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, 3rd Edition (West Sussex, UK: John Wiley & Sons, 2015). Chapter 4 – Counterparty Risk

Learning Objective: Describe counterparty risk and differentiate it from lending risk.

20. By using a clearinghouse to handle the repo transactions between ABC Co. 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: C is correct. Close-out netting occurs if there is an event of default, which would include an incidence of fraud. One of the shortcomings of clearinghouses, and close-out netting as well, is that the other party, in this case ABC, 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.

A is incorrect. Payment netting is the simple netting of cash flows due on the same day. It relates to settlement risk and not to counterparty risk.

B is incorrect, as explained in A and C.

D is incorrect. While close-out netting is the most appropriate type of netting to use in this case, it is ABC's counterparty risk that would be reduced (and not Repo Co.'s).

Section: Credit Risk Measurement and Management

Reference: Jon Gregory, The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, 3rd Edition (West Sussex, UK: John Wiley & Sons, 2015). Chapter 5 – Netting, Close-out, and Related Aspects

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.

21. A risk manager at a fund management company is discussing potential weaknesses in the company's risk measurement system with the risk team. Among the areas suggested for improvement is the ability to better anticipate the company's cash flow needs, so the manager recommends implementation of a liquidity-at-risk (LaR) measurement system into the firm's risk management framework. Which of the following statements concerning LaR is correct?

A. A firm's LaR tends to increase as its credit quality declines.
B. For a hedged portfolio, the LaR will typically be smaller than the VaR.
C. Hedging using futures has the same impact on LaR as hedging using long options.
D. Entering into collateralized financial contracts such as swaps decreases the LaR of a firm.

Correct Answer: A

Explanation: A is correct. LaR measures the maximum likely cash outflow the firm should expect at a given confidence level over a specific time horizon. LaR typically increases when a firm's credit quality declines as investors or creditors become more motivated to withdraw funds from the firm.

B is incorrect. The LaR can differ substantially from the VaR in a hedged portfolio, and in different situations can be larger or smaller than the VaR. One example is when a long asset position is hedged with a short option position. The combined portfolio might have a relatively low VaR, but if the asset increases in value, the short option position could result in a much larger cash outflow due to collateral calls.

C is incorrect. Consider, for example, a portfolio where short futures contracts are used to hedge a long position in the underlying asset. 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 that do not expire during the period), the LaR can be smaller than the VaR.

D is incorrect. Collateralized obligations can generate cash inflows or outflows depending on the way market moves.

Section: Operational and Integrated Risk Management

Reference: Kevin Dowd, Measuring Market Risk, 2nd Edition (West Sussex, UK: John Wiley & Sons, 2005). Chapter 14 - Estimating Liquidity Risks.

Learning Objective: Describe liquidity at risk (LaR) and compare it to LVaR and VaR, describe the factors that affect future cash flows, and explain challenges in estimating and modeling LaR.

22. 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 basic indicator approach for operational risk
B. The standardized approach for market risk
C. The internal models approach for market risk
D. The standardized approach for operational risk

Correct Answer: C

Explanation: C is correct. 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 using the internal models approach, banks are explicitly allowed to recognize empirical correlations across broad market risk categories. The standardized approach for market risk, on the other hand, assigns capital separately to each of debt securities, equity securities, foreign exchange risk, commodity risk, and options without consideration for correlations between different types of instruments. Thus, C is correct, and B is incorrect. Also, A and D are incorrect because these approaches do not recognize diversification.

Section: Operational and Integrated Risk Management

Reference: John Hull, Risk Management and Financial Institutions, 5th Edition, (Hoboken, NJ: John Wiley & Sons, 2018). 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.

23. The risk audit committee of an equity mutual fund is reviewing a portfolio construction technique proposed by a new portfolio manager who has recently been allocated capital to manage. The fund typically grants its portfolio managers flexibility in selecting and implementing appropriate portfolio construction procedures but requires that any methodology adopted fulfills key risk control objectives set by the firm. Which of the following portfolio construction techniques and its capability for 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 portfolio construction techniques 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: A is correct. 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 and the less than perfect nature of most data, it introduces the potential for noise and poor calibration.

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 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.

24. 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 40 million:

Pension	Assets	Liabilities
Amount (USD million)	180	140
Expected annual growth rate	6%	10%
Annual volatility of growth rates	25%	12%

To evaluate the sufficiency of the fund's surplus, the advisor estimates the possible surplus values at the end of 1 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 0.68. Assuming that the volatility of surplus in dollars is USD 35.76 million, what is the lower bound of the 95% confidence interval for the expected end-of-year surplus that the advisor can report?

A. USD -76.4 million
B. USD -58.2 million
C. USD -33.3 million
D. USD -22.0 million

Correct Answer: C

Explanation: C is correct. The lower bound of the 95% confidence interval is equal to: Expected Surplus – (95% confidence factor * Volatility of Surplus).
Expected surplus:
$V_A*[1 + E(R_A)] – V_L*[1 + E(R_L)] = 180*1.06 – 140*1.10 = USD\ 36.80\ million.$
For a 95% confidence interval, the appropriate z-value is 1.96. Therefore, the lower bound of the surplus at the 95% confidence level = 36.80 – 1.96*35.76 = USD -33.2896 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.

25. 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 appropriate criteria the specialist should use 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: C is correct. 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.

A is incorrect. 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.

B is incorrect. Many funds employ independent risk service providers to report risks to investors, but these firms do not get involved in risk related decision making.

D is incorrect. 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, 2nd Edition (Hoboken, NJ: Wiley Finance, 2016).

Learning Objective: Describe criteria that can be evaluated in assessing a fund’s risk management process.

26. A packaging materials manufacturer is considering a project that has an estimated risk-adjusted return on capital (RAROC) of 15%. Suppose that the risk-free rate is 3% per year, the expected market rate of return is 11% per year, and the company's equity beta is 1.8. 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 risk-free rate.
D. Accept the project because the ARAROC is lower than the risk-free rate.

Correct Answer: C

Explanation: C is correct. Consider the basic adjusted RAROC (ARAROC) formula for a project:

ARAROC = RAROC - β_E*(R_m – R_f)

Where:

β_E = Beta of the equity of the firm

R_m.= Expected market rate of return

R_f = Risk-free rate of interest

β_E*(R_m – R_f) = Risk premium of the project.

ARAROC is simply "RAROC adjusted for the systematic riskiness of the returns". ARAROC can be used in evaluating the project in the following way: If the project's "RAROC less the project's risk premium" is greater than the risk-free rate, then the firm's shareholders are compensated for the non-diversifiable systematic risk they bear when investing in the activity, assuming the investors hold a well-diversified portfolio (i.e., the project adds value). That is, if the project's ARAROC exceeds the risk-free rate, it should be accepted by the firm. Otherwise, if it is less than the risk-free rate, the project should be rejected.

Given RAROC = 15%, β_E = 1.8, R_m = 11% and R_f = 3%, one can compute ARAROC = 0.15-1.8*(0.11- 0.03) = 0.006 = 0.6% and is less than R_f = 3%. Thus, the project is rejected.

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, Risk Capital Attribution and Risk-Adjusted Performance Measurement.

Learning Objective: Compute the adjusted RAROC for a project to determine its viability

27. A derivative trading firm 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: A is correct. 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. The company already has contracts with a handful of other firms that dominate the market for the rare derivatives asked in the question and thus diversification cannot be a solution. 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, The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, 3rd Edition (West Sussex, UK: John Wiley & Sons, 2015). Chapter 4 – Counterparty Risk

Jon Gregory, The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, 3rd Edition (West Sussex, UK: John Wiley & Sons, 2015). Chapter 6 – Collateral

Learning Objective: Identify and describe the different ways institutions can quantify, manage and mitigate counterparty risk.

Describe the rationale for collateral management.

Describe the terms of a collateral and features of a credit support annex (CSA) within the ISDA Master Agreement including threshold, initial margin, minimum transfer amount and rounding, haircuts, credit quality, and credit support amount.

28. HIP Bank (HIP) often enters into interest rate swaps with ADB Banking Corporation (ADB) on terms that reflect appropriate counterparty risk. Earlier in the year, HIP and ADB entered into a 3-year swap in which ADB agreed to pay HIP a fixed rate of 5% in return for 6-month LIBOR plus a spread. Since the swap was entered into, both banks were downgraded. As a result of the ratings changes, the credit spread for HIP has increased from 36 bps to 144 bps, while the credit spread for ADB has increased from 114 bps to 156 bps. Assuming no change in the LIBOR curve, if an identical 3-year swap was entered into today, which of the following is the most likely to be correct?

A. Since HIP's spread increased more than ADB's spread, HIP's DVA will increase and ADB's DVA will decrease.
B. Since HIP's spread increased more than ADB's spread, HIP's CVA will increase and ADB's CVA will decrease.
C. Since both banks' spreads increased, the CVA on both sides of the contract will be higher.
D. Since both banks' spreads increased, the DVA on both sides of the contract will be lower.

Correct Answer: C

Explanation: C is correct. The lower credit qualities and increased credit spreads should result in higher DVA and CVA for both ADB and HIP. Therefore, only C is correct, and A, B and D are all incorrect.

Section: Credit Risk Measurement and Management

Reference: Jon Gregory, The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, 3rd Edition (West Sussex, UK: John Wiley & Sons, 2015). Chapter 14 – Credit and Debt Value Adjustments

Stress Testing: Approaches, Methods, and Applications, Edited by Akhtar Siddique and Iftekhar Hasan (London: Risk Books, 2013). Chapter 4 - The Evolution of Stress Testing Counterparty Exposures

Learning Objective: Explain the motivation for and the challenges of pricing counterparty risk

Calculate the debt value adjustment (DVA) and explain how stressing DVA enters into aggregating stress tests of CCR.

29. A risk analyst estimates that the hazard rate for a company is 0.12 per year. Assuming a constant hazard rate model, what is the probability that the company will survive in the first year and then default before the end of the second year?

A. 8.9%
B. 10.0%
C. 11.3%
D. 21.3%

Correct Answer: B

Explanation: B is correct.

The joint probability of survival up to time t and default over (t, t+ τ) is:

$P[t^* > t \cap t^* < t+\tau] = 1-e^{-\lambda(t+\tau)}-(1-e^{-\lambda t}) = e^{-\lambda t}(1-e^{-\lambda \tau})$

The joint probability of survival the first year and default over the first year and the second year is:

$P[t^* > 1 \cap t^* < 1+1] = e^{-0.12*1}(1-e^{-0.12*1}) = 10.03\%$

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.

Jon Gregory, The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, 3rd Edition (West Sussex, UK: John Wiley & Sons, 2015). Chapter 12 - Default Probabilities, Credit Spreads, and Funding Costs

Learning Objective: Define the hazard rate and use it to define probability functions for default time and conditional default probabilities.

Distinguish between cumulative and marginal default probabilities.

30. 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 mapping technique for the given positions is the most appropriate?

A. USD/EUR forward contracts are mapped to the USD/EUR spot exchange rate.
B. Each position in a corporate bond portfolio is mapped to the bond with the closest maturity among a set of government bonds.
C. Zero-coupon government bonds are mapped to government bonds paying regular coupons.
D. A position in the stock market index is mapped to a position in a stock within that index.

Correct Answer: A

Explanation: A is correct. Mapping several USD/EUR forward contracts to USD/EUR spot exchange rate is an adequate process, because all the forward positions are exposed to a single major risk factor, which is the USD/EUR spot exchange rate. However, this is not a perfect mapping (for instance, the sensitivity of both the forward and the spot exchange rates to a specific risk factor such as changes in interest rates, may differ).

While the single aggregation of exposure of this risk factor is acceptable for risk measurement, it is not adequate for pricing of the portfolio.

B is incorrect because any bond must be mapped on yields that best represent its current profile and the yield differences between the corporate bonds and the government bonds disqualify this as the best mapping.

C is incorrect because such procedure maps a simple single source of uncertainty (the payoff at the maturity) to multiple sources of uncertainty (coupon payments and the payoff at the maturity) which violates the first principle of mapping, simplify the source of uncertainty.

D is also incorrect as the stock market index is a more diversified factor than a single stock. In fact, it is usually the reverse, i.e., a position of stock within an index is mapped to a position in that index.

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: Explain the principles underlying VaR mapping, and describe the mapping process.

31. A market risk manager seeks to calculate the price of a 2-year zero-coupon bond. The 1-year interest rate today is 10.0%. There is a 50% probability that the 1-year interest rate will be 12.0% and a 50% probability that it will be 8.0% in 1 year. Assuming that the risk premium of duration risk is 50 bps each year, and that the bond's face value is EUR 1,000, which of the following should be the price of the zero-coupon bond?

A. EUR 822.98
B. EUR 826.74
C. EUR 905.30
D. EUR 921.66

Correct Answer: A

Explanation: A is correct. The value of the 2-year zero-coupon bond = (50%(1/1.125+1/1.085)/1.10)*EUR 1,000 = EUR 822.976

Section: Market Risk Measurement and Management

Reference: Bruce Tuckman and Angel Serrat, Fixed Income Securities, 3rd Edition (Hoboken, NJ: John Wiley & Sons, 2011), Chapter 8 - The Evolution of Short Rates and the Shape of the Term Structure

Learning Objective: Calculate the price and return of a zero-coupon bond incorporating a risk premium.

32. A financial analyst is pricing a 5-year call option on a 5-year Treasury note using a successfully validated pricing model. Current interest rate volatility is high, and the analyst 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. When short-term rates are negative, the financial analyst adjusts the risk-neutral probabilities.
B. When short-term rates are negative, the financial analyst increases the volatility.
C. When short-term rates are negative, the financial analyst sets the rate to zero.
D. When short-term rates are negative, the financial analyst sets the mean-reverting parameter to 1.

Correct Answer: C

Explanation: C is correct. Negative short-term interest rates can arise in models for which the terminal distribution of interest rates follow a normal distribution. The existence of negative interest rates (although possible) 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.

33. An investment bank has been using VaR as its main risk measurement tool. 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. For the same confidence level, ES is always greater than VaR.
B. If a VaR backtest at a specified confidence level is accepted, then the corresponding ES will always be accepted.
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. While ES is more complicated to calculate than VaR, it is easier to backtest than VaR.

Correct Answer: A

Explanation: A is correct. Expected shortfall is always greater than or equal to VaR for a given confidence level α, since α measures the minimum loss in case the worst α probability event happens and ES accounts for the severity of expected losses beyond VaR.

Section: Market Risk Measurement and Management

Reference: "Messages from the Academic Literature on Risk Measurement for the Trading Book", Basel Committee on Banking Supervision, Working Paper No. 19, January 2011.

Learning Objective: Compare VaR, expected shortfall, and other relevant risk measures.

34. A derivative 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 3-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 4 years using the RiskMetrics EWMA method.

For testing purposes, the new model is used in parallel with the existing model for 6 weeks to estimate the 1-day 99% VaR. After 6 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.

Which of the following statements is a correct conclusion for this replacement?

A. Delta-normal VaR is more appropriate than historical simulation VaR for assets with non-linear payoffs.
B. Changing the look-back period and weighting scheme from 3 years, equally weighted, to 4 years, exponentially weighted, will understate the risk in the portfolio.
C. Overnight examination by the junior analyst increased the desk's exposure to model risk due to the potential for incorrect calibration and programming errors.
D. A 99% VaR model that generates no exceedances in 6 weeks is necessarily conservative.

Correct Answer: C

Explanation: C is correct. Given the quick implementation of the new VaR model and the insufficient amount of testing that was done, the desk's exposure to model risk has increased 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.

35. The senior management team of a small regional bank has established a committee to review procedures and implement best practices related to entering into significant contracts with third-party vendors. The committee is reviewing one proposed relationship with a third-party vendor who would have a significant responsibility for marketing the bank's financial products to potential customers. In establishing policies to reduce the operational risk associated with this potential vendor contract, which of the following recommendations would be most appropriate?

A. The bank should review all third-party audit reports of the vendor that are publicly available.
B. The bank should ensure that the vendor's sales representatives are compensated mainly with commissions from the sale of the bank's products.
C. The bank should prevent the third-party vendor from having access to any of its critical processes.
D. The bank should be responsible for developing the vendor's contingency planning process to mitigate risk exposure to the vendor.

Correct Answer: A

Explanation: A is correct. From the guidelines regarding internal controls: "For significant service provider relationships, financial institutions should assess the adequacy of the provider's control environment. Assessments should include reviewing available audits or reports such as the American Institute of Certified Public Accountants' Service Organization Control 2 report."

B is incorrect. The bank should review the vendor's incentive compensation structure and ensure that the structure does not encourage vendor sales representatives to direct customers towards higher margin products without regard for the risk incurred.

Compensating sales reps mostly with commissions would not be appropriate.

C is incorrect. Outsourcing critical processes is not ruled out as a guideline, for example: "A community banking organization may have critical business activities being outsourced, but the number may be few and to highly reputable service providers." "(Larger) financial institutions may use hundreds or thousands of service providers for numerous business activities that have material risk…"

D is incorrect. The bank should monitor the vendor's contingency planning process and "assess the adequacy and effectiveness of a service provider's disaster recovery and business continuity plan and its alignment with its own plan".

Section: Operational and Integrated Risk Management

Reference: "Guidance on Managing Outsourcing Risk," Board of Governors of the Federal Reserve System, December 2013.

Learning Objective: Describe topics and provisions that should be addressed in a contract with a third-party service provider.

36. The Basel Committee recommends that banks use a set of early warning indicators 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. Credit rating upgrade
B. Increased asset diversification
C. Rapid growth in the leverage ratio with significant dependence on short-term repo financing
D. Decreased collateral haircuts applied to the bank's collateralized exposures

Correct Answer: C

Explanation: C is correct. Rapid levered asset growth combined with substantial use of short term repos is an early warning of a potential liquidity problem. Decreased collateral haircuts, a credit rating upgrade, and increased asset diversification are generally positive developments and 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.

37. Large dealer banks have often financed significant fractions of their assets using short-term (overnight) repurchase agreements in which creditors hold bank securities as collateral against default losses. The table below shows the quarter-end financing of four A-rated broker-dealer banks. All values are in USD billion.

Financial instruments	**Bank P**	**Bank Q**	**Bank R**	**Bank S**
Owned	656	750	339	835
Pledged as collateral	258	472	139	209
Not pledged	398	278	200	626

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 P
B. Bank Q
C. Bank R
D. Bank S

Correct Answer: B

Explanation: B is correct. 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. The bank may therefore be forced to sell its assets in a hurry to buyers that know it needs to sell quickly. This leads to the potential for a fire sale and supports using the proportion of assets covered by repos as a signal of liquidity risk. Also, low prices recorded in a fire sale could lower the market valuation of securities not sold, and thus reduce the amount of cash that could be raised through repurchase agreements collateralized by those securities. Overall, this vulnerability is directly related to the proportion of assets a bank has pledged as collateral.

Bank Q 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.

38. During a training seminar, a supervisor at Firm W discusses different types of operational risk that the firm may face, which could be in the short-term or over a longer-term period. Which of the following is an example of a loss caused by an operational risk of Firm W?

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

Correct Answer: B

Explanation: B is correct. 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: Describe tools and processes that can be used to identify and assess operational risk.

39. An information technology analyst at a large global bank is preparing a plan to aggregate the bank's risk data and increase the quality of the firm's data governance practices. The bank has several business divisions that represent product lines that are offered across multiple regions. To effectively aggregate the risk data and ensure a strong data governance process, which of the following conditions would the analyst point out as posing the greatest information technology challenge to the bank?

A. Most of the risk data are located on spreadsheets at the individual business units.
B. The bank rapidly integrates the information technology systems of each company that it acquires into its own technology platform.
C. The product lines are divided into legal entities by geographic region, but data from each entity is aggregated in a centralized data warehouse.
D. The bank installs technology platforms before investing in approved strategic initiatives that require those platforms.

Correct Answer: A

Explanation: A is correct. As per the Senior Supervisors Group reading: "Many firms still rely heavily on spreadsheet environments, which significantly delay report processing while raising concerns about accuracy." Spreadsheets involve a high level of manual intervention and are therefore prone to error, so spreadsheet-based systems are generally considered to be a weak process.

B is incorrect. Banks are encouraged to integrate technology systems of acquired companies as quickly as possible after a merger or acquisition in order to reduce fragmentation.

C is incorrect. Aggregating risk data from different divisions into a centralized data warehouse is a recommended practice.

D is incorrect. It is also a recommended practice for the bank to envision the technology system requirements.

Section: Operational and Integrated Risk Management

Reference: "Observations on Developments in Risk Appetite Frameworks and IT Infrastructure," Senior Supervisors Group, December 2010

Learning Objective: Explain the challenges and best practices related to data aggregation at an organization.

40. A risk analyst is implementing an enterprise risk management system at a bank. During the process, the analyst takes an inventory of risks faced by the bank and categorizes these risks as market, credit, or operational risks. 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 many 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 symmetric.

Correct Answer: B

Explanation: B is correct. 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, as well as challenges to the implementation of an ERM system.

41. A regional commercial bank is considering a 1-year loan to be fully funded by deposits, with the following parameters:

- Loan amount: JPY 4.2 billion
- Average annual interest rate paid on deposits: 0.4%
- Annual interest rate received on loan: 3.2%
- Expected loss: 2.0% of face value of loan
- Annual operating costs: 0.5% of face value of loan
- Economic capital required to support the loan: 10.0%
- Average pre-tax return on economic capital: 1.4%
- Effective tax rate: 38%
- Other transfer costs: JPY 0

What is the after-tax RAROC for this loan?

A. 0.27%
B. 2.73%
C. 4.40%
D. 10.73%

Correct Answer: B

Explanation: B is correct. The risk-adjusted after-tax return on capital (RAROC) is computed by:

$$RAROC = \frac{After-tax\ expected\ risk-adjusted\ net\ income}{Economic\ capital}$$

$$= \frac{ER + ROEC - IC - OC - EL - Taxes \pm Transfers}{Economic\ capital}$$

where,

Economic capital = JPY 4,200,000,000 x 0.10 = JPY 420,000,000

ER = expected revenue = JPY 4,200,000,000 x 0.032 = JPY 134,400,000

ROEC = pre-tax return on invested economic capital =

=Economic capital x 0.014 = JPY 420,000,000 x 0.014 = JPY 5,880,000

IC = interest expense = JPY 4,200,000,000 x 0.004 = JPY 16,800,000

OC = Operating Cost = JPY 4,200,000,000 x 0.005 = JPY 21,000,000

EL = expected loss = JPY 4,200,000,000 x 0.02 = JPY 84,000,000

Taxes = (Revenue + Income – Interest – Operating Cost – Loss)*(Tax rate)

= (134,400,000 + 5,880,000 – 16,800,000 – 21,000,000 – 84,000,000)*(0.38)

= (JPY 18,480,000)*(0.38) = JPY 7,022,400

Therefore, numerator = JPY 11,457,600 and so,

$$RAROC = \frac{11{,}457{,}600}{420{,}000{,}000} = 0.0273 = 2.73\%$$

A is incorrect. 0.27% is the result obtained when the economic capital is incorrectly taken to be JPY 4.2 billion instead of it being 10% of the loan amount.

C is incorrect. 4.40% is the result obtained when taxes are ignored.

D is incorrect. 10.73% is the result obtained when IC is added instead of subtracting in the numerator.

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, Risk Capital Attribution and Risk-Adjusted Performance Measurement.

Learning Objective: Compute and interpret the RAROC for a project, loan, or loan portfolio, and use RAROC to compare business unit performance.

42. A bank is using the VaR and stressed VaR market risk framework in line with the Basel II.5 guidelines. The bank's internal models for market risk have 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%	238	484	252	546
99.0%	451	995	413	1,106
99.9%	578	1,281	528	1,372

Assuming the supervisory authority has set the multiplication factors for both the VaR and the stressed VaR values to 3, what is the correct capital requirement for general market risk for the bank under Basel II.5?

A. USD 1,248 million
B. USD 1,533 million
C. USD 4,557 million
D. USD 4,799 million

Correct Answer: C

Explanation: C is correct. The Basel II.5 market risk capital requirement requires a 99.0% confidence level and is calculated as follows: Market Risk Capital =
= $\max(VaR_{t-1}, m_c * VaR_{60\text{-day Avg}}) + \max(sVaR_{t-1}, m_s * sVaR_{60\text{-day Avg}})$
= max(451, 3*413) + max(995, 3*1,106)
= USD 1,239 million + USD 3,318 million
= USD 4,557 million

Section: Operational and Integrated Risk Management

Reference: John Hull, Risk Management and Financial Institutions, 5th Edition (New York: John Wiley & Sons, 2018). Chapter 16, Basel II.5, Basel III, and Other Post-Crisis Changes.

Learning Objective: Describe and calculate the stressed value-at-risk measure introduced in Basel II.5, and calculate the market risk capital charge.

43. Company PQR has an outstanding zero-coupon bond with 1 year remaining to maturity. The bond has a face value of USD 2,000,000 and a recovery rate of 0% in the event of default. The bond is currently trading at 75% of face value. Assuming the excess spread only captures credit risk and that the continuously compounding risk-free rate is 3% per year, and using risk-neutral binomial pricing tree methodology, what is the approximate risk-neutral 1-year probability of default of Company PQR?

A. 13.3%
B. 16.5%
C. 19.2%
D. 22.7%

Correct Answer: D

Explanation: D is correct.

As the bond is trading at 75% of the current value, the bond price for face value USD 2M is 0.75*2 = USD 1.5M. The risk-neutral argument equates the risk-free investment payoff in 1 year to the expected risk-neutral payoff, i.e.,

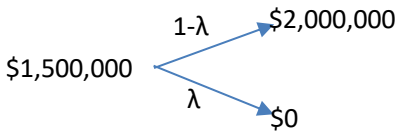
$1.5 * \exp(0.03*1) = 0 * PD + 2 * (1 - PD)$

where PD is the risk-neutral probability of default. Thus,

$PD = 1 - [1.5 * \exp(0.03) / 2] = 0.227$

Easier explanation:

Risk-neutral probability of default (λ)



$1{,}500{,}000 = [(1-\lambda)*2{,}000{,}000 + \lambda*0]*e^{-3\%*1}$
and thus $\lambda = 22.72\%$

Section: Market Risk Measurement and Management

Reference: Bruce Tuckman and Angel Serrat, Fixed Income Securities, 3rd Edition (Hoboken, NJ: John Wiley & Sons, 2011), Chapter 8 - The Evolution of Short Rates and the Shape of the Term Structure

Learning Objective: Calculate the price and return of a zero-coupon bond incorporating a risk premium.

44. A portfolio manager at an insurance company has observed the price of one of the corporate bonds that the company currently holds and wants to estimate the premium the company needs to accept the default risk of the bond. The manager has determined that the bond's real-world default probability is 2.0%, its liquidity risk premium is 1.8%, and its risk-neutral default probability is 6.1%. Ignoring any other risk premiums that might affect the bond's pricing, what is the bond's default risk premium?

A. 2.0%
B. 2.3%
C. 3.8%
D. 4.1%

Correct Answer: B

Explanation: B is correct. Risk-neutral default probability = Real-world default prob. + Default risk premium + Liquidity risk premium

Therefore,

Default risk premium = Risk-neutral default probability - Real-world default prob. - Liquidity risk premium

= 6.1% - 2.0% - 1.8% = 2.3%

A is incorrect. 2.0% is the given real-world default probability.

C is incorrect. 3.8% is the sum of the real-world default probability and the liquidity risk premium.

D is incorrect. 4.1% is the difference between the risk-neutral default probability and the real-world default probability.

Section: Credit Risk Measurement and Management

Reference: Jon Gregory, The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, 3rd Edition (West Sussex, UK: John Wiley & Sons, 2015). Chapter 12 - Default Probabilities, Credit Spreads, and Funding Costs

Learning Objective: Calculate risk-neutral default probabilities, and compare the use of risk-neutral and real-world default probabilities in pricing derivative contracts.

45. A financial institution has four open derivative positions with an investment company. A description of the positions and their current market values are displayed in the table below:

Position	Exposure (USD)
Long swaptions	32 million
Long credit default swaps	12 million
Long currency derivatives	-16 million
Long futures contracts	-8 million

If the investment company defaults, what would be the loss to the financial institution if netting is used compared to the loss if netting is not used?

A. Loss of USD 20 million if netting is used; loss of USD 24 million if netting is not used
B. Loss of USD 20 million if netting is used; loss of USD 44 million if netting is not used
C. Loss of USD 24 million if netting is used; loss of USD 32 million if netting is not used
D. Loss of USD 24 million if netting is used; loss of USD 44 million if netting is not used

Correct Answer: B

Explanation: B is correct. 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 every payout, hence the loss will be reduced to: USD 32 million + USD 12 million – USD 16 million – USD 8 million = USD 20 million. Without netting, the loss is the outstanding long position: USD 32 million + USD 12 million = USD 44 million.

Section: Credit Risk Measurement and Management

Reference: Jon Gregory, The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, 3rd Edition (West Sussex, UK: John Wiley & Sons, 2015). Chapter 5, Netting, Close-out, and Related Aspects.

Learning Objective: Describe the effectiveness of netting in reducing credit exposure under various scenarios.

46. A derivative trading firm sells a European-style call option on stock JKJ with a time to expiration of 9 months, a strike price of EUR 45, an underlying asset price of EUR 67, and implied annual volatility of 27%. The annual risk-free interest rate is 2.5%. What is the firm's counterparty credit exposure from this transaction?

A. EUR 0
B. EUR 9.45
C. EUR 19.63
D. EUR 22.00

Correct Answer: A

Explanation: A is correct. Selling an option exposes the firm to zero counterparty credit risk as the premium is paid up front. However, buying an option would expose the firm to a counterparty credit risk. All the pieces of information necessary to price the option are provided but they are not necessary for answering the question.

Section: Credit Risk Measurement and Management

Reference: Jon Gregory, The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, 3rd Edition (West Sussex, UK: John Wiley & Sons, 2015). Chapter 4 – Counterparty Risk

Learning Objective: Describe transactions that carry counterparty risk and explain how counterparty risk can arise in each transaction.

47. A financial firm has sold default protection on the most senior tranche of a CDO. If the default correlation between assets held in the CDO decreases sharply from the correlation used in pricing the CDO tranches, assuming everything else is unchanged, how will the position of the financial firm be impacted?

A. It will either increase or decrease, depending on the pricing model used and the market conditions.
B. It will gain significant value, since the probability of exercising the protection falls.
C. It will lose significant value, since the protection will gain value.
D. It will neither gain nor lose value, since only expected default losses matter and correlation does not affect expected default losses.

Correct Answer: B

Explanation: B is correct. 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.

48. A risk analyst constructs a binomial interest rate tree by using the Ho-Lee model. The time step is monthly and the annualized drift is 80 bps in the first month and 120 bps in the second month. Assuming the current annualized short-term rate is 3.2% and the annual basis point-volatility is 2.1%, what is the interest rate in the lowest node after 2 months?

A. 1.82%
B. 2.15%
C. 2.76%
D. 3.03%

Correct Answer: B

Explanation: B is correct. The interest rate in the lowest node based on the Ho-Lee model is:

$$r_0 + (\lambda_1 + \lambda_2)dt - 2\sigma\sqrt{dt}$$

$$= 3.2\% + \frac{(0.8\% + 1.2\%)}{12} - 2 * 2.1\% * \sqrt{\frac{1}{12}}$$

$$= 0.021542 = 2.15\%$$

A is incorrect. This uses the incorrect formula $r_0 - (\lambda_1 + \lambda_2)dt - 2\sigma\sqrt{dt}$ dt to calculate the interest rate, subtracting instead of adding the second term in the formula.

C Is incorrect. This uses the incorrect formula $r_0 + (\lambda_1 + \lambda_2)dt - \sigma\sqrt{dt}$ to calculate the interest rate, forgetting to multiply by 2 in the third term.

D Is incorrect. This uses the incorrect formula $r_0 - (\lambda_1 + \lambda_2)dt$ to calculate the interest rate, omitting the third term entirely.

Section: Market Risk Measurement and Management

Reference: Bruce Tuckman and Angel Serrat, 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.

49. Four derivative counterparties have entered into bilateral netting arrangements. The exhibit below presents a summary of their bilateral mark-to-market (MtM) trades.

Mark-to-Market Trades for Four Counterparties (USD million)				
		Opposing Counterparty		
Counterparty P	Trades with positive MtM	Q 8	R 10	S 4
	Trades with negative MtM	-6	-2	-4
Counterparty Q	Trades with positive MtM	P 15	R 6	S 7
	Trades with negative MtM	-16	0	-8
Counterparty R	Trades with positive MtM	P 6	Q 4	S 8
	Trades with negative MtM	-6	-5	-12
Counterparty S	Trades with positive MtM	P 2	Q 13	R 1
	Trades with negative MtM	-2	-10	-1

If netting agreements exist between all pairs of counterparties shown, what is the correct order of net exposure per counterparty, from highest to lowest?

A. P, Q, S, R
B. Q, R, S, P
C. R, Q, P, S
D. S, P, Q, R

Correct Answer: A

Explanation: A is correct. The properly netted amounts are:

For counterparty P: Q = 8-6= $2; R = 10-2 = $8; S = 4-4 = 0; for a sum of $10.

For counterparty Q: P = 15-16 =-1 = $0, R = 6-0 = $6; S = 7-8 = -1 = $0; for a sum of $6.

For counterparty R: P = 6-6 = $0; Q = 4-5 =-1 = $0; S = 8-12=-4 = $0; for a sum of $0.

For counterparty S: P = 2-2 = $0, Q = 13-10 = $3; R = 1-1 = $0; for a sum of $3.

Therefore, the correct sequence of net exposure amounts per counterparty, from highest to lowest, is P, Q, S, and R.

Note that a negative netted amount means the counterparty has no exposure.

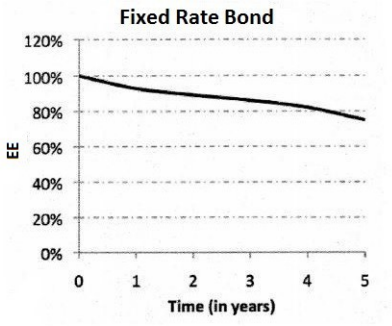
Section: Credit Risk Measurement and Management

Reference: Jon Gregory, The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, 3rd Edition (West Sussex, UK: John Wiley & Sons, 2015). Chapter 5 - Netting, Close-out, and Related Aspects

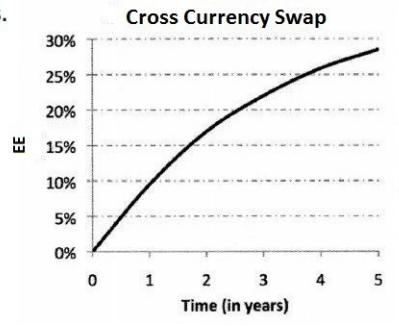
Learning Objective: Describe the effectiveness of netting in reducing credit exposure under various scenarios.

50. Interest rate and currency swaps display differing profiles of expected exposure (EE) over time. Assuming each instrument matures in 5 years, which of the following graphs is an accurate representation of a typical EE profile for the corresponding instrument?

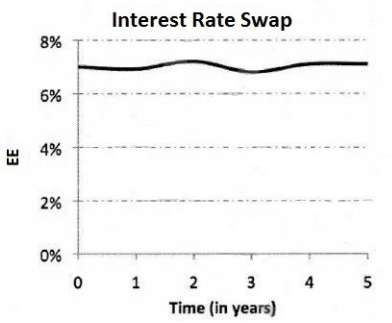
A



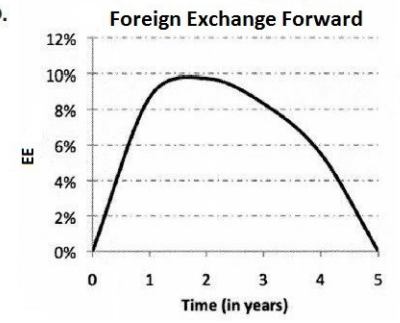
B.



C



D.



Correct Answer: B

Explanation: B is correct. 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.

A is incorrect. For fixed rate bond, the EE is usually considered constant (notional value) between t=0 and its maturity.

C is incorrect. The EE of an interest rate swap should be 0 at t=0 and also 0 when it expires.

D is incorrect. The EE of a foreign exchange forward should be 0 at t=0 but should be the notional amount at maturity.

Section: Credit Risk Measurement and Management

Reference: Jon Gregory, The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, 3rd Edition (West Sussex, UK: John Wiley & Sons, 2015). Chapter 7 - Credit Exposure and Funding

Learning Objective: Identify typical credit exposure profiles for various derivative contracts and combination profiles.

51. A risk analyst is examining a firm's foreign currency option price assumptions. The implied volatility is relatively low for an at-the-money option and it becomes progressively higher as the option moves either into the money or out of the money. Compared to the lognormal distribution with the same mean and standard deviation, the distribution of option prices on this foreign currency implied by the Black-Scholes-Merton model would have:

A. A heavier left tail and a less heavy right tail.
B. A heavier left tail and a heavier right tail.
C. A less heavy left tail and a heavier right tail.
D. A less heavy left tail and a less heavy right tail.

Correct Answer: B

Explanation: B is correct. For a foreign currency option, the implied distribution gives a relatively high price for the option. The implied volatility is relatively low for at-the-money options, but it becomes higher as the option moves either in-the-money or out-of-the-money. Thus, the implied distribution has heavier tails than the lognormal distribution.

Section: Market Risk Measurement and Management

Reference: John Hull, Options, Futures, and Other Derivatives, 10th Edition (New York: Pearson, 2017). 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.

52. A wealth management firm has JPY 72 billion in assets under management. The portfolio manager computes the daily VaR at various confidence levels as follows:

Confidence Level	VaR (JPY)
95.0%	332,760,000
95.5%	336,292,500
96.0%	340,095,000
96.5%	350,332,500
97.0%	359,107,500
97.5%	367,882,500
98.0%	378,412,500
98.5%	392,452,500
99.0%	410,880,000
99.5%	439,252,500

What is the closest estimate of the daily ES at the 97.5% confidence level?

A. JPY 398 million
B. JPY 400 million
C. JPY 405 million
D. JPY 497 million

Correct Answer: C

Explanation: C is correct. 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 97.5%. Therefore,

ES = (378,412,500+392,452,500+410,880,000+439,252,500)/4 = JPY 405,249,375

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.

53. A newly hired risk analyst is backtesting a firm's VaR model. Previously, the firm calculated a 1-day VaR at the 95% confidence level. Following the Basel framework, the risk analyst is recommending that the firm switch to a 99% VaR confidence level. Which of the following statements concerning this switch is correct?

A. The decision to accept or reject a VaR model based on backtesting results at the two-tailed 95% confidence level is less reliable with a 99% VaR model than with a 95% VaR model.
B. The 95% VaR model is less likely to be rejected using backtesting than the 99% VaR model.
C. When backtesting using a two-tailed 90% confidence level test, there is a smaller probability of incorrectly rejecting a 95% VaR model than a 99% VaR model.
D. Using a 99% VaR model will lower the probability of committing both type 1 and type 2 errors.

Correct Answer: A

Explanation: A is correct. 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 (namely 95%), and how they interact with one another.

Using a 95% VaR confidence level creates a narrower nonrejection region than using a 99% VaR confidence level 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 than using a 99% confidence level.

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.

54. A hedge fund risk manager is looking at various models that are flexible enough to incorporate mean reversion and risk premium into term structure modeling. Which of the following is correct about the Vasicek model?

A. It incorporates the mean reversion feature and its drift is always zero.
B. It incorporates the mean reversion feature and models the risk premium as a component of a constant or changing drift.
C. It cannot incorporate risk premium and its drift is always zero.
D. It cannot capture the mean reversion feature but can be used to model the time-varying risk premium.

Correct Answer: B

Explanation: B is correct. The Vasicek model incorporates mean reversion. The flexibility of the model also allows for risk premium, which enters into the model as constant drift or a drift that changes over time.

Section: Market Risk Measurement and Management

Reference: Bruce Tuckman and Angel Serrat, Fixed Income Securities, 3rd Edition (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 9, The Art of Term Structure Models: Drift.

Learning Objective: Describe the process of constructing a simple and recombining tree for a short term rate under the Vasicek Model with mean reversion.

55. A hedge fund that runs a distressed securities strategy is evaluating the solvency conditions of two potential investment targets. Currently firm RST is rated BB and firm WYZ is rated B. The hedge fund is interested in determining the joint default probability of the two firms over the next 2 years using the Gaussian default time copula under the assumption that a 1-year Gaussian default correlation is 0.36. The fund reports that x_{BB} and x_B are abscise values of the bivariate normal distribution presented in the table below where $x_{BB}= N^{-1}(Q_{BB}(t_{BB}))$ and $x_B= N^{-1}(Q_B(t_B))$ with t_{BB} and t_B being the time-to-default of BB-rated and B-rated companies respectively; and Q_{BB} and Q_B being the cumulative distribution functions of t_{BB} and t_B, respectively; and N denotes the standard normal distribution:

Default time in Year	Firm RST Default Probability	Firm RST Cumulative Default Probability $Q_{BB}(t)$	Firm RST Cumulative Standard Normal Percentiles $N^{-1}(Q_{BB}(t))$	Firm WYZ Default Probability	Firm WYZ Cumulative Default Probability $Q_B(t)$	Firm WYZ Cumulative Standard Normal Percentiles $N^{-1}(Q_B(t))$
1	5.21%	5.21%	-1.625	19.06%	19.06%	-0.876
2	6.12%	11.33%	-1.209	10.63%	29.69%	-0.533
3	5.50%	16.83%	-0.961	8.24%	37.93%	-0.307
4	4.81%	21.64%	-0.784	6.10%	44.03%	-0.150
5	4.22%	25.86%	-0.648	4.03%	48.06%	-0.049

Applying the Gaussian copula, which of the following corresponds to the joint probability that firm RST and firm WYZ will both default before the end of year 2?

A. $M(x_{BB} = 0.0612) + M(x_B = 0.1063) – M(x_{BB} = 0.0612)*M(x_B = 0.1063)$

B. $M(x_{BB} = 0.1133) + M(x_B = 0.2969) – M(x_{BB} = 0.1133)*M(x_B = 0.2969)$

C. $M(x_{BB} \leq 0.1133 \cap x_B \leq 0.2969)$

D. $M(x_{BB} \leq – 1.209 \cap x_B \leq –0.533)$

Correct Answer: D

Explanation: D is correct. The required probability is:

$$P\{[t_{BB} \leq 2] \cap [t_B \leq 2]\} = P\{\left[N^{-1}\left(Q_{BB}(t_{BB})\right) \leq N^{-1}\left(Q_{BB}(2)\right)\right] \cap \left[N^{-1}\left(Q_B(t_B)\right) \leq N^{-1}\left(Q_B(2)\right)\right]\} = P\{[X_{BB} \leq -1.209] \cap [X_B \leq -0.533]\}$$

A and B are both incorrect. In fact, under copula model, both x_{BB} and x_B are continuous random variables and thus both A and B correspond to zero probability.

C is also incorrect because the transformation N^{-1} is not properly considered in this option.

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: Describe the Gaussian copula and explain how to use it to derive the joint probability of default of two assets.

56. A risk committee of the board of company ABC is discussing the difference between pricing deep out-of-the-money call options on ABC stock and pricing deep out-of-the-money call options on the USD/GBP foreign exchange (FX) rate using the Black-Scholes-Merton model. The committee considers pricing each of these two options based on two distinct probability distributions of underlying asset prices at the option expiration date: a lognormal probability distribution, and an implied risk-neutral probability distribution obtained from the volatility smile for each aforementioned option of the same maturity and the same moneyness. If the implied risk-neutral probability distribution is used instead of the lognormal distribution, which of the following is correct?

A. The price of the option on ABC stock would be relatively high and the price of the option on USD/GBP FX rate would be relatively low compared to those computed from the lognormal counterparts.
B. The price of the option on ABC stock would be relatively low and the price of the option on USD/GBP FX rate would be relatively high compared to those computed from the lognormal counterparts.
C. The price of the option on ABC stock would be relatively low and the price of the option on USD/GBP FX rate would be relatively low compared to those computed from the lognormal counterparts.
D. The price of the option on ABC stock would be relatively high and the price of the option on USD/GBP FX rate would be relatively high compared to those computed from the lognormal counterparts.

Correct Answer: B

Explanation: B is correct. 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 implied distribution of prices causes deep-out-of-the-money call options on the underlying to be priced relatively low compared with using the lognormal distribution.

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 implied distribution of prices causes deep-out-of-the-money call options on the underlying to be priced relatively high compared with using the lognormal distribution.

Section: Market Risk Measurement and Management

Reference: John Hull, Options, Futures, and Other Derivatives, 10th Edition (New York: Pearson, 2017). Chapter 20, Volatility Smiles.

Learning Objective: Describe characteristics of foreign exchange rate distributions and their implications on option prices and implied volatility.

57. A CRO is concerned that a firm's existing internal risk models are not adequate in addressing potential random extreme losses of the firm. The CRO then recommends the use of extreme value theory (EVT). When applying EVT and examining distributions of losses exceeding a threshold value, which of the following is correct?

A. As the threshold value is increased, the distribution of losses over a fixed threshold value converges to a generalized Pareto distribution.
B. If the tail parameter value of the generalized extreme-value (GEV) distribution goes to infinity, then the GEV essentially becomes a normal distribution.
C. To apply EVT, the underlying loss distribution must be either normal or lognormal.
D. The number of exceedances decreases as the threshold value decreases, which causes the reliability of the parameter estimates to increase.

Correct Answer: A

Explanation: A is correct. 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. It is known as the Gnedenko–Pickands–Balkema–deHaan (GPBdH) theorem and is heavily used in the peaks-over-threshold (POT) approach.

B is incorrect. If the tail parameter value of the generalized extreme-value (GEV) distribution goes to zero, and not infinity, then the distribution of the original data (not the GEV) could be a light-tail distribution such as normal or log-normal. In other words, the corresponding GEV distribution is a Gumbel distribution.

C is incorrect. To apply EVT, the underlying loss distribution can be any of the commonly used distributions: normal, lognormal, t, etc.

D is incorrect. As the threshold value is decreased, the number of exceedances increases.

Section: Operational and Integrated Risk 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.

58. In the Basel framework, a penalty is given to banks that have more than four exceptions to their 1-day 99% VaR over the course of the last 250 trading days. Which of the following causes of exceptions is most likely to lead to a penalty?

A. A large move in interest rates occurs in conjunction with a small move in correlations.
B. The bank's model calculates interest rate risk based on the median duration of the bonds in the portfolio.
C. A sudden market crisis in an emerging market, which leads to losses in the equity positions in that country.
D. A sudden devastating earthquake that causes major losses in the bank's key area of operation.

Correct Answer: B

Explanation: B is correct. 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.

59. A fund manager owns a portfolio of options on TUV, a non-dividend paying stock. The portfolio is made up of 5,000 deep in-the-money call options on TUV and 20,000 deep out-of-the-money call options on TUV. The portfolio also contains 10,000 forward contracts on TUV. Currently, TUV is trading at USD 52. Assuming 252 trading days in a year, the volatility of TUV is 12% per year, and that each of the option and forward contracts is on one share of TUV, which of the following amounts would be closest to the 1-day 99% VaR of the portfolio?

A. USD 11,557
B. USD 12,627
C. USD 13,715
D. USD 32,000

Correct Answer: C

Explanation: C is correct. We need to map the portfolio to a position in the underlying stock TUV. 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 (D_p) of about 1*5,000 + 0*20,000 + 1*10,000 = 15,000 and is approximately gamma neutral.

Let:

α = 2.326 (99% confidence level)

S = price per share of stock TUV = USD 52

D_p = delta of the position = 15,000

σ = volatility of TUV = 0.12

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

α *S*D_p*σ*sqrt(1/T) = (2.326)*(52)*(15,000)*(0.12/sqrt(252)) = USD 13,714.67

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.

60. When measuring risk in hedge funds that hold illiquid assets using monthly data, certain biases can create a misleading picture. For example, these hedge funds might have the appearance of low systematic risk. Which of the following represents an appropriate means of correction?

A. Account for negative serial correlation of returns by first differencing the data when extrapolating risk to longer time horizons.
B. Account for positive serial correlation of returns by aggregating the data.
C. Use regressions with fewer lags of the market factors and sum the coefficients across lags.
D. Use regressions with additional lags of the market factors and sum the coefficients across lags.

Correct Answer: D

Explanation: D is correct. Artificially low asset class correlations leading to the appearance of low systematic risk is a bias faced by hedge funds with illiquid holdings that use monthly valuation data. One way to correct for this is to use enlarged regressions with additional lags of the market factors and to sum the coefficients across lags.

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 risk management challenges associated with investments in hedge funds.

QUESTIONS 61 AND 62 REFER TO THE FOLLOWING INFORMATION:

A financial risk consultant assumes that the joint distribution of returns is multivariate normal and calculates the following risk measures for a two-asset portfolio managed by a mid-size insurance company:

Asset	Position (JPY)	Individual VaR (JPY)	Marginal VaR
Financial	20,000,000	4,787,400	0.316
Real-Estate	20,000,000	7,299,300	0.562
Portfolio	40,000,000	11,562,450	

61. If the real-estate asset is dropped from the portfolio and the proceeds from liquidating the asset are not reinvested in the portfolio, what will be the reduction in portfolio VaR?

A. JPY 2,252,250
B. JPY 3,494,700
C. JPY 5,746,950
D. JPY 6,775,050

Correct Answer: D

Explanation: D is correct. If the real-estate asset is dropped, the portfolio will contain only the financial asset. Then the new portfolio VaR is that of the financial asset alone (JPY 4,787,400), which implies that dropping the real-estate asset will result in a reduction in portfolio VaR of JPY 11,562,450 – JPY 4,787,400 = JPY 6,775,050

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.

62. What is the closest to the correct estimate for the component VaR of the financial asset?

A. JPY 4,787,000
B. JPY 6,322,000
C. JPY 7,299,000
D. JPY 11,240,000

Correct Answer: B

Explanation: B is correct.

Since Marginal $VaR_F = \beta_F$*(Portfolio VaR)/(Portfolio Value), the beta of the financial asset can be computed as:

β_F = (Marginal VaR_F*Portfolio Value)/(Portfolio VaR) = (0.316*40,000,000)/(11,562,450) = 1.0932.

Then, Component VaR = Portfolio VaR * Beta of Asset to Portfolio * Asset Weight to Portfolio Component (Financial Asset) = JPY 11,562,450 * 1.0932 * 0.5 = JPY 6,322,000

A is incorrect. JPY 4,787,000 is close to the individual VaR of the financial asset.

C is incorrect. JPY 7,299,000 is close to the individual VaR of the real-estate asset.

D is incorrect. JPY 11,240,000 is the component VaR of the real-estate asset.

Section: Risk Management and Investment Management

Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition (New York, NY: 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.

63. An analyst regresses the returns of 400 stocks against the returns of a major market index. The resulting pool of alphas has a residual risk of 13.78% and an information coefficient of 0.12. If the alphas are normally distributed with a mean of 0%, roughly how many stocks have an alpha greater than 3.24% or less than -3.24%?

A. 5
B. 15
C. 20
D. 45

Correct Answer: C

Explanation: C is correct. The standard deviation of the alphas = Residual Risk (volatility) x Information Coefficient (IC) = 0.1378 * 0.12 = 0.016536.

3.24% is 1.96 times the standard deviation of the alphas. The alphas follow a normal distribution with a mean of 0, so about 5% of the alphas are out of the interval [-3.24%, 3.24%]. The total number of stocks is 400, so roughly there are 20 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: Distinguish among the inputs to the portfolio construction process.

Evaluate the methods and motivation for refining alphas in the implementation process.

64. A risk analyst at an investment bank is conducting performance analyses of hedge funds and real estate funds. Each year, whenever a hedge fund stops reporting its performance, the hedge fund is removed from the database of hedge funds. Assets owned by the real estate funds are valued only once a year due to infrequent trading. Which of the following best describes the impacts on the hedge fund and real estate fund analyses performed using these databases?

A. The average Sharpe ratio of hedge funds is understated and the average Sharpe ratio of real estate funds is overstated.
B. The average Sharpe ratio of hedge funds is overstated and the average Sharpe ratio of real estate funds is also overstated.
C. The average volatility of hedge funds is overstated and the average volatility of real estate funds is overstated.
D. The average volatility of hedge funds is overstated and the average volatility of real estate funds is understated.

Correct Answer: B

Explanation: B is correct.

Typically, hedge funds stop reporting because of poor performance. As poor performers drop out of the database, the average performance increases. The removal of poor performers would also reduce average volatility.

Similarly, with infrequent trading, estimates of volatilities, correlations, and betas are too low when computed using reported returns.

Thus, Sharpe ratios would be higher under the circumstances.

Section: Risk Management and Investment Management

Reference: G. Constantinides, M. Harris and R. Stulz, eds., Handbook of the Economics of Finance, Volume 2B (Oxford, UK: Elsevier, 2013). Chapter 17. Hedge Funds

Andrew Ang, Asset Management: A Systematic Approach to Factor Investing (New York: Oxford University Press, 2014), Chapter 13, Illiquid Assets.

Learning Objective: Explain biases that are commonly found in databases of hedge funds.

Assess the impact of biases on reported returns for illiquid assets.

65. A money manager wants to invest a small amount of new capital 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 whose performances, during the most recent evaluation period, are described in the following table:

Asset	Portfolio Weight	Actual Return	Volatility of Return	Beta to the portfolio
BDE	0.35	14%	19%	1.20
JKL	0.30	13%	18%	0.90
MNO	0.25	13%	16%	1.00
STU	0.10	10%	10%	0.80

The portfolio manager wants to select the asset that has the lowest marginal VaR as long as its Jensen's alpha is greater than or equal to the market risk premium. Assuming the risk-free rate is 3% and the market return is 8%, which asset should the portfolio manager select?

A. Asset BDE
B. Asset JKL
C. Asset MNO
D. Asset STU

Correct Answer: B

Explanation: B is correct. We can derive marginal VaR as:

Marginal VaR of asset i = $(VaR_p/Value_p)*Beta_i$

Since $VaR_p/Value_p$ will be the same for all the assets, the size of beta will actually determine the level of marginal VaRs.

Jensen's Alpha measure is calculated as:

Jensen's Alpha = Actual return – Expected return based on systematic risk

= Actual return – (risk-free rate + (Market return – risk-free rate)*Beta)

Note that the market risk premium = expected market return – risk-free rate = 0.08-0.03 = 5%

Thus, among those assets whose Jensen's Alphas are greater than or equal to market risk premiums, Asset JKL has the lowest Marginal VaR:

Asset	Portfolio Weight	Actual Return	Beta to the portfolio	Marginal VaR	Expected Return	Jensen's Alpha
BDE	0.35	14%	1.20	1.2W	9.0%	5.0%
JKL	0.30	13%	0.90	0.9W	7.5%	5.5%
MNO	0.25	13%	1.00	1.0W	8.0%	5.0%
STU	0.10	10%	0.80	0.8W	7.0%	3.0%

where W = $VaR_p/Value_p$

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.

Zvi Bodie, Alex Kane, and Alan J. Marcus, Investments, 11th Edition (New York: McGraw-Hill, 2017). Chapter 24 - Portfolio Performance Evaluation

Learning Objective: Explain the difference between risk management and portfolio management, and describe how to use marginal VaR in portfolio management.

Describe and distinguish between risk-adjusted performance measures, such as Sharpe's measure, Treynor's measure, Jensen's measure (Jensen's alpha), and information ratio.

66. A risk analyst at an insurance company has determined that a counterparty to the company has a constant default probability of 5% per year. What is the probability that this counterparty survives the first 2 years and defaults in year 3?

A. 4.51%
B. 5.00%
C. 9.50%
D. 15.00%

Correct Answer: A

Explanation: A is correct.

Probability (Survives the first 2 years and defaults in year 3) = (1–0.05) (1–0.05) (0.05) = 0.0451 = 4.51%.

B is incorrect. It is simply the default probability per year, which equals 5.00%.

C is incorrect. It is 2*(1–0.05) (0.05) = 9.50%
D is incorrect. It is 0.05*3 = 0.1500 = 15.00%

Section: Credit Risk Measurement and Management

Reference: Jon Gregory, The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, 3rd Edition (West Sussex, UK: John Wiley & Sons, 2015). Chapter 12 - Default Probabilities, Credit Spreads, and Funding Costs

Learning Objective: Calculate risk-neutral default probabilities, and compare the use of risk-neutral and real-world default probabilities in pricing derivative contracts.

67. The board of directors of a manufacturing company is considering the funding risk of the defined benefit plan of the company's pension fund. Which of the following statements about the pension fund's funding risk is correct?

A. Decreases in interest rates will reduce funding risk.
B. Funding risk represents the true long-term risk to the plan sponsor.
C. Funding risk is effectively transferred to the employees of the manufacturing company.
D. The longer the horizon for expected payouts, the lower the funding risk.

Correct Answer: B

Explanation: B is correct. Funding risk of a defined benefit plan is the risk that the value of the pension plan assets will not be sufficient to meet the pension plan liabilities. If the plan has a deficit (that is, if the surplus turns negative), the plan sponsor (the manufacturing company) has to provide additional contributions to the fund. This additional contribution (the funding risk) is borne by the company's shareholders (and not by the employees). Thus, the funding risk represents a true long-term risk to the company (plan sponsor).

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 a low interest rate environment, the value of assets (equities on the asset side) will rise; however, the value of liabilities is likely to increase more, thereby exacerbating funding risk. 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.

68. A portfolio manager is evaluating the risk profile for a portfolio of stocks. Currently, the portfolio is valued at CAD 20 million and contains CAD 5 million in stock XYZ. The standard deviation of returns of stock XYZ is 15% annually and that of the overall portfolio is 12% annually. The correlation of returns between stock XYZ and the portfolio is 0.3. Assuming the portfolio manager uses a 1-year 99% VaR and that returns are normally distributed, what is the estimated component VaR of stock XYZ?

A. CAD 162,972
B. CAD 234,906
C. CAD 523,350
D. CAD 632,152

Correct Answer: C

Explanation:
C is correct.
Let;
α(99%) represent the 99% confidence factor for the VaR estimate, which is 2.326,
ρ represent the correlation of stock XYZ with the portfolio, which is 0.3, and
V_{XYZ} represent the value of stock XYZ, which is CAD 5 million.
Then,
$VaR_{XYZ} = V_{XYZ} * \sigma_{XYZ} * \alpha(99\%)$ = CAD 5,000,000 x 0.15 x 2.326 = CAD 1,744,500
Component $VaR_{XYZ} = \rho * VaR_{XYZ}$ = 0.30 x CAD 1,744,500 = CAD 523,350

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.

69. The risk management division of a financial institution is using a loss distribution approach to model its operational risk exposure for economic capital purposes. This approach requires that the bank model both the frequency and severity of operational loss events. Which of the following loss frequency and loss severity distribution pairs is the most appropriate to use?

A. Beta distribution for frequency, and Weibull distribution for severity.
B. Generalized Pareto distribution for frequency, and normal distribution for severity.
C. Lognormal distribution for frequency, and Generalized Gamma distribution for severity.
D. Poisson distribution for frequency, and lognormal distribution for severity.

Correct Answer: D

Explanation: D is correct. Poisson distribution is appropriate for loss frequency while lognormal distribution is generally used for loss severity.

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.

QUESTIONS 70 AND 71 REFER TO THE FOLLOWING INFORMATION:

The CRO of Bank LGX, a non-dividend-paying US-based bank, is preparing a report to the board of directors on the bank's capital adequacy and planning. Bank LGX is subject to both the Basel framework and the US banking rules governing global systemically important banks (G-SIBs). The bank claims that it was in compliance with all the capital requirements in January 2016 as all Basel III phase-ins have already occurred. The CRO is conducting the analysis for January 2017 using selected and most recent annual performance data, which are shown in the table below:

Item	Value (USD million) as of January 2017
Common equity Tier 1 (CET1) capital	1,515
Preferred stock (noncumulative)	100
Tier 2 capital	827
Risk-weighted assets	26,395
Total assets	42,828
Total exposure	47,460

The CRO also reports the minimum regulatory capital requirements under the revised capital framework as presented in the table below. The capital ratios also include the capital conservation buffer of 2.5% (phased-in at an annual increment of 0.75%, starting January 2016) and a G-SIB surcharge of 3.0% (phased-in at an annual increment of 0.625%, starting January 2016) of risk-weighted assets to be reached by January 2019:

	January 2016 Minimum Ratio	January 2017 Minimum Ratio	January 2018 Minimum Ratio	January 2019 Minimum Ratio
Capital conservation buffer	0.625%	1.25%	1.875%	2.5%
G-SIB surcharge	0.75%	1.5%	2.25%	3.0%
CET 1 ratio	4.5%	5.25%	6.5%	10.0%
Tier 1 capital ratio	6.0%	6.75%	8.0%	11.5%
Total capital ratio	8.0%	8.75%	11.5%	13.5%
Leverage ratio	4.0%	4.0%	4.0%	4.0%

70. Given the regulatory benchmarks and the bank's performance, which of the capital requirements does Bank LGX satisfy as of January 2017?

A. CET1 capital ratio only
B. Leverage ratio only
C. Tier 1 capital ratio and Leverage ratio only
D. Total capital ratio and CET1 capital ratio only

Correct Answer: D

Explanation: D is correct. The bank's CET1 capital ratio = (CET 1 capital)/(risk-weighted assets)= (1,515/26,395) = 5.74%. This ratio meets and exceeds the 5.25% minimum CET1 capital requirement;

The bank's leverage ratio = (Tier 1 capital)/(Exposure) = (1,515 + 100)/(47,460) = 3.40%. This ratio does not meet the 4.0% minimum leverage ratio requirement;

The bank's Tier 1 capital ratio = (Tier 1 capital)/(risk-weighted assets)= (1,515 + 100)/26,395) = 6.12%. This ratio does not meet the 6.75% minimum Tier 1 capital requirement;

The bank's Total capital ratio = (Total capital)/(risk-weighted assets)= (1,515 + 100 + 827)/26,395) = 9.25%. This ratio meets and exceeds the 8.75% minimum Total capital requirement.

Section: Operational and Integrated Risk Management

Reference: John Hull, Risk Management and Financial Institutions, 5th Edition (Hoboken, NJ: John Wiley & Sons, 2018). Chapter 16. Basel II.5, Basel III, and Other Post-Crisis Changes.

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.

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.

71. In viewing the results of this capital analysis report and other considerations for Bank LGX's capital planning, which of the following conclusions is correct?

A. The capital conservation buffer can be met by an increase in Tier 2 capital.
B. If the exposure on derivative asset positions decreases, holding other factors constant, the total capital ratio would decrease.
C. An increase in the CVA due to the bank's asset counterparty positions would tend to raise the bank's risk-weighted assets.
D. If the bank raises additional CET 1 capital and invests the same amount in gold, Bank LGX's net stable funding ratio will not change.

Correct Answer: C

Explanation: C is correct. Increasing CVA charge increases the amount of risk-weighted assets.

A is incorrect. According to Basel, the conservation buffer can only be met by additional CET 1 capital.

B is incorrect. Derivative exposure (as well as other off-balance sheet items) are part of the total exposure. As exposure declines, Total capital ratio increases (assuming no change in Total capital).

D is incorrect. The NSFR = (amount of stable funding)/(required amount of stable funding). CET 1 capital, which goes to the numerator, has a weight of 100%. Gold, which goes to the denominator, has a weight of 50%. Thus, the increase to the numerator and denominator will not be exactly the same, so the NSFR changes.

Section: Operational and Integrated Risk Management

Reference: John Hull, Risk Management and Financial Institutions, 5th Edition (Hoboken, NJ: John Wiley & Sons, 2018). Chapter 16. Basel II.5, Basel III, and Other Post-Crisis Changes.

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.

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.

QUESTIONS 72 THROUGH 74 REFER TO THE FOLLOWING INFORMATION:

In a surprise monetary policy action on August 10, 2015, the People's Bank of China cut its daily currency reference rate against the USD, resulting in a large devaluation of the CNY per the USD. Immediately after the announcement, the CRO of CMM Bank (CMM), an international bank with headquarters in Shanghai, began evaluating the impact of this and other events on the bank's position.

CMM had outstanding long-term debt denominated in USD and deposits denominated in CNY. A significant portion of CMM's lending portfolio was also denominated in CNY and consisted largely of loans and lines of credit to Chinese manufacturers who were heavily dependent on imported raw materials. Other loans to non-Chinese firms with exposure to China were denominated in USD. The bank's portfolio investments included CNY-denominated Chinese Treasury securities and other sovereign debt.

A portion of CMM's retail customer base had invested on margin in the Chinese equity markets. Over the next few weeks, local stock markets experienced declines in share prices. Many of CMM's larger retail depositors experienced margin calls and had begun to draw down demand deposits to meet them. Offsetting these outflows, however, were increases in the 3-month, 6-month and 9-month term deposit balances at CMM of several large corporate customers. The result was that CMM's overall net deposit flow had been approximately zero.

Because of credit developments elsewhere in the world, several of CMM's sovereign debt holdings were downgraded, some from AA to A and some from A to BBB. One of the noticeable outcomes was that the bid-ask spreads on many of the sovereign bonds held and traded by CMM widened. Despite these developments, CMM's sovereign debt portfolio remained exclusively investment grade with a weighted average rating of A+.

72. CMM's CRO was concerned about the bank's liquidity position and decided to review the impact of the devaluation and other capital market events on its net stable funding ratio (NSFR). Ignoring any changes in the market value of CMM's sovereign debt holdings, which of the following is correct?

A. The NSFR will not be impacted by the sovereign credit rating changes because the overall sovereign debt portfolio remains investment grade.
B. The NSFR will be reduced by the sovereign credit rating changes but this effect can be offset by selling A-rated sovereign debt and investing the proceeds in gold.
C. The NSFR will not be impacted by the change in demand deposits because the bank's overall deposit level is unchanged.
D. The NSFR will be reduced by the change in demand deposits but this effect can be offset by issuing common stock.

Correct Answer: D

Explanation: D is correct. The shift in the demand deposit base from retail demand deposits to wholesale demand deposits with terms less than 1 year would reduce the NSFR. The change in retail deposit behavior would likely cause a shifting of demand deposit classification from "stable" to "less stable" also reducing the NSFR. The downward sovereign credit migration would increase the required stable funding factor applied to these bonds and reduce the NSFR. Similarly, selling A-rated debt and investing in gold would not increase the NSFR since gold has a higher stable funding requirement than A-rated debt. The issuance of common stock, which is classified as Tier 1 capital, would increase the NSFR.

Section: Operational and Integrated Risk Management

Reference: Allan Malz, Financial Risk Management: Models, History, and Institutions (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 12 - Liquidity and Leverage.

Kevin Dowd, Measuring Market Risk, 2nd Edition (West Sussex, England: John Wiley & Sons, 2005). Chapter 14 - Estimating Liquidity Risks.

John Hull, Risk Management and Financial Institutions, 5th Edition (Hoboken, NJ: John Wiley & Sons, 2018). Chapter 16 - Basel II.5, Basel III and Other Post-Crisis Changes

Learning Objective: Summarize the asset liability management process at a fractional-reserve bank, including the process of liquidity transformation.

Define liquidity risk and describe factors that influence liquidity including the bid-ask spread.

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.

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.

Describe the motivations for and calculate the capital conservation buffer and the countercyclical buffer introduced in Basel III.

73. Before the devaluation of CNY, CMM's trading desk had established a short call options position on the USD-CNY (CNY per USD) exchange rate that was made delta-neutral through a spot USD transaction. The position was no longer delta-neutral after the devaluation came into effect and the desk wanted to take steps to make it delta-neutral again. The bank was concerned about whether this would involve buying or selling USD and what impact this might have on liquidity. The trader who initiated the position suggested that, once it was made delta-neutral, the short call options position would be an effective way to hedge the bank's long CNY exposure against further devaluations and that the bank should consider increasing the size of the position accordingly. In considering this situation, what should the CRO conclude?

A. The bank will have to buy USD to make the position delta neutral, but the delta-neutral short call options position is not an effective way to hedge an underlying long CNY exposure against further devaluations.
B. The bank will have to sell USD to make the position delta neutral, but the delta-neutral short call options position is not an effective way to hedge an underlying long CNY exposure against further devaluations.
C. The bank will have to buy USD to make the position delta neutral, and the delta-neutral short call options position is an effective way to hedge an underlying long CNY exposure against further devaluations.
D. The bank will have to sell USD to make the position delta neutral, and the delta-neutral short call options position is an effective way to hedge an underlying long CNY exposure against further devaluations.

Correct Answer: A

Explanation: A is correct. If the desk had sold call options on the dollar, it had to buy dollar spot to be delta-neutral. Because the options were more in-the-money, their absolute value delta increased, so dollars had to be bought. This eliminates choices B and D. The delta-neutral short-call options position would, at best, earn the risk-free rate if it was dynamically hedged. Static hedging would likely result in losses if the CNY devalued further. Regardless, it would not be an effective hedge for an underlying long CNY exposure.

Section: Market Risk Measurement and Management

Operational and Integrated Risk 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.

John Hull, Options, Futures, and Other Derivatives, 10th Edition (New York, NY: Pearson, 2017). Chapter 19 – The Greek Letters (FRM Part I, Valuation and Risk Models)

John Hull, Options, Futures, and Other Derivatives, 10th Edition (New York, NY: Pearson, 2017). Chapter 20 – Volatility Smiles

Learning Objective: Describe the method of mapping forwards, forward rate agreements, interest rate swaps, and options.

Explain how to implement and maintain a delta-neutral and a gamma-neutral position.

Describe the dynamic aspects of delta hedging and distinguish between dynamic hedging and hedge-and-forget strategy.

Describe characteristics of foreign exchange rate distributions and their implications on option prices and implied volatility.

74. CMM had CNY-denominated loans outstanding to TVR, a foreign manufacturing firm that generated its revenue in CNY. To hedge some of its risk, CMM had bought CDS protection on TVR from a bank from the same country as TVR, Bank EP. Assuming the default probability of TVR increases unexpectedly, and the default correlation between TVR and Bank EP is positive and remains constant, which of the following is correct?

A. The value of the CDS will increase and CMM has a wrong-way risk with Bank EP.
B. The value of the CDS will decrease and CMM has a wrong-way risk with Bank EP.
C. The value of the CDS will increase and CMM has a right-way risk with Bank EP.
D. The value of the CDS will decrease and CMM has a right-way risk with Bank EP.

Correct Answer: A

Explanation: A is correct. Since the default probability of the reference entity (TVR) increases, the CDS spread would widen which would increase the value of the CDS from the perspective of CMM (buyer of the CDS). At the same time, as the default probability of TVR increases, so will the default probability of Bank EP, given their positive correlation. Therefore, the value of the CDS (exposure amount) is increasing as the default probability of the CMM's counterparty (Bank EP) is increasing. This is a wrong-way risk that CMM has with Bank EP.

Both B and D are incorrect as the value of CDS should increase as explained in A above.

C is incorrect because CMM has a wrong-way risk, not a right-way risk, with EP.

Section: Credit Risk Measurement and Management

Reference: Jon Gregory, The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, 3rd Edition (West Sussex, UK: John Wiley & Sons, 2015). Chapter 17 - Wrong-way Risk.

Learning Objective: Describe financial correlation risk and the areas in which it appears in finance.

Identify examples of wrong-way risk and examples of right-way risk.

75. A large bank is reviewing its processes and procedures to manage operational risk in accordance with best practices established by the Basel Committee. In implementing the three lines of defense model, which of the following statements is correct?

A. The internal audit function should serve as the first line of defense and continually validate operational procedures used by the business lines.
B. Business line managers, as part of the first line of defense, should provide a credible challenge to the internal audit function.
C. The corporate operational risk function, as part of the second line of defense, should challenge risk inputs from business line managers.
D. The corporate operational risk function should serve as the third line of defense and validate model assumptions made by senior management.

Correct Answer: C

Explanation: C is correct. The Basel three lines of defense model establishes the following lines of defense: In the first line of defense business line managers manage the risk of their business lines, in the second line of defense the corporate operational risk function (CORF) reviews the risk controls put in place by the first line of defense and establishes firm-wide risk management procedures, and in the third line of defense, an independent review (such as an internal auditor) reviews the effectiveness of the risk controls in the first two lines of defense. C is correct, since as part of the second line of defense, the CORF should challenge inputs from business line managers.

A is incorrect, as internal audit is part of the third line of defense and the validation team is generally part of the corporate risk function as part of the second line of defense.

B is incorrect, business line managers do not challenge the audit function as part of the first line; rather, they manage the risk of the business lines.

D is incorrect, as the CORF is the second line of defense.

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: Describe the three “lines of defense” in the Basel model for operational risk governance.

76. A CRO at an investment bank has asked the risk department to evaluate the bank's 3-year derivative exposure position with a counterparty. The risk department assumes that the counterparty's default probability follows a constant hazard rate process. The table below presents trade and forecast data on the CDS spread, the expecte exposure, and the recovery rate on the counterparty:

	Year 1	**Year 2**	**Year 3**
Expected exposure (AUD million)	14	14	14
CDS spread (bps)	200	300	400
Recovery rate (%)	80	70	60

Additionally, the CRO has presented the risk team with the following set of assumptions to use in conducting th analysis:

- The investment bank and the counterparty have signed a credit support annex to cover this exposure, which requires collateral posting of AUD 11 million.
- The current risk-free rate of interest is 3% and the term structure of interest rates remains flat over the 3-yea horizon.
- Collateral and exposure values remain stable as projected over the 3-year life of the contract.

Given the information and the assumptions above, what is the correct estimate for the CVA for this position?

A. AUD 0.214 million
B. AUD 0.253 million
C. AUD 0.520 million
D. AUD 0.998 million

Correct Answer: A

Explanation: A is correct. To derive the credit valuation adjustment (CVA), we use the standard formula:

$CVA = \sum_{t=0}^{n}(1 - RR_t)(EE_t)(PD_t)(DF_t)$,

where (at any time t):

The discount factor (DF_t) is determined from the risk-free rate of 3%. For year 1, 2, and 3, they are exp(-0.03)=0.9704, exp(-0.03*2)=0.9418, and exp(-0.03*3)=0.9139, respectively.

The hazard rate is constant over the 3 years, and λ = spread/(1 – RR) = 10%. Therefore:

Year 1 cumulative probability of default = 1 – exp(-0.1*1) = 9.52% (marginal probability (PD_1))

Year 2 cumulative probability of default = 1 – exp(-0.1*2) = 18.13%; thus, marginal probability (PD_2) = 18.13 – 9.52 = 8.61%.

Year 3 cumulative probability of default = 1 – exp(-0.1*3) = 25.92%; thus, marginal probability (PD_2) = 25.92 – 18.13 = 7.79%.

Collateral amounts of AUD 14 million for each of the years 1, 2 and 3 are considered. Therefore, the rest of the derivation becomes:

	Year 0	Year 1	Year 2	Year 3
Marginal probability of default [PD(t)]		9.52%	8.61%	7.79%
Discount factor (DF)		0.9704	0.9418	0.9139
Recovery rate (RR)		80%	70%	60%
Expected exposure (EE) (AUD million)		14	14	14
Collateral (C) (AUD million)		11	11	11
EE' (netted) (AUD million)		3	3	3
(1-RR)*(EE')*PD(t)*(DF) (AUD million)		0.0554	0.0730	0.0854

$$CVA = \sum_{t=0}^{n}(1 - RR_t)(EE_t)(PD_t)(DF_t) = 0.0554 + 0.0730 + 0.0854 = 0.2138$$

B is incorrect. AUD 0.2527 million is the result obtained when the hazard rate of 10% is used as the marginal default probability for each of the 3 years.

C is incorrect. AUD 0.5201 million is the result obtained when the recovery rate and not the LGD is used.

D is incorrect. AUD 0.9980 million is the result obtained when collateral is not considered.

Section: Credit Risk Measurement and Management

Reference: Jon Gregory, The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, 3rd Edition (West Sussex, UK: John Wiley & Sons, 2015). Chapter 14 - Credit and Debt Value Adjustments.

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 CVA and the CVA spread with no wrong-way risk, netting, or collateralization.

Define the hazard rate and use it to define probability functions for default time and conditional default probabilities.

77. The CEO of a large bank has reported that the bank's framework for managing operational risk is consistent with the Basel II and Basel III guidelines for operational risk governance. Which of the following actions and principles of the bank is correct?

A. The bank considers identification and management of risk as the second line of defense.
B. The bank considers independent review and audit of the risk processes and systems as the third line of defense.
C. The bank includes damaged reputation due to a failed merger in its measurement of operational risk.
D. The bank excludes destruction by fire or other external catastrophes from its measurement of operational risk.

Correct Answer: B

Explanation: B is correct. Sound operational risk governance, according to Basel, relies on three lines of defense: (i) First line of defense - business line management, which is responsible for identifying and managing the risks inherent in the products, activities, processes and systems for which it is accountable; (ii) Second line of defense – an independent corporate operational risk management function, generally complementing the business lines' operational risk management activities; (iii) Third line of defense – an independent review – review and audit of the bank's operational risk management controls, processes and systems.

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.

78. A risk manager has asked a junior analyst to estimate the implied default probability for a BBB-rated discount corporate bond. The continuously compounded annual yields of other fixed-income securities are given below:

- 3-year Treasury note (a risk-free bond): 3%
- 1-year BBB-rated discount bond: 5%
- 2-year BBB-rated discount bond: 8%
- 3-year BBB-rated discount bond: 9%

If the recovery rate on that BBB-rated bond is expected to be 0% in the event of default, which of the following is the best estimate of the risk-neutral probability that the BBB-rated discount bond defaults within the next 3 years?

A. 12.29%
B. 13.76%
C. 14.61%
D. 16.47%

Correct Answer: D

Explanation: D is correct. The continuously compounded spread for the BBB-rated discount bond is 0.09 - 0.03 = 0.06 per year. Thus, the default probability for the next 3 years is: 1 - exp(-0.06*3) = 16.47%

A is incorrect. 12.29% is the 3-year cumulative probability of default of the 3-year BBB-rated bond while incorrectly using the credit spreads of the 1-year, 2-year, and 3-year BBB-rated bonds, and also failing to scale the hazard rates (credit spreads) by the factor of time.

B is incorrect. 13.76% is the result obtained as the probability of default of the 3-year BBB-rated bond in the third year (i.e., between end of second year and end of third year).

C is incorrect. 14.61% is the result obtained as the probability of default of the 3-year BBB-rated bond in the third year (i.e., between end of second year and end of third year) and incorrectly using the credit spreads of the 1-year, 2-year, and 3-year BBB-rated bonds.

Section: Credit Risk Measurement and Management

Reference: Jon Gregory, The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, 3rd Edition (West Sussex, UK: John Wiley & Sons, 2015). Chapter 12 - Default Probabilities, Credit Spreads, and Funding Costs

Learning Objective: Calculate risk-neutral default probabilities, and compare the use of risk-neutral and real-world default probabilities in pricing derivative contracts.

79. Pension fund managers must deal with a range of policy, risk, and return requirements. 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: 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.

A is incorrect. The policy-mix VaR and active-management VaR do not always add up to the total-asset VaR. In fact, there is a slightly negative correlation between the two, leading to a lower overall asset VaR.

B is incorrect. Pension funds always benchmark their performance to a portfolio of index funds.

C is incorrect. In fact, if the assets of a pension fund are not sufficient to cover these liabilities, the shortfall will have to be made up by the fund's owner.

Section: Risk Management and Investment Management

Reference: Philippe Jorion, Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition (New York, NY: 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.

80. A financial institution has a two-way credit support annex (CSA) with a counterparty covering a portfolio valued at JPY 400 million. The margining terms of the collateralized portfolio include a threshold of JPY 180 million, a minimum transfer amount of JPY 30 million, and a margin period of risk of 10 days. Which of the following is correct?

A. A lower threshold value implies that a larger portion of exposure is protected by collateral.
B. A shorter margin period of risk implies that a smaller portion of exposure is protected by collateral.
C. A lower independent amount implies that a larger portion of exposure is protected by collateral.
D. The protection from collateral specified in the CSA is uniform throughout the life of the exposure profile.

Correct Answer: A

Explanation: A is correct. Threshold is the amount of uncollateralized exposure. A lower threshold value means a larger portion of exposure is protected by collateral.

In contrast, C is incorrect because a lower independent amount means a smaller initial margin is posted.

B is incorrect because the margin period of risk is the effective time assumed between a collateral call and receiving the appropriate collateral. Exposure may increase or decrease during this period.

D is incorrect. Collateral has little effect at both the beginning and the end of the exposure profile when the exposure is relatively small.

Section: Credit Risk Measurement and Management

Reference: Jon Gregory, The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital, 3rd Edition (West Sussex, UK: John Wiley & Sons, 2015). Chapter 6 - Collateral

Learning Objective: Describe the terms of a collateral and features of a credit support annex (CSA) within the ISDA Master Agreement including threshold, initial margin, minimum transfer amount and rounding, haircuts, credit quality, and credit support amount.

GARP | Global Association of Risk Professionals

Creating a culture of risk awareness®

garp.org

About GARP | The Global Association of Risk Professionals (GARP) is a non-partisan, not-for-profit membership organization serving the risk management industry. Founded in 1996, GARP advances the profession through education, research and promotion of best practices through the GARP Risk Institute, GARP Benchmarking Initiative and an array of informational and certification programs. GARP has 200,000 members in more than 190 countries and territories, and has certified more than 50,000 professionals.

New York
111 Town Square Place
14th floor
Jersey City, New Jersey
07310 USA
+1 201.719.7210

London
17 Devonshire Square
4th floor
London, EC2M 4SQ
UK
+44 (0) 20.7397.9630

Washington D.C.
1001 19th Street North
#1200
Arlington, Virginia
22209 USA
+1 703.420.0920

Beijing
Unit 1010 Financial Street Centre
No 9A, Financial Street
Xicheng District
Beijing 100033 P.R. China
+86 (010) 5737.9835