FRM®

PRACTICE EXAM PART I 2022

GARP
FRM | Financial Risk Manager

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Introduction

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

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

The 2022 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 2022. 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 2022 FRM Exam.

The 2022 FRM Part I Practice Exam contains 100 multiple-choice questions and the 2022 FRM Part II Practice Exam contains 80 multiple-choice questions, the same number of questions that the actual 2022 FRM Exam Part I and 2022 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 2022 FRM Practice Exams do not necessarily cover all topics to be tested in the 2022 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 2022 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 2022 FRM Exam Study Guide and 2022 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 2022 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

2022 FRM Part I Practice Exam – Candidate Answer Sheet

1.		26.		51.		76.	
2.		27.		52.		77.	
3.		28.		53.		78.	
4.		29.		54.		79.	
5.		30.		55.		80.	
6.		31.		56.		81.	
7.		32.		57.		82.	
8.		33.		58.		83.	
9.		34.		59.		84.	
10.		35.		60.		85.	
11.		36.		61.		86.	
12.		37.		62.		87.	
13.		38.		63.		88.	
14.		39.		64.		89.	
15.		40.		65.		90.	
16.		41.		66.		91.	
17.		42.		67.		92.	
18.		43.		68.		93.	
19.		44.		69.		94.	
20.		45.		70.		95.	
21.		46.		71.		96.	
22.		47.		72.		97.	
23.		48.		73.		98.	
24.		49.		74.		99.	
25.		50.		75.		100.	

1. A risk manager is deciding between buying a futures contract on an exchange and entering into a forward contract directly with a counterparty on the same underlying asset. Both contracts would have the same maturity and delivery specifications. The manager finds that the futures price is lower than the forward price. Assuming no arbitrage opportunity exists, and interest rates are expected to increase, what single factor acting alone would be a realistic explanation for this price difference?

A. The futures contract is less liquid than the forward contract.
B. A futures contract offers more flexible terms than a forward contract.
C. The price of the underlying asset is strongly negatively correlated with interest rates.
D. The upfront transaction cost on the futures contract is higher than that on the forward contract.

2. A trader on the statistical arbitrage desk of a multinational bank finds that a financial asset is trading at USD 1,000, the price of a 1-year futures contract on that asset is USD 1,020, and the price of a 2-year futures contract is USD 1,045. The trader assumes that there will be no cash flows from the asset for 2 years. If the term structure of risk-free interest rates is flat at 2% per year, which of the following is an appropriate arbitrage strategy?

A. Short 1-year futures contracts and long 2-year futures contracts
B. Short 2-year futures contracts and long 1-year futures contracts
C. Short 1-year futures contracts and long the underlying asset funded by borrowing for 1 year at 2% per year
D. Short 2-year futures contracts and long the underlying asset funded by borrowing for 2 years at 2% per year

3. A derivatives trader wants to price a European-style call option on a stock with a strike price of USD 25.00 and a time to maturity of 6 months. The trader observes that the price of a 6-month European-style put option on the same underlying with a USD 25.00 strike price is USD 3.00. The stock price is USD 26.00. A special one-time dividend of USD 1.00 is expected in 3 months. The continuously compounded risk-free rate for all maturities is 5% per year. Which of the following is closest to the no-arbitrage value of the call option?

A. USD 2.37
B. USD 3.01
C. USD 3.63
D. USD 4.62

4. A market risk team at a hedge fund is developing stress test scenarios to assess the impact of changes in different market variables on the fund's portfolio of agency-backed MBS. The team wants to identify potential factors that would likely cause the rate of prepayments on the MBS portfolio to increase. Holding all else constant, which of the following would most likely result in increased prepayments in the portfolio?

A. A decrease in defaults experienced in the mortgage pool
B. A decrease in the average loan-to-value ratio of the mortgage pool
C. An increase in market interest rates
D. An increase in the supply of newly built housing

5. Pear, Inc. is a manufacturer that is heavily dependent on plastic parts shipped from Malaysia. Pear wants to hedge its exposure to plastic price shocks over the next 7.5 months. Futures contracts, however, are not readily available for plastic. After some research, Pear identifies futures contracts on other commodities whose prices are closely correlated to plastic prices. Futures on Commodity A have a correlation of 0.85 with the price of plastic, and futures on Commodity B have a correlation of 0.92 with the price of plastic. Futures on both Commodity A and Commodity B are available with 6-month and 9-month expirations. Ignoring liquidity considerations, which contract would be the best to minimize basis risk?

A. Futures on Commodity A with 6 months to expiration
B. Futures on Commodity A with 9 months to expiration
C. Futures on Commodity B with 6 months to expiration
D. Futures on Commodity B with 9 months to expiration

6. A currency analyst is examining the exchange rate between the USD and the EUR. The analyst observes the following market data:

- Current USD per EUR 1 exchange rate: 1.13
- Current USD-denominated 1-year risk-free interest rate: 2.7% per year
- Current EUR-denominated 1-year risk-free interest rate: 1.7% per year

According to interest rate parity, what is the 2-year forward USD per EUR 1 exchange rate?

A. 1.1081
B. 1.1190
C. 1.1411
D. 1.1523

7. An investor implements a spread trading strategy using options on the stock of XYZ Limited. The investor sells a January 2023 call option with a strike price of USD 50 for USD 10, and buys a January 2023 call option with a strike price of USD 60 for USD 2. What is the name of this strategy, and what is the maximum profit and loss the investor could incur at expiration?

	Strategy	Maximum Profit	Maximum Loss
A.	Bear spread	USD 8	USD 2
B.	Bear spread	Unlimited	USD 2
C.	Bull spread	USD 8	USD 2
D.	Bull spread	USD 8	Unlimited

8. A portfolio manager is assessing whether the 1-year probability of default of a longevity bond issued by a life insurance company is uncorrelated with returns of the equity market. The portfolio manager creates the following probability matrix based on 1-year probabilities from the preliminary research:

		Longevity bond	
		No default	**Default**
Market returns	**20% increase**	61%	1%
	20% decrease	35%	3%

Given the information in the table, what is the probability that the longevity bond defaults in 1 year given that the market decreases by 20% over 1 year?

A. 3.00%
B. 4.00%
C. 7.89%
D. 10.53%

9. For a sample of 400 firms, the relationship between corporate revenue (Y_i) and the average years of experience per employee (X_i) is modeled as follows:

$$Y_i = \beta_1 + \beta_2 * X_i + \varepsilon_i \qquad i = 1, 2 ..., 400$$

An analyst wants to test the joint null hypothesis that $\beta_1 = 0$ and $\beta_2 = 0$ at the 95% confidence level. The p-value for the t-statistic for β_1 is 0.07, and the p-value for the t-statistic for β_2 is 0.06. The p-value for the F-statistic for the regression is 0.045. Which of the following statements is correct?

A. The analyst can reject the joint null hypothesis because each β is different from 0 at the 95% confidence level.
B. The analyst cannot reject the joint null hypothesis because neither β is different from 0 at the 95% confidence level.
C. The analyst can reject the joint null hypothesis because the F-statistic is significant at the 95% confidence level.
D. The analyst cannot reject the joint null hypothesis because the F-statistic is not significant at the 95% confidence level.

10. A fixed-income portfolio manager currently holds a portfolio of bonds of various companies. The manager assumes that all these bonds have the same annualized probability of default and that the defaults are independent. What type of distribution would best describe the number of defaults in this portfolio over the next year?

A. Bernoulli
B. Lognormal
C. Binomial
D. Exponential

11. An analyst has been asked to check for arbitrage opportunities in the Treasury bond market by comparing the cash flows of selected bonds with the cash flows of combinations of other bonds. A 1-year zero-coupon bond is priced at USD 98 and a 1-year bond paying an 8% coupon semi-annually is priced at USD 103. Using a replication approach, what should be the price of a 1-year Treasury bond that pays a coupon of 6% semi-annually?

A. USD 99.3
B. USD 101.1
C. USD 101.8
D. USD 103.9

12. A risk manager on the derivatives trading desk of an investment bank is monitoring the sensitivity measures for several of the desk's positions in options on stock FIR. The current market price of the stock is USD 60. Which of the following options on stock FIR has the highest gamma?

A. Long call option expiring in 5 days with strike price of USD 30
B. Long call option expiring in 5 days with strike price of USD 60
C. Long call option expiring in 30 days with strike price of USD 30
D. Long call option expiring in 30 days with strike price of USD 60

13. An investment advisor is advising a wealthy client. The client would like to invest USD 500,000 in a bond rated at least AA. The advisor is considering bonds issued by Company X, Company Y, and Company Z, and wants to choose a bond that satisfies the client's rating requirement, but also has the highest yield to maturity. The advisor has gathered the following information:

	Company/Bond		
	X	**Y**	**Z**
Bond rating	AA+	A+	AAA
Annual coupon rate (%)	3.50	3.56	3.38
Time to maturity in years	5	5	5
Price (USD)	975	973	989
Par value (USD)	1,000	1,000	1,000

Assuming semi-annual coupon payments, which bond should the investment advisor purchase for the client?

A. Bond X
B. Bond Y
C. Bond Z
D. Either Bond X or Bond Z

14. The CFO and CRO at a French property-casualty insurer are discussing the impact recent flooding in Europe is having on their company. They are concerned about a surge in property insurance claims causing the company's regulatory capital to fall below the solvency capital requirement (SCR) prescribed under Solvency II. Which of the following would be a result of this situation?

A. The company will be prevented from writing new property-casualty policies.
B. A plan to bring capital above the minimum capital requirement must be formulated.
C. The company can lower the capital charges assessed for determining the capital requirement by decreasing investment risk.
D. A waiver of capital requirements can be granted by the French insurance regulator.

15. A portfolio manager bought 600 call options on a non-dividend-paying stock, with a strike price of USD 60, for USD 3 each. The current stock price is USD 62 with a daily stock return volatility of 1.82%, and the delta of the option is 0.5. Using the delta-normal approach to calculate VaR, what is an approximation of the 1-day 95% VaR of this position?

A. USD 54
B. USD 557
C. USD 787
D. USD 1,114

16. The CRO of a large bank is interviewing a candidate for an operational risk analyst position. The CRO asks the candidate several questions about various aspects of operational risk measurement. Which of the following responses given by the candidate is correct?

A. Economic capital of a bank should be sufficient to cover both the expected and the worst-case operational risk losses of the bank.
B. Loss severity and loss frequency are often modeled with lognormal and Poisson distributions, respectively.
C. Operational loss data available from data vendors tend to be biased toward small losses but are particularly useful in determining loss frequency.
D. The standardized approach used by banks in calculating operational risk capital requires the calculation of unexpected as well as expected losses.

17. A financial analyst is using ordinary least squares (OLS) estimation to explain the behavior of a financial variable. The analyst notes that the proper selection of regressors to include in an OLS estimation is critical to the accuracy of the result. When does omitted variable bias occur?

A. Omitted variable bias occurs when the omitted variable is correlated with an included regressor and is a determinant of the dependent variable.
B. Omitted variable bias occurs when the omitted variable is correlated with an included regressor but is not a determinant of the dependent variable.
C. Omitted variable bias occurs when the omitted variable is independent of an included regressor and is a determinant of the dependent variable.
D. Omitted variable bias occurs when the omitted variable is independent of an included regressor but is not a determinant of the dependent variable.

18. A treasury risk manager working for a large bank is responsible for liquidity risk management. The manager is particularly interested in processes for funding liquidity risk management. Which of the following is the most appropriate process used for funding liquidity risk management?

A. Building VaR models
B. Purchasing credit default swaps
C. Implementing asset-liability management
D. Calculating loss given default

19. A junior analyst has just started working for a national banking supervisor and is training for a position as a bank examiner. As part of the training program, the analyst is asked to explain how banking regulations evolved as a result of the 2007 – 2009 financial crisis to encourage better risk governance. Which of the following correctly describes an impact of regulations that were introduced as a result of the crisis?

A. Banks were required to securitize all the mortgages they originate in order to distribute risk across financial institutions.
B. Banks were encouraged to establish an independent risk management function with access to the board of directors.
C. Proprietary trading operations were merged with traditional banking operations to provide banks better governance over their trading desks.
D. Derivatives were encouraged to be traded OTC rather than centrally cleared to provide greater transparency.

20. A newly hired risk analyst at a bank is a certified FRM. The analyst is reviewing the bank's policies and procedures related to employee conduct and notices areas where they conflict with the GARP Code of Conduct. Which of the following is a potential consequence of violating the GARP Code of Conduct once a formal determination is made that such a violation has occurred?

A. Formal notification of a violation sent to the GARP Member's employer
B. Suspension of the GARP Member's right to work in the risk management profession
C. Removal of the GARP Member's right to use the FRM designation
D. Required participation by the GARP Member in ethics training

21. A risk manager at a major global bank is conducting a time series analysis of equity returns. The manager wants to know whether the time series is covariance stationary. Which of the following statements describes one of the requirements for a time series to be covariance stationary?

A. The distribution of a time series should have a kurtosis value near 3.0, ensuring no fat tails will distort stationarity.
B. The distribution of a time series should have a skewness value near 0, so that its mean will fall in the center of the distribution.
C. The autocovariance of a covariance stationary time series depends only on the lag, h, between observations, not on time.
D. When the autocovariance function is asymmetric with respect to lag, h, forward looking stationarity can be achieved.

22. A risk manager at a pension fund is analyzing the risk profile of several of the fund's portfolios. The portfolios are invested in different asset classes and have the same current market value. Which of the following portfolios would likely have the highest potential level of unexpected loss during a sharp broad-based downturn in financial markets?

A. A portfolio of US Treasury notes with 2 to 5 years to maturity
B. A portfolio of long stock positions in an international large cap stock index combined with long put options on the same index
C. A portfolio of mezzanine tranche MBS structured by a large regional bank
D. A short position in futures for industrial commodities such as copper and steel

23. An investor is assessing the market risk of Andromeda Fund. The fund has an expected annual return of 6.8% and volatility of 7.0% and is benchmarked against the S&P 500 Index. The investor assumes the S&P 500 Index has an expected annual return of 7.2% and volatility of 8.2%. According to the CAPM, if the risk-free rate is 2.2% per year, what is the beta of Andromeda Fund?

A. 0.92
B. 0.95
C. 1.13
D. 1.23

24. A risk consultant is presenting to a group of junior risk managers on how risk management failures contributed to financial disasters. The consultant focuses on the lessons learned from examining historical financial disasters in the US and around the world. Which of the following correctly describes a lesson learned from the given case?

A. The Orange County case emphasizes the importance of fully understanding complex derivative contracts before entering into them.
B. The London Whale case emphasizes the importance of recognizing that correlations can increase sharply during a global financial crisis.
C. The Northern Rock case emphasizes the importance of having a strong cybersecurity framework.
D. The LTCM case emphasizes the importance of meeting regulatory capital requirements.

25. An analyst is evaluating the performance of a portfolio of Mexican equities that is benchmarked to the IPC Index. The analyst collects the information about the portfolio and the benchmark index, shown below:

Expected return of the portfolio	8.7%
Volatility of returns of the portfolio	12.0%
Expected return of the IPC	4.0%
Volatility of returns of the IPC	8.7%
Risk-free rate of return	2.0%
Beta of portfolio relative to IPC	1.4%

What is the Sharpe ratio of this portfolio?

A. 0.036
B. 0.047
C. 0.389
D. 0.558

26. A risk manager has estimated a regression of a firm's monthly portfolio returns against the returns of three US domestic equity indexes: the Russell 1000 Index, the Russell 2000 Index, and the Russell 3000 Index. The results are shown below:

Regression statistics	
Multiple R	0.951
R-squared	0.905
Adjusted R-squared	0.903
Standard error	0.009
Observations	192

Regression output	Coefficients	Standard error	t-stat	P-value
Intercept	0.0023	0.0006	3.5305	0.0005
Russell 1000	0.1093	1.5895	0.0688	0.9452
Russell 2000	0.1055	0.1384	0.7621	0.4470
Russell 3000	0.3533	1.7274	0.2045	0.8382

Correlation matrix	Portfolio returns	Russell 1000	Russell 2000	Russell 3000
Portfolio returns	1.000			
Russell 1000	0.937	1.000		
Russell 2000	0.856	0.813	1.000	
Russell 3000	0.945	0.998	0.845	1.000

Based on the regression results, which statement is correct?

A. The estimated coefficient of 0.3533 indicates that the returns of the Russell 3000 Index are more statistically significant in determining the portfolio returns than the other two indexes.
B. The high adjusted R^2 indicates that the estimated coefficients on the Russell 1000, Russell 2000, and Russell 3000 Indexes are statistically significant.
C. The high p-value of 0.9452 indicates that the regression coefficient of the returns of the Russell 1000 Index is more statistically significant than the other two indexes.
D. The high correlations between each pair of index returns indicate that multicollinearity exists between the variables in this regression.

27. An analyst is examining a portfolio that consists of 1,000 subprime mortgages and 600 prime mortgages. Of the subprime mortgages, 200 are late on their payments. Of the prime mortgages, 48 are late on their payments. If the analyst randomly selects a mortgage from the portfolio and it is currently late on its payments, what is the probability that it is a subprime mortgage?

A. 60%
B. 67%
C. 75%
D. 81%

28. An analyst is testing a hypothesis that the beta, β, of stock CDM is 1. The analyst runs an ordinary least squares regression of the monthly returns of CDM, R_{CDM}, on the monthly returns of the S&P 500 Index, R_m, and obtains the following relation:

$$R_{CDM} = 0.86R_m - 0.32$$

The analyst also observes that the standard error of the coefficient of R_m is 0.80. In order to test the hypothesis H_0: $\beta = 1$ against H_1: $\beta \neq 1$, what is the correct statistic to calculate?

A. t-statistic
B. Chi-squared test statistic
C. Jarque-Bera test statistic
D. Sum of squared residuals

29. A data analyst at a large bank is assessing the valuation of a unique stock option with few known properties. The analyst is considering using simulation to model the option's potential value. The analyst considers whether to use Monte Carlo simulation or bootstrapping to conduct the analysis. Which of the following statements about bootstrapping is correct?

A. Data used for bootstrapping must follow a standard normal distribution.
B. Data used for bootstrapping must be resampled with replacement.
C. Data used for bootstrapping must come from a variable with known properties.
D. Data used for bootstrapping must be resampled such that all possible outcomes in a probability space are present.

30. A risk analyst is assessing the correlation between the returns of two financial assets. The analyst wants to determine if the two sets of returns are dependent. Which of the following is correct regarding correlation and dependence?

A. Returns on financial assets tend to be independent.
B. Pearson's correlation measures both linear and nonlinear dependence.
C. Correlation and the regression slope are closely related.
D. If the returns of the two assets are normally distributed, their rank correlation and Pearson's correlation would not be equal.

31. A quantitative analyst at a foreign exchange (FX) trading company is developing a new factor model to be used for estimating potential risk exposures on FX trades. The analyst is evaluating potential factors to use in the model, and their effects on the performance of the model. Which of the following statements is most likely correct for the analyst to consider when developing the model?

A. Using a large number of underlying factors will allow the model to correctly predict future exchange rates.
B. The most important factor in predicting a country's interest rates is the political stability of the country.
C. The pair-wise exchange rates for currencies of developed countries can be assumed to be constant for terms shorter than 3 months.
D. The value of a country's currency will be negatively correlated with a factor representing changes in that country's money supply.

32. A portfolio manager holds USD 88 million face value of zero-coupon bonds maturing in 5 years and yielding 4%. The portfolio manager expects that interest rates will increase. To hedge the exposure, the portfolio manager wants to sell part of the 5-year bond position and use the proceeds from the sale to purchase zero-coupon bonds maturing in 1.5 years and yielding 3%. Assuming continuous compounding, what is the market value of the 1.5-year bonds that the portfolio manager should purchase to reduce the duration on the combined position to 3 years?

A. USD 31.00 million
B. USD 37.72 million
C. USD 41.17 million
D. USD 50.28 million

33. A 15-month futures contract on an equity index is currently trading at USD 3,759.52. The underlying equity index is currently valued at USD 3,625 and has a continuously compounded dividend yield of 2% per year. The continuously compounded risk-free rate is 5% per year. Assuming no transactions costs, what is the appropriate strategy to earn potential arbitrage profit?

A. Buy the futures contract and buy the underlying.
B. Buy the futures contract and sell the underlying.
C. Sell the futures contract and buy the underlying.
D. Sell the futures contract and sell the underlying.

34. Savers Bancorp entered into a 2-year interest rate swap on August 9, 2014, in which it received a 4.00% fixed rate and paid LIBOR plus 1.20% on a notional amount of USD 6.5 million. Payments were to be made every 6 months. The table below displays the actual annual 6-month LIBOR rates over the 2-year period:

Date	6-month LIBOR
Aug 9, 2014	3.11%
Feb 9, 2015	1.76%
Aug 9, 2015	0.84%
Feb 9, 2016	0.39%
Aug 9, 2016	0.58%

Assuming no default, how much did Savers Bancorp receive on August 9, 2016?

A. USD 72,150
B. USD 78,325
C. USD 117,325
D. USD 156,650

35. A commodity trader observes that the 6-month forward price of commodity X is USD 1,000. The trader also notes that there is a 6-month zero-coupon risk-free bond with face value USD 1,000 that trades in the secondary fixed-income market. Which of the following strategies creates a synthetic long position in commodity X for a period of 6 months?

A. Buy the forward contract and buy the zero-coupon bond.
B. Buy the forward contract and short the zero-coupon bond.
C. Short the forward contract and buy the zero-coupon bond.
D. Short the forward contract and short the zero-coupon bond.

36. Bank A and Bank B are two competing investment banks. The banks are calculating the 1-day 99% VaR for a long position in an at-the-money call option on a non-dividend-paying stock with the following information:

- Current stock price: USD 120
- Estimated annual stock return volatility: 18%
- Current Black-Scholes-Merton call option value: USD 5.20
- Call option delta: 0.6

To compute VaR, Bank A uses the delta-normal model, while Bank B uses a Monte Carlo simulation method for full revaluation. Which bank will estimate a higher value for the 1-day 99% VaR?

A. Bank A
B. Bank B
C. Both banks will have the same VaR estimate
D. Insufficient information to determine

37. A trader on the derivatives trading desk of an investment bank holds a portfolio of short option positions. The trader limits the risk of these exposures by maintaining a delta hedging strategy. In evaluating the dynamic nature of this strategy, which of the following is correct about the interest cost of carrying the delta hedge?

A. The cost will be highest when the options are deep out-of-the-money.
B. The cost will be highest when the options are deep in-the-money.
C. The cost will be highest when the options are at-the-money.
D. The cost will be lowest when the options are at-the-money.

38. A junior analyst at a banking supervisory agency is taking an internal training class on the Vasicek model. The analyst reviews the following equations related to the model:

$$U_i = aF + \sqrt{1 - a^2 Z_i}$$

$$Default\ rate\ as\ a\ function\ of\ F = N\left(\frac{N^{-1}(PD) - aF}{\sqrt{1 - a^2}}\right)$$

Which of the following statements regarding the Vasicek model is correct?

A. The default probabilities of the individual loans in a portfolio are each mapped to the standard normal distribution U_i, of which values in the extreme right tail represent default.
B. A low value of the factor *F* indicates that the economy is strong, while a high value of *F* represents economic weakness.
C. For corporate borrowers, the value of the factor *F* is higher for loans to companies with more cyclical businesses.
D. The model coefficient *a* directly relates to the correlations between the default probability distributions U_i of the loans in the portfolio.

39. A team of risk analysts is conducting an independent review of a recent stress test. As part of this process, the team evaluates the stress testing models used as well as the supporting assumptions in the models. Which of the following, if found in the review, should the analysts identify as the greatest deficiency relating to the models or their assumptions?

A. Relationships between core and peripheral variables in the model are found by regressing their past behavior during stressed market conditions only.
B. Credit risk losses are modeled by mapping historical default rate data provided by credit rating agencies to estimates of gross domestic product.
C. The stress test does not account for the likely responses of other financial institutions to changes in the core variables of the test.
D. A scenario used in the stress test was developed using reverse stress testing.

40. A fixed-income portfolio manager currently holds a bullet 7-year US Treasury position with USD 60 million face value. The manager would like to create a cost matching barbell portfolio by purchasing a combination of a 2-year Treasury and a 15-year Treasury that would have the same duration as the 7-year US Treasury position. The data for the three US Treasuries are listed below:

Maturity	Price	Duration
2 years	100.972	1.938
7 years	106.443	6.272
15 years	122.175	11.687

Which of the following combinations correctly describes the weights of the two bonds that the manager will use to construct the barbell portfolio?

	Weight of 2-Year Treasury	Weight of 15-Year Treasury
A.	14.22%	85.78%
B.	44.46%	55.54%
C.	55.54%	44.46%
D.	85.78%	14.22%

41. A junior risk analyst is modeling the volatility of a certain market variable. The analyst considers using either the EWMA or the GARCH (1,1) model. Which of the following statements is correct?

A. The EWMA model is a special case of the GARCH (1,1) model with the additional assumption that the long-run volatility is zero.
B. A variance estimated from the GARCH (1,1) model is a weighted average of the prior day's estimated variance and the prior day's squared return.
C. The GARCH (1,1) model assigns a higher weight to the prior day's estimated variance than the EWMA model.
D. A variance estimated from the EWMA model is a weighted average of the prior day's estimated variance and the prior day's squared return.

42. A risk manager is estimating the sensitivity of a stock's return to the return on the S&P 500 Index. The manager performs this task using an ordinary least squares (OLS) regression. Which of the following descriptions of the OLS procedure is correct?

A. OLS minimizes the square of the sum of differences between the actual and estimated S&P 500 Index returns.
B. OLS minimizes the square of the sum of differences between the actual and estimated stock returns.
C. OLS minimizes the sum of differences between the actual and estimated squared S&P 500 Index returns.
D. OLS minimizes the sum of squared differences between the actual and estimated stock returns.

43. A market risk analyst is projecting a range of returns on stock XYZ for the next month. Using the returns of the prior 12 months, the analyst estimates the mean monthly return of the stock to be -0.75% with a standard error of 2.70%.

One-tailed t-distribution table			
Degrees of freedom	**α**		
	0.100	**0.050**	**0.025**
8	1.397	1.860	2.306
9	1.383	1.833	2.262
10	1.372	1.812	2.228
11	1.363	1.796	2.201
12	1.356	1.782	2.179

Using the t-table above, which of the following is the 95% confidence interval for the mean return of stock XYZ?

A. -6.69% and 5.19%
B. -6.63% and 5.15%
C. -5.60% and 4.10%
D. -5.56% and 4.06%

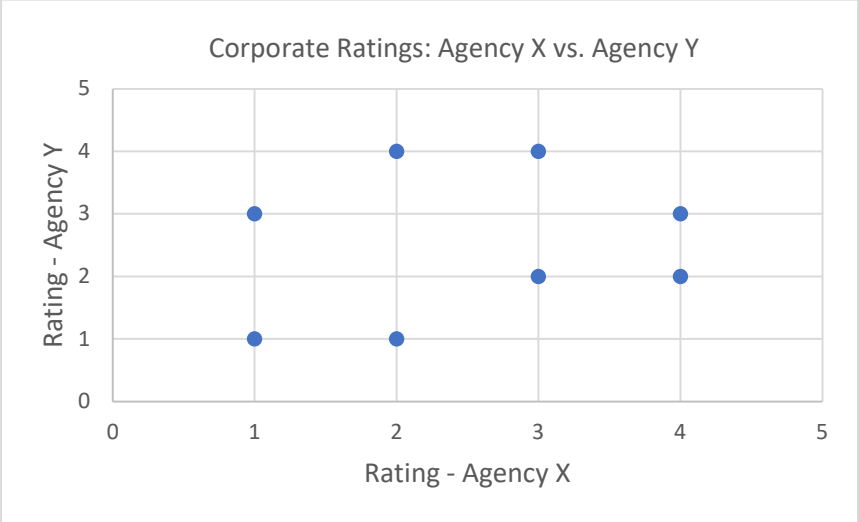
44. A financial analyst is concerned about the market risk of a stock. Based on the stock's return data of the most recent 12 months, it has been estimated that the historical volatility of the monthly returns is 4.5%. Which of the following is most likely correct?

A. The implied volatility of the annual returns is 15.6%.
B. The implied volatility of the annual returns is 54.0%.
C. The volatility of the annual returns is 15.6%.
D. The volatility of the annual returns is 54.0%.

45. A credit risk manager is in charge of credit risk analysis of large corporates at Bank XYZ. The manager is in possession of credit ratings provided by two rating agencies, X and Y, for 30 companies the manager oversees. The ratings are classified into four categories:

Rating categories	Description
1	High investment grade
2	Mid investment grade
3	Low investment grade
4	Non-investment grade

The manager plots the rating categories from the two agencies as shown below:



Which of the following statistical measures could best help the manager approximate the link between rating categories from the two agencies?

A. Spearman correlation
B. Pearson correlation
C. Structured correlation matrix
D. Covariance

46. An analyst is evaluating a dataset of annual returns for a financial asset. The analyst decides to use the Jarque-Bera test to determine if the returns of the asset are normally distributed. Which of the following is correct regarding the Jarque-Bera test?

A. The Jarque-Bera test statistic follows a Student's t distribution.
B. The Jarque-Bera test only takes into account the skewness and kurtosis of a distribution.
C. The Jarque-Bera test requires that a Gaussian copula be applied to the returns data before conducting the test.
D. The Jarque-Bera test statistic does not depend on the sample size of the returns dataset.

47. An analyst is conducting a Monte Carlo simulation to estimate the expected value of a random variable. The analyst wants to reduce the standard error of the simulated expectation. Which of the following correctly describes a method for reducing the standard error?

A. Increasing the expected value of the simulation
B. Increasing the number of replications
C. Increasing the variance of the distribution
D. Increasing the confidence level of the simulation

48. An investment advisor is analyzing the range of potential expected returns of a new fund designed to replicate the directional moves of the China Shanghai Composite Stock Market Index (SHANGHAI) but with twice the volatility of the index. SHANGHAI has an expected annual return of 7.6% and a volatility of 14.0%, and the risk-free rate is 3.0% per year. Assuming the correlation between the fund's returns and that of the index is 1.0, what is the expected return of the fund using the CAPM?

A. 12.2%
B. 19.0%
C. 22.1%
D. 24.6%

49. The board of directors of a growing asset management company is conducting a review of the firm's approach to risk management. The board concludes that the firm should establish an ERM framework. Which of the following represents a key benefit that the firm will likely attain after establishing an ERM framework?

A. Allowing the company to determine and make use of a higher risk appetite
B. Finding the optimal reporting methodology for each risk function
C. Improving the top-down communication and coordination in the company
D. Taking advantage of the new opportunities that create value on a standalone basis

50. A risk analyst is estimating the variance of returns on a stock index for the next trading day. The analyst uses the following GARCH (1,1) model:

$$\sigma_n^2 = \alpha r_{n-1}^2 + \beta \sigma_{n-1}^2 + \gamma V_L,$$

where σ_n^2, r_{n-1}, and σ_{n-1} represent the index variance on day n, return on day n-1, and volatility on day n-1, respectively. If the expected value of the return is constant over time, which combination of values for α and β would result in a stable GARCH (1,1) process?

A. α = 0.073637 and β = 0.927363
B. α = 0.075637 and β = 0.923363
C. α = 0.084637 and β = 0.916363
D. α = 0.086637 and β = 0.914363

51. An analyst wants to price a 1-year, European-style call option on company CZC's stock using the Black-Scholes-Merton (BSM) model. CZC announces that it will pay a dividend of USD 0.50 per share on an ex-dividend date 1 month from now and has no further dividend payout plans for at least 1 year. The relevant information for the BSM model inputs is in the following table:

Current stock price	USD 40
Stock price volatility	16% per year
Risk-free rate	3% per year
Call option exercise price	USD 40
$N(d_1)$	0.5750
$N(d_2)$	0.5116

What is the price of the 1-year call option on the stock?

A. USD 1.52
B. USD 1.78
C. USD 1.95
D. USD 2.85

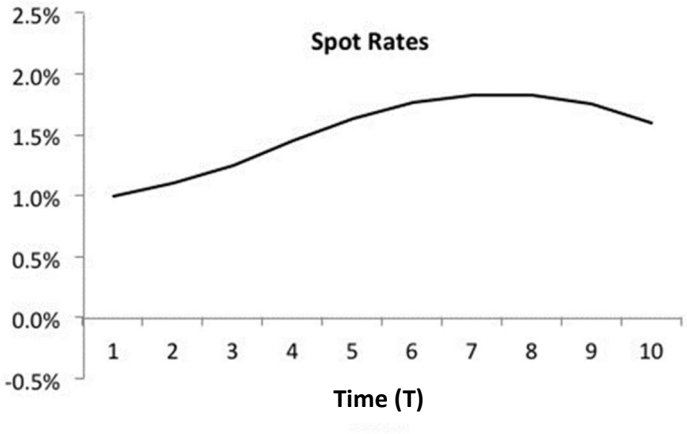
52. The treasurer of a London-based insurance company expects that 3 years from today the company will receive GBP 800,000. The treasurer plans to invest the funds for 1 year after that and decides to lock in a rate of return on the funds at today's forward rate for the period. The current 3-year and 4-year spot rates are 1.5% and 2% respectively, and the company can borrow and lend at these rates. Assuming continuous compounding, how much interest income will the company earn in the 1-year period beginning 3 years from today, and what transactions should the treasurer enter into today in order to lock in this return?

A. Borrow at the 3-year spot rate and lend at the 4-year spot rate to earn a return of GBP 28,000.
B. Lend at the 3-year spot rate and borrow at the 4-year spot rate to earn a return of GBP 28,000.
C. Borrow at the 3-year spot rate and lend at the 4-year spot rate to earn a return of GBP 28,119.
D. Lend at the 3-year spot rate and borrow at the 4-year spot rate to earn a return of GBP 28,119.

53. A derivative trading firm that previously used only the Black-Scholes-Merton (BSM) model to value options has recently decided to use the binomial tree option pricing model as well. An analyst at the firm is reviewing the different features of the two models to compare and contrast their inputs and assumptions. In comparing the two models, which of the following statements is correct?

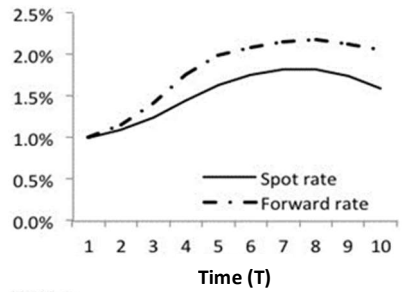
A. The BSM model uses an underlying asset's implied volatility as an input but the binomial tree approach uses its historical volatility.
B. The binomial tree approach, but not the BSM model, assumes that the expected return from the underlying asset is the risk-free rate of interest.
C. In the binomial tree approach, delta is equal at each node since the probabilities of the price moving up or down during a period are constant and equal for both the underlying asset and the option.
D. If the assumptions of the BSM model hold, the implied volatility of a longer-term option and the implied volatility of a shorter-term option on the same underlying asset will be the same.

54. An analyst for a fixed-income investment fund is constructing the risk-free forward rate curve. The analyst observes the following term structure of risk-free spot rates:

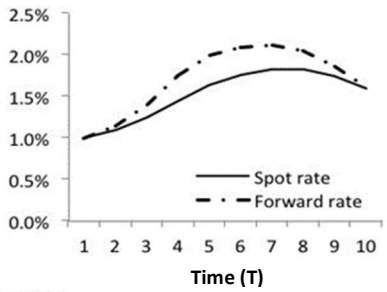


Which of the charts below presents the correctly derived curve for the 1-year forward rate beginning at time T?

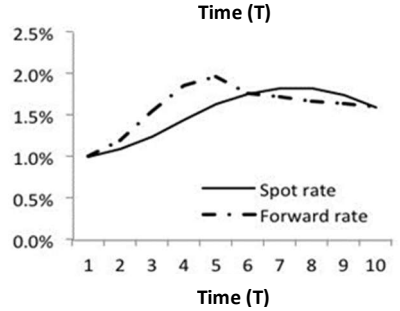
A.



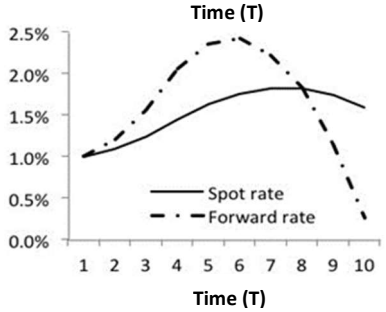
B.



C.



D.



55. A hedge fund manager who holds a portfolio of interest rate-sensitive positions has just received an economist's report forecasting a significant shift in interest rates. Accordingly, the manager wants to change the fund's interest rate exposure by investing in fixed-income securities with negative duration. Which of the following positions should the fund manager take?

A. A long position in a callable corporate bond
B. A long position in a putable corporate bond
C. An interest rate swap paying fixed and receiving LIBOR plus a spread
D. An interest rate swap paying LIBOR plus a spread and receiving fixed

56. A junior credit risk analyst at a US firm is preparing a research report on the attributes and performance of corporate bonds. The analyst assesses corporate bond default rates, credit spread risk, recovery rates, and their impact on portfolio returns for a typical class of investment grade bonds. Which of the following statements would the analyst be correct to include in the report?

A. The distribution of recovery rates of corporate issues is best described as a binomial distribution.
B. The size of a bond issuance is not empirically related to its recovery rates.
C. Measured over the same time period, US Treasury securities always outperform a portfolio of corporate bonds that experiences defaults.
D. Spread duration is best measured by the change in the corporate bond yield for a given 100 bp change in the Treasury rate.

57. A fixed-income portfolio manager purchases a seasoned 5% agency MBS with a weighted average loan age of 60 months. The current balance on the loans at the beginning of this month is USD 32 million, and the conditional prepayment rate is assumed to be constant at 0.6% per year. Which of the following is closest to the expected principal prepayment this month?

A. USD 3,210
B. USD 9,600
C. USD 16,000
D. USD 16,045

58. An operational risk analyst is attempting to estimate a bank's loss severity distribution. However, there is a limited amount of historical data on operational risk losses. Which of the following is the best way to address this issue?

A. Generate additional data using Monte Carlo simulation and merge it with the bank's internal historical data.
B. Estimate the parameters of a Poisson distribution to model the loss severity of operational losses.
C. Estimate relevant probabilities using loss information that is published by credit rating agencies.
D. Merge external data from other banks with the bank's internal data after making appropriate scale adjustments.

59. A French bank enters into a 6-month forward contract with an importer to sell GBP 60 million in 6 months at a rate of EUR 1.15 per GBP 1. If in 6 months the exchange rate is EUR 1.13 per GBP 1, what is the payoff for the bank from the forward contract?

A. EUR -2,000,000
B. EUR -1,200,000
C. EUR 1,200,000
D. EUR 2,000,000

60. An oil driller recently issued USD 250 million of fixed-rate debt at 4.0% per year to help fund a new project. It now wants to convert this debt to a floating-rate obligation using a swap. A swap desk analyst for a large investment bank that is a market maker in swaps has identified four firms interested in swapping their debt from floating-rate to fixed-rate. The following table quotes available loan rates for the oil driller and each firm:

Firm	Fixed rate (in %)	Floating rate (in %)
Oil driller	4.0	6-month LIBOR + 1.5
Firm A	3.5	6-month LIBOR + 1.0
Firm B	6.0	6-month LIBOR + 3.0
Firm C	5.5	6-month LIBOR + 2.0
Firm D	4.5	6-month LIBOR + 2.5

A swap between the oil driller and which firm offers the greatest possible combined benefit?

A. Firm A
B. Firm B
C. Firm C
D. Firm D

61. An analyst at a hedge fund is evaluating an American-style call option and an American-style put option, each with 3 months to maturity, written on a non-dividend-paying stock currently priced at USD 40. The strike price for both options is USD 35 and the risk-free rate is 1.5%. What are the lower and upper bounds on the difference between the prices of the call and put options?

Scenario	Lower bound (USD)	Upper bound (USD)
A	0.13	34.87
B	5.00	5.13
C	5.13	40.00
D	34.87	40.00

A. Scenario A
B. Scenario B
C. Scenario C
D. Scenario D

62. A German housing corporation needs to hedge against rising interest rates. It has chosen to use futures on 10-year German government bonds. Which position in the futures should the corporation take, and why?

A. Take a long position in the futures because rising interest rates lead to rising futures prices.
B. Take a long position in the futures because rising interest rates lead to declining futures prices.
C. Take a short position in the futures because rising interest rates lead to rising futures prices.
D. Take a short position in the futures because rising interest rates lead to declining futures prices.

63. A newly hired risk analyst at a bank is studying historical cases of financial disasters to learn how financial risks can arise in practice. The analyst focuses on the example of Barings Bank, which was forced to declare bankruptcy after reporting over USD 1 billion in unauthorized trading losses by the trader Nick Leeson. Which of the following statements would the analyst be correct to make concerning the collapse of Barings Bank?

A. Leeson avoided reporting the unauthorized trades by convincing the head of his back office that they did not need to be reported.
B. Management failed to investigate high levels of reported profits even though they were associated with a low-risk trading strategy.
C. Leeson traded primarily in OTC foreign currency swaps that allowed Barings Bank to delay cash payments on losing trades until the first payment was due.
D. The loss at Barings Bank was detected when several customers complained of losses on trades that were booked to their accounts.

64. For a sample of the past 30 monthly stock returns for McCreary, Inc., the mean return is 4% and the sample standard deviation is 20%. The population variance is unknown but the standard error of the sample mean is estimated to be:

$$S_x = \frac{20\%}{\sqrt{30}} = 3.651\%$$

The related t-table values are shown below ($t_{i,j}$ denotes the (100-*j*)th percentile of t-distribution value with *i* degrees of freedom):

$t_{29,2.5}$	2.045
$t_{29,5.0}$	1.699
$t_{30,2.5}$	2.042
$t_{30,5.0}$	1.697

What is the 95% confidence interval for the mean monthly return?

A. [-3.466%, 11.466%]
B. [-3.453%, 11.453%]
C. [-2.201%, 10.201%]
D. [-2.194%, 10.194%]

65. An analyst on the fixed-income trading desk observed that the number of defaults per year in the bond portfolio follows a Poisson process. The average number of defaults is four per year. Assuming defaults are independent, what is the probability that there is at most one default next year?

A. 6.58%
B. 7.33%
C. 9.16%
D. 25.00%

66. A quantitative analyst is building a model whose output depends on the value of a financial variable, X. The analyst assumes X is a random variable that follows a normal distribution with a mean of 40 and a standard deviation of 14. What is the probability that X lies outside the range between 12 and 61?

A. 4.56%
B. 6.18%
C. 8.96%
D. 18.15%

67. An insurance company estimates that 40% of policyholders who have only an auto policy will renew next year, and 70% of policyholders who have only a homeowner policy will renew next year. The company estimates that 80% of policyholders who have both an auto and a homeowner policy will renew at least one of those policies next year. Company records show that 70% of policyholders have an auto policy, 50% of policyholders have a homeowner policy, and 20% of policyholders have both an auto and a homeowner policy. Using the company's estimates, what is the percentage of policyholders that will renew at least one policy next year?

A. 29%
B. 41%
C. 53%
D. 57%

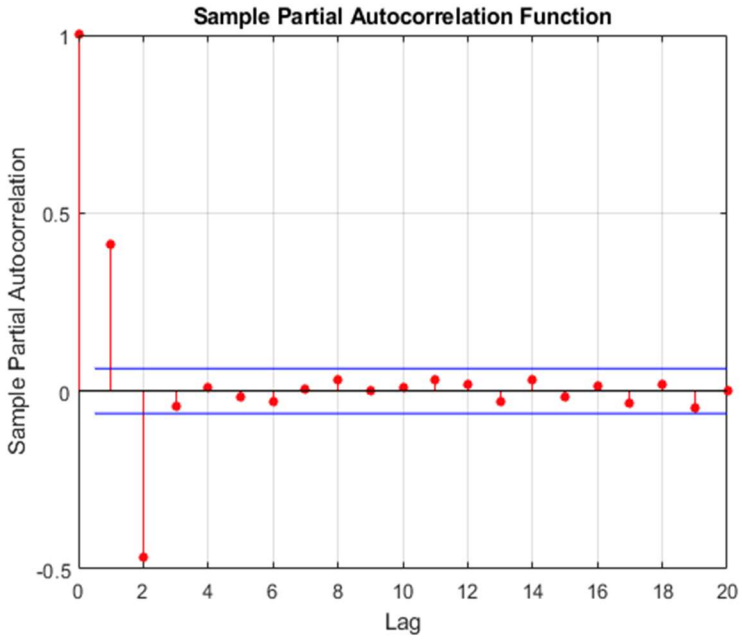
68. A risk manager is calculating the VaR of a fund with a data set of 25 weekly returns. The mean weekly return is 7% and the standard deviation of the return series is 15%. Assuming that weekly returns are independent and identically distributed, what is the standard deviation of the mean weekly return?

A. 0.4%
B. 0.7%
C. 3.0%
D. 10.0%

69. The recent performance of Prudent Fund, a fund with USD 50 million of assets under management, has been weak and the institutional sales group is recommending that it be merged with Aggressive Fund, a USD 200 million fund. The returns on Prudent Fund are normally distributed with a mean of 3% and a standard deviation of 7%, and the returns on Aggressive Fund are normally distributed with a mean of 7% and a standard deviation of 15%. Assuming the returns on the two funds are independent, what is the probability that the returns on the combined fund will exceed 26%?

A. 1.0%
B. 2.5%
C. 5.0%
D. 10.0%

70. A market risk manager would like to analyze and forecast a security performance and has obtained the historical time series for that security. The manager consults a colleague from the quantitative analytic team who provides the following Partial Autocorrelation Function (PACF) plot:



Based on the plot above, which of the following is the best regression approach for the security?

A. AR(1)
B. MA(1)
C. AR(2)
D. MA(2)

71. An analyst wants to price a 6-month futures contract on a stock index. The index is currently valued at USD 750 and the continuously compounded risk-free rate is 3.5% per year. If the stocks underlying the index provide a continuously compounded dividend yield of 2.0% per year, what is the price of the 6-month futures contract?

A. USD 744.40
B. USD 755.65
C. USD 763.24
D. USD 770.91

72. On November 1, the fund manager of a USD 60 million US mid-to-large cap equity portfolio, considers locking in the profit from a recent market rally. The S&P 500 Index is trading at 2,110. The S&P 500 Index futures with a multiplier of 250 is trading at 2,120. Instead of selling the holdings, the fund manager would rather hedge two-thirds of the market exposure over the remaining 2 months. Given that the correlation between the equity portfolio and the S&P 500 Index futures is 0.89 and the volatilities of the equity portfolio and the S&P 500 futures are 0.51 and 0.48 per year, respectively, what position should the manager take to achieve the objective?

A. Sell 71 futures contracts of the S&P 500 Index
B. Sell 103 futures contracts of the S&P 500 Index
C. Sell 148 futures contracts of the S&P 500 Index
D. Sell 167 futures contracts of the S&P 500 Index

73. A risk analyst at a commodity trading firm is examining the supply and demand conditions for various commodities and is concerned about the volatility of the forward prices for silver in the medium term. Currently, silver is trading at a spot price of USD 20.35 per troy ounce and the 6-month forward price is quoted at USD 20.50 per troy ounce. Assuming that after 6 months the lease rate rises above the continuously compounded risk-free interest rate, which of the following statements is correct about the shape of the silver forward curve after 6 months?

A. The forward curve will be downward sloping.
B. The forward curve will be upward sloping.
C. The forward curve will be flat.
D. The forward curve will be humped.

74. Company XYZ operates in the US. On June 1, 2019, it has a net trade receivable of EUR 5,000,000 from an export contract to Germany. The company expects to receive this amount on December 1, 2019. The CFO of XYZ wants to protect the value of this receivable. On June 1, 2019, the EUR spot rate is USD 1.19 per EUR 1, and the 6-month EUR forward rate is USD 1.17 per EUR 1. The CFO can lock in an exchange rate by taking a position in the forward contract. Alternatively, the CFO can sell a 6-month EUR 5,000,000 call option with strike price of USD 1.19 per EUR 1.

In assessing the potential hedging strategy, the CFO thinks that selling an option is better than taking a forward position because if the EUR appreciates against the USD, XYZ can take delivery of the USD at USD 1.19 per EUR 1, while if the EUR depreciates against the USD, the contract will not be exercised and XYZ will pocket the premium obtained from selling the call option. What can be concluded about the CFO's analysis?

A. The CFO's analysis is correct and the company is better off whichever way the EUR rate goes.
B. The CFO's analysis is not correct and the company will suffer if the EUR appreciates sharply against the USD.
C. The CFO's analysis is not correct and the company will suffer if the EUR moves within a narrow range.
D. The CFO's analysis is not correct and the company will suffer if the EUR depreciates sharply against the USD.

75. A portfolio manager at an asset management firm is examining an existing portfolio to determine if it still holds an optimal asset mix based on the firm's latest market expectations. The manager identifies a long position in a futures contract that is no longer consistent with the goals of the portfolio and wants to close out the position using a market-if-touched order. Which of the following actions would be consistent with the use of this type of order?

A. Execute at the best available price once a trade occurs at the specified price or a better price.
B. Execute at the best available price once a bid or offer occurs at the specified price or a worse price.
C. Allow a broker to delay execution of the order to get a better price.
D. Execute the order immediately or not at all.

76. A bond trader is using current zero rates to calculate forward rates. The trader gathers the following information on the current term structure of continuously compounded zero rates:

Maturity in years	Zero rate (%)
1	1.50
2	2.00
3	2.50
4	3.00
5	3.50

Which of the following is closest to the 2-year forward rate starting in 3 years?

A. 3.50%
B. 4.17%
C. 5.00%
D. 6.09%

77. A portfolio manager is analyzing the impact of yield changes on two portfolios: portfolio ASD and portfolio BTE. Portfolio ASD has two zero-coupon bonds and portfolio BTE has only one zero-coupon bond. Additional information on the portfolio is provided in the table below:

	Portfolio components	Yield per year	Maturity (years)	Face value
Portfolio ASD	Bond 1	10%	3	USD 1,000,000
	Bond 2	10%	9	USD 1,000,000
Portfolio BTE	Bond 3	8%	6	USD 1,000,000

To assess the potential effect of a parallel shift in the yield curve on portfolio values, the manager runs a scenario in which yields increase by 200 bps across all points of the yield curve. In addition, the manager estimates a convexity of 34.51 for portfolio ASD and 36.00 for portfolio BTE. Assuming continuous compounding, which of the following are the best estimates of the decrease in the values of the two portfolios due to the combined effects of duration and convexity?

	Portfolio ASD	Portfolio BTE
A.	USD 102,000	USD 65,000
B.	USD 110,000	USD 70,000
C.	USD 118,000	USD 74,000
D.	USD 127,000	USD 79,000

78. A US financial institution entered into a 4-year currency swap contract with an industrial company located in France. Under the terms of the swap, the financial institution receives interest at 3% per year in EUR and pays interest at 2% per year in USD. The principal amounts are EUR 50 million and USD 60 million, and interest payments are exchanged once at the end of each year. Immediately before cash flow payments and receipts are exchanged at the end of year 3, the exchange rate is USD 1.044 per EUR 1, the 1-year risk-free rate in France is 3.0%, and the 1-year risk-free rate in the US is 2.0%. Assuming continuous compounding, what is the value of the swap to the financial institution at the end of year 3?

A. USD -7.603 million
B. USD -7.445 million
C. USD -7.068 million
D. USD -6.921 million

79. The investment banking division of a large German bank recently engaged a new client whose business is in direct competition with an existing client of the commercial banking division of the bank. A manager in the commercial banking division is concerned about conflicts of interest that may arise from providing both clients with a high level of customer service. What is of greatest concern to the manager regarding this situation?

A. The investment banking division pressuring the banks brokers to buy certain securities for clients
B. The investment banking division pressuring researchers to generate buy recommendations for the new client
C. The investment banking division pressuring commercial bankers to confirm material nonpublic information
D. The investment banking division pressuring commercial bankers to open a banking relationship with the new client

80. A risk manager wishes to hedge an investment in zirconium using futures. Unfortunately, there are no futures that are based on this asset. To determine the best futures contract to hedge with, the risk manager runs a regression (as shown below) of daily changes in the price of zirconium against daily changes in the prices of similar assets that have futures contracts associated with them:

$$\text{Change in Price of Zirconium} = \alpha + \beta*(\text{Change in Price of Asset}_t) + \varepsilon_t$$

Asset	α	β	R^2
A	1.25	1.03	0.62
B	0.67	1.57	0.81
C	0.01	0.86	0.35
D	4.56	2.30	0.45

Based on the results shown in the table above, futures tied to which asset would likely introduce the least basis risk into the hedging position?

A. Asset A
B. Asset B
C. Asset C
D. Asset D

81. A risk manager asks a junior risk analyst to assess the prepayment risk on a pool of fixed-rate mortgages. In order to calculate the conditional prepayment rate (CPR) for the pool, the analyst begins by estimating the monthly prepayments on one selected mortgage. At origination, the 30-year mortgage was a USD 1,750,000 loan making monthly mortgage payments at a fixed mortgage rate of 8% per year. Assuming the borrower made a total payment on the mortgage of USD 15,950.00 in one specific month, and the loan balance at the beginning of that month was USD 1,644,235.78, what is the correct estimate of the prepayment amount for that month?

A. USD 3,060.29
B. USD 4,933.62
C. USD 11,016.38
D. USD 14,076.60

82. A derivatives trader is determining the bounds for prices of several options on a stock. The current share price of the stock is USD 100.00, and the continuously compounded risk-free rate is 12% per year. What are the upper bounds for the prices of a 3-month European-style call option, American-style call option, European-style put option, and American-style put option, respectively, if the strike price for each option is USD 90.00?

A. USD 97.04; USD 97.04; USD 87.34; USD 87.34
B. USD 97.04; USD 100.00; USD 90.00; USD 90.00
C. USD 100.00; USD 100.00; USD 87.34; USD 90.00
D. USD 100.00; USD 100.00; USD 90.00; USD 90.00

83. An analyst has been asked to estimate the VaR of a long position in a put option on the stock of Big Pharma, Inc. The stock is trading at USD 26.00 with a daily volatility of 1.5%, and the option is at-the-money with a delta of -0.5. Using the delta-normal method, which of the following choices is closest to the 1-day 95% VaR of the option position?

A. USD 0.32
B. USD 0.45
C. USD 0.64
D. USD 0.91

84. A newly hired quantitative analyst at a financial institution has been asked by a portfolio manager to calculate the VaR of a portfolio for 10-, 15-, 20-, and 25-day periods. The portfolio manager notices something wrong with the analyst's calculations. Assuming the annualized volatilities of daily returns for the four periods are equal, and that the daily returns are independently and identically normally distributed with a mean of zero, which of the following VaR estimates for this portfolio is inconsistent with the others?

A. VaR(10-day) = USD 474 million
B. VaR(15-day) = USD 503 million
C. VaR(20-day) = USD 671 million
D. VaR(25-day) = USD 750 million

85. A portfolio manager uses a valuation model to estimate the value of a bond portfolio at USD 125.00 million. The term structure is flat. Using the same model, the portfolio manager estimates that the value of the portfolio would increase to USD 127.70 million if all interest rates fall by 20 bps and would decrease to USD 122.20 million if all interest rates rise by 20 bps. Using these estimates, which of the following is the effective duration of the bond portfolio closest to?

A. 5.5
B. 11.0
C. 22.0
D. 44.0

86. A portfolio manager is calculating the realized return and the historical volatility of returns for the stock of company VMG. The stock ended the month of June 2021 at a price per share of INR 280, and ended the month of December 2021 at INR 320. The manager reports that the monthly volatility of the stock returns over the 6-month period was 2.76%. Assuming continuous compounding, and that the stock's returns are independent over time, what are the realized return over the 6-month period and the volatility of the stock returns per year?

A. The realized return is 12.5%, and the annual volatility is 9.6%.
B. The realized return is 12.5%, and the annual volatility is 33.1%.
C. The realized return is 26.7%, and the annual volatility is 9.6%.
D. The realized return is 26.7%, and the annual volatility is 33.1%.

87. The CRO of a small bank is estimating the volatility of the bank's asset portfolio using its key rate 01s, in preparation for calculating the bank's market risk capital. The portfolio is only exposed to 2-year and 10-year spot rates. Relevant information on market rates and the portfolio is as follows:

	2-year	10-year
Standard deviation of daily changes in the spot rate (in bps)	4	11
Correlation between spot rate	0.6	0.6
Portfolio key rate 01s (CAD)	52	97

Given the above information, what is the standard deviation of the daily change in portfolio value?

A. CAD 516
B. CAD 988
C. CAD 1,026
D. CAD 1,203

88. The CRO of a major bank is reviewing a new risk measure, W, with the risk team. The CRO runs a test on the new risk measure to determine if the measure is coherent and satisfies the property of translation invariance. Which of the following tests would correctly determine that the risk measure W exhibits translation invariance?

A. When cash is added to a portfolio, the value of W for that portfolio should decrease by the amount of cash that is added.
B. When W is used to measure the risk of two portfolios A and B, then W(A) + W(B) should be less than or equal to W(A+B).
C. When W is used to measure the risk of two portfolios A and B, and if portfolio A always produces a worse outcome than portfolio B, then W(A) should always be higher than W(B).
D. When W is used to measure the risk of portfolio A, and if all exposures in portfolio A are increased by a constant factor, then W(A) should increase proportionally by that factor.

89. A risk analyst at a financial institution is preparing a report on capital requirements for the senior management team to be used in risk appetite discussions. The analyst compares regulatory capital and economic capital requirements in the report. Which of the following statements is correct for the analyst to include in the report?

A. The regulatory capital for credit risk is designed to be sufficient to cover a loss that is expected to be exceeded only once every ten years.
B. Regulatory capital is sometimes referred to as going concern capital because it absorbs losses incurred while the bank is still in business.
C. The most important capital for a bank is regulatory capital, which equals the bank's estimate of its expected losses.
D. Economic capital is an internal risk measure that reflects the amount of capital needed to ensure a company remains solvent with a high level of confidence, given its risk profile.

90. A risk analyst at a bank is calculating credit risk for various types of assets in the bank's portfolio. The analyst begins by estimating the parameters used as inputs to these calculations, and encounters several challenges while doing so. Which of the following will the analyst find to be correct regarding the estimated inputs for credit risk calculations?

A. The probability of default of a derivative counterparty often increases as the bank's exposure at default with respect to that derivative position increases.
B. The loss given default for a derivative transaction is typically negatively correlated with the counterparty's probability of default.
C. Banks must make both through-the-cycle and point-in-time estimates of loss given default to comply with both regulatory requirements and accounting standards.
D. Current exposure is typically used to estimate exposure at default for a line of credit in order to provide a conservative estimate.

91. A market risk manager at a pension fund is calculating the annual VaR of a portfolio of investment securities. The portfolio has a current market value equal to USD 7,444,000 with a daily variance of 0.0002. Assuming there are 250 trading days in a year and the daily portfolio returns are independent and follow the same normal distribution with a mean of zero, what is the estimate of the 1-year VaR at the 95% confidence level?

A. USD 38,723
B. USD 173,150
C. USD 2,737,737
D. USD 3,871,110

92. A fixed-income portfolio manager at a pension fund is investigating the information contained in credit ratings and credit default swap spreads. The manager reviews the literature on the subject and finds research by Hull, Predescu, and White examining the impact of rating changes on credit default swap spreads. According to this study, which of the following ratings actions is found to have the greatest impact on credit default swap spreads when announced?

A. Watchlist reviews for ratings upgrades
B. Ratings upgrades
C. Watchlist reviews for ratings downgrades
D. Ratings downgrades

93. Two risk analysts are attending a seminar on the topic of modern portfolio theory. One of the presentations in the seminar focuses on the efficient frontier, the capital market line, and the CAPM. Assuming the CAPM holds, which of the following observations is correct for the analysts to make?

A. The capital market line always has a positive slope and its steepness depends on the market risk premium and the volatility of the market portfolio.
B. The capital market line is the straight line connecting the risk-free asset with the zero-beta minimum-variance portfolio.
C. The portfolio of risky assets with the lowest standard deviation on the efficient frontier is typically held by the least risk averse investors.
D. The efficient frontier indicates that different individuals hold different portfolios of risky assets based upon their individual forecasts for asset returns.

94. A wealth manager is calculating the beta of a portfolio of large-cap industrial company stocks. The manager determines that the correlation between the return of the portfolio and the return of its benchmark is 0.8, the volatility of portfolio returns is 5%, and the volatility of the benchmark is 4%. What is the beta of the portfolio with respect to its benchmark?

A. -1.00
B. 0.64
C. 0.80
D. 1.00

95. The CRO of a bank is evaluating the bank's practices for the management of risk data. The CRO notes that in characterizing various dimensions of a bank's data, the Basel Committee has suggested several principles to promote strong and effective risk data aggregation capabilities. Which statement correctly describes a recommendation that a bank should follow in accordance with the Basel Committee's principles for effective risk data aggregation and risk reporting?

A. The integrity principle recommends that data aggregation should be completely automated without any manual intervention.
B. The completeness principle recommends that a financial institution should capture data on its entire universe of material risk exposures.
C. The adaptability principle recommends that a bank should frequently update its risk reporting systems to incorporate changes in best practices.
D. The accuracy principle recommends that the risk data be reconciled with management's estimates of risk exposure prior to aggregation.

96. A risk analyst at a growing bank is concerned about a loan exposure to a large manufacturing company which is losing significant market share in its industry. The analyst considers the use of different credit risk transfer mechanisms, including CDS, to manage this exposure. Which of the following statements correctly describes an appropriate benefit of using CDS in this situation?

A. CDS quantify the manufacturing company's default risk and allow the bank to monitor changes in this risk on a real-time basis.
B. CDS provide an agreement to periodically revalue the loan and transfer any net value change.
C. CDS require the manufacturing company to pay back the loan in full at an earlier point in time.
D. CDS allow the bank to offset its exposure to the company with loan exposures to other manufacturing companies.

97. An investment performance analyst is calculating some performance measures on portfolio LCM. Portfolio LCM has an expected return of 9%, volatility of 21%, and a beta of 0.3. If the risk-free rate is 3%, what is the Treynor measure of portfolio LCM?

A. 0.08
B. 0.15
C. 0.20
D. 0.40

98. A risk consultant is advising a pension fund to revise its asset allocation approach to be more consistent with the theory of CAPM. The consultant prepares a list of the assumptions of CAPM to support the advice. Which of the following is an assumption of CAPM?

A. There are transaction costs associated with buying and selling assets.
B. An individual investor can affect the price of a stock by buying or selling that stock.
C. Investors make their investment decisions by taking into account their personal income taxes.
D. Investors have the same expectations regarding the expected returns and the variance of returns of all assets.

99. An analyst is analyzing the historical performance of two commodity funds tracking the Reuters/Jefferies-CRB® Index as benchmark. The analyst collated the data on the monthly returns and decided to use the information ratio (IR) to assess which fund achieved higher returns more efficiently, and presented the findings as shown below:

	Fund 1	**Fund 2**	**Benchmark returns**
Average monthly return	1.488%	1.468%	1.415%
Average excess return	0.073%	0.053%	0.000%
Standard deviation of returns	0.294%	0.237%	0.238%
Tracking error	0.344%	0.341%	0.000%

What is the information ratio for each fund, and what conclusion can be drawn?

A. IR for Fund 1 = 0.212, IR for Fund 2 = 0.155; Fund 1 performed better as it has a higher IR.
B. IR for Fund 1 = 0.212, IR for Fund 2 = 0.155; Fund 2 performed better as it has a lower IR.
C. IR for Fund 1 = 0.248, IR for Fund 2 = 0.224; Fund 1 performed better as it has a higher IR.
D. IR for Fund 1 = 0.248, IR for Fund 2 = 0.224; Fund 2 performed better as it has a lower IR.

100. An analyst is estimating the sensitivity of the return of stock A to different macroeconomic factors. The following estimates for the factor betas are prepared:

$$\beta_{\text{Industrial production}} = 1.30 \qquad \beta_{\text{interest rate}} = -0.75$$

Under baseline expectations, with industrial production growth of 3.0% and an interest rate of 1.5%, the expected return for Stock A is estimated to be 5.0%. The economic research department is forecasting an acceleration of economic activity for the following year, with industrial production forecast to grow 4.2% and interest rates increasing 25 bps to 1.75%. According to this forecast, what return of Stock A can be expected for next year?

A. 4.8%
B. 6.4%
C. 6.8%
D. 7.8%

2022 FRM Part I Practice Exam – Answer Key

1.	C	26.	D	51.	D	76.	C
2.	D	27.	D	52.	A	77.	B
3.	C	28.	A	53.	D	78.	B
4.	B	29.	B	54.	D	79.	C
5.	D	30.	C	55.	C	80.	B
6.	D	31.	D	56.	B	81.	A
7.	A	32.	C	57.	D	82.	C
8.	C	33.	B	58.	D	83.	A
9.	C	34.	B	59.	C	84.	B
10.	C	35.	A	60.	C	85.	B
11.	C	36.	A	61.	B	86.	C
12.	B	37.	B	62.	D	87.	D
13.	A	38.	D	63.	B	88.	A
14.	C	39.	C	64.	A	89.	C
15.	B	40.	C	65.	C	90.	A
16.	B	41.	D	66.	C	91.	C
17.	A	42.	D	67.	D	92.	C
18.	C	43.	A	68.	C	93.	A
19.	B	44.	C	69.	C	94.	D
20.	C	45.	A	70.	C	95.	B
21.	C	46.	B	71.	B	96.	A
22.	C	47.	B	72.	A	97.	C
23.	A	48.	A	73.	A	98.	D
24.	A	49.	C	74.	D	99.	A
25.	D	50.	B	75.	A	100.	B

1. A risk manager is deciding between buying a futures contract on an exchange and entering into a forward contract directly with a counterparty on the same underlying asset. Both contracts would have the same maturity and delivery specifications. The manager finds that the futures price is lower than the forward price. Assuming no arbitrage opportunity exists, and interest rates are expected to increase, what single factor acting alone would be a realistic explanation for this price difference?

A. The futures contract is less liquid than the forward contract.
B. A futures contract offers more flexible terms than a forward contract.
C. The price of the underlying asset is strongly negatively correlated with interest rates.
D. The upfront transaction cost on the futures contract is higher than that on the forward contract.

Correct Answer: C

Explanation: C is correct. When an asset is strongly negatively correlated with interest rates, futures prices will tend to be slightly lower than forward prices. When the underlying asset increases in price, the immediate gain arising from the daily futures settlement will tend to be invested at a lower than average rate of interest due to the negative correlation. In this case, futures would sell for slightly less than forward contracts, which are not affected by interest rate movements in the same manner since forward contracts do not have a daily settlement feature.

A is incorrect. Forward contracts are less liquid than futures contracts. Closing out is not as easy as it is for futures contracts.

B is incorrect. Because futures contracts are traded on an exchange, they are standardized financial products. Forward contracts are traded over the counter, and their terms can be chosen to meet the needs of the counterparties.

D is incorrect. Neither type of contract has upfront transaction costs.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 10. Pricing Financial Forwards and Futures.

Learning Objective: Explain the relationship between forward and futures prices.

2. A trader on the statistical arbitrage desk of a multinational bank finds that a financial asset is trading at USD 1,000, the price of a 1-year futures contract on that asset is USD 1,020, and the price of a 2-year futures contract is USD 1,045. The trader assumes that there will be no cash flows from the asset for 2 years. If the term structure of risk-free interest rates is flat at 2% per year, which of the following is an appropriate arbitrage strategy?

A. Short 1-year futures contracts and long 2-year futures contracts
B. Short 2-year futures contracts and long 1-year futures contracts
C. Short 1-year futures contracts and long the underlying asset funded by borrowing for 1 year at 2% per year
D. Short 2-year futures contracts and long the underlying asset funded by borrowing for 2 years at 2% per year

Correct Answer: D

Explanation: D is correct.

The 1-year futures price should be $1{,}000 * e^{0.02*1} = 1{,}020.20$

The 2-year futures price should be $1{,}000 * e^{0.02*2} = 1{,}040.81$

The current 2-year futures price in the market is overvalued compared to the theoretical price. To lock in a profit, the trader would short the 2-year futures, borrow USD 1,000 at 2%, and buy the underlying asset. At the end of the 2nd year, the trader would sell the asset at USD 1,045 and return the borrowed money with interest, which would be $1{,}000 * e^{0.02*2} = 1{,}040.81$, resulting in a USD 4.19 gain.

A, B, and C are incorrect per the explanation for D above.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 10. Pricing Financial Forwards and Futures.

Learning Objective: Calculate the forward price given the underlying asset's spot price and describe an arbitrage argument between spot and forward prices.

3. A derivatives trader wants to price a European-style call option on a stock with a strike price of USD 25.00 and a time to maturity of 6 months. The trader observes that the price of a 6-month European-style put option on the same underlying with a USD 25.00 strike price is USD 3.00. The stock price is USD 26.00. A special one-time dividend of USD 1.00 is expected in 3 months. The continuously compounded risk-free rate for all maturities is 5% per year. Which of the following is closest to the no-arbitrage value of the call option?

A. USD 2.37
B. USD 3.01
C. USD 3.63
D. USD 4.62

Correct Answer: C

Explanation: C is correct. From the equation for put-call parity, this can be solved by the following equation:

$$c = S_0 + p - PV(K) - PV(D)$$

where PV represents the present value, so that:

$$PV(K) = K * e^{-rt} \text{ and } PV(D) = D * e^{-rt}$$

where:

p is the put price = USD 3.00
c is the call price = to be determined
K is the strike price of the put option = USD 25.00
D is the dividend = USD 1.00
S_0 is the current stock price = USD 26.00
t is the time to the next dividend = 0.25
T is the time to expiration of the option = 6/12 = 0.5
r is the annual risk-free rate of interest = 5%

Calculating PV(K), the present value of the strike price results in a value of $25.00 * e^{-0.05*0.5}$ or 24.3827, while PV(D) is equal to $1.00 * e^{-0.05*0.25}$ = 0.9876.

Hence, c = 26.00 + 3.00 – 24.3827 – 0.9876 = USD 3.6297.

A is incorrect. USD 2.37 is the value of the put option if the question is switched (misinterpreted) such that the price of the call option is taken as USD 3.00 and the put-call parity formula is used.

B is incorrect. USD 3.01 is the option price if the strike price, not the present value of the strike price, is used in the put-call parity formula.

D is incorrect. USD 4.62 is the value of the call option if the dividend payment is ignored.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 13. Properties of Options.

Learning Objective: Explain put-call parity and apply it to the valuation of European and American stock options, with dividends and without dividends, and express it in terms of forward prices.

4. A market risk team at a hedge fund is developing stress test scenarios to assess the impact of changes in different market variables on the fund's portfolio of agency-backed MBS. The team wants to identify potential factors that would likely cause the rate of prepayments on the MBS portfolio to increase. Holding all else constant, which of the following would most likely result in increased prepayments in the portfolio?

A. A decrease in defaults experienced in the mortgage pool
B. A decrease in the average loan-to-value ratio of the mortgage pool
C. An increase in market interest rates
D. An increase in the supply of newly built housing

Correct Answer: B

Explanation: B is correct. A decrease in the average loan-to-value ratio is likely to cause curtailments, which are partial prepayments, therefore increasing prepayments.

A is incorrect. A decrease in defaults usually decreases prepayments.

C is incorrect. An increase in market interest rates usually decreases prepayments.

D is incorrect. An increase in the supply of new houses decreases the value of existing houses, thus slowing down refinancing activity for drawing on home equity.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 18. Mortgages and Mortgage-Backed Securities.

Learning Objective: Describe the mortgage prepayment option and factors that affect it; explain prepayment modeling and its four components: refinancing, turnover, defaults, and curtailments.

5. Pear, Inc. is a manufacturer that is heavily dependent on plastic parts shipped from Malaysia. Pear wants to hedge its exposure to plastic price shocks over the next 7.5 months. Futures contracts, however, are not readily available for plastic. After some research, Pear identifies futures contracts on other commodities whose prices are closely correlated to plastic prices. Futures on Commodity A have a correlation of 0.85 with the price of plastic, and futures on Commodity B have a correlation of 0.92 with the price of plastic. Futures on both Commodity A and Commodity B are available with 6-month and 9-month expirations. Ignoring liquidity considerations, which contract would be the best to minimize basis risk?

A. Futures on Commodity A with 6 months to expiration
B. Futures on Commodity A with 9 months to expiration
C. Futures on Commodity B with 6 months to expiration
D. Futures on Commodity B with 9 months to expiration

Correct Answer: D

Explanation: D is correct. In order to minimize basis risk, one should choose the futures contract with the highest correlation to price changes, and the one with the closest maturity, preferably expiring after the duration of the hedge.

A, B, and C are incorrect per the explanation for D above.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 8. Using Futures for Hedging.

Learning Objective: Define and calculate the basis, discuss various sources of basis risk, and explain how basis risks arise when hedging with futures.

6. A currency analyst is examining the exchange rate between the USD and the EUR. The analyst observes the following market data:

- Current USD per EUR 1 exchange rate: 1.13
- Current USD-denominated 1-year risk-free interest rate: 2.7% per year
- Current EUR-denominated 1-year risk-free interest rate: 1.7% per year

According to interest rate parity, what is the 2-year forward USD per EUR 1 exchange rate?

A. 1.1081
B. 1.1190
C. 1.1411
D. 1.1523

Correct Answer: D

Explanation: D is correct. The forward rate, F_t, is given by the interest rate parity equation:

$$F = S\frac{(1 + R_{USD})^T}{(1 + R_{EUR})^T}$$

where:

S is the spot exchange rate,
R_{USD} is the USD risk-free rate,
R_{EUR} is the EUR risk-free rate, and
T is the time to delivery.

Substituting the values in the equation:

$$F = 1.13\frac{(1 + 0.027)^2}{(1 + 0.017)^2} = 1.1523$$

A is incorrect. USD 1.1081 per EUR 1 is the 2-year forward exchange rate when the 1-year risk-free rates for the two countries are switched in the formula.

B is incorrect. USD 1.1190 per EUR 1 is the 1-year forward exchange rate when the 1-year risk-free rates for the two countries are switched in the formula.

C is incorrect. USD 1.1411 per EUR 1 is the 1-year forward exchange rate, not the 2-year forward rate.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 10. Pricing Financial Forwards and Futures.

Learning Objective: Calculate the forward price given the underlying asset's spot price and describe an arbitrage argument between spot and forward prices.

7. An investor implements a spread trading strategy using options on the stock of XYZ Limited. The investor sells a January 2023 call option with a strike price of USD 50 for USD 10, and buys a January 2023 call option with a strike price of USD 60 for USD 2. What is the name of this strategy, and what is the maximum profit and loss the investor could incur at expiration?

	Strategy	Maximum Profit	Maximum Loss
A.	Bear spread	USD 8	USD 2
B.	Bear spread	Unlimited	USD 2
C.	Bull spread	USD 8	USD 2
D.	Bull spread	USD 8	Unlimited

Correct Answer: A

Explanation: A is correct. This strategy of buying a call option at a higher strike price and selling a call option on the same security with the same maturity at a lower strike price is known as a bear spread. To establish a bull spread, one would buy a call option at a lower strike price and sell a call option on the same security with the same maturity at a higher strike price.

The cost of the bear spread strategy will be:

USD -10 + USD 2 = USD -8 (a negative cost, which represents an inflow of USD 8 to the investor)

The maximum payoff occurs when the stock price $S_T \leq$ USD 50 and is equal to USD 8 (the cash inflow from establishing the position) as none of the options will be exercised. The maximum loss occurs when the stock price $S_T \geq$ USD 60 at expiration, as both options will be exercised. The investor would then be forced to sell XYZ shares at USD 50 to meet the obligations on the call option sold, but could exercise the second call to buy the shares back at USD 60 for a loss of USD -10. However, since the investor received an inflow of USD 8 by establishing the strategy, the total profit would be USD 8 - USD 10 = USD -2.

When the stock price is USD 50 $< S_T \leq$ USD 60, only the call option sold by the investor would be exercised, hence the payoff will be 50 - S_T. Since the inflow from establishing the original strategy was USD 8, the net profit will be 58 - S_T, which would always be higher than USD -2.

B is incorrect. The maximum profit of the bear spread is USD 8 (earned when neither option is exercised).

C is incorrect. The strategy is a bear spread.

D is incorrect. The strategy is a bear spread, and its maximum loss is USD 2 (incurred when both options are exercised).

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 14. Trading Strategies.

Learning Objective: Describe the use and calculate the payoffs of various spread strategies.

8. A portfolio manager is assessing whether the 1-year probability of default of a longevity bond issued by a life insurance company is uncorrelated with returns of the equity market. The portfolio manager creates the following probability matrix based on 1-year probabilities from the preliminary research:

		Longevity bond	
		No default	**Default**
Market returns	**20% increase**	61%	1%
	20% decrease	35%	3%

Given the information in the table, what is the probability that the longevity bond defaults in 1 year given that the market decreases by 20% over 1 year?

A. 3.00%
B. 4.00%
C. 7.89%
D. 10.53%

Correct Answer: C

Explanation: C is correct.

Using Bayes' theorem, let A = bond default and let B = 20% decrease in market returns. Then we must solve:

$$P[A|B] = \frac{P[A \cap B]}{P[B]}$$

Using the values from the table, we have $P[A \cap B] = 3\%$ and $P[B] = 35\% + 3\% = 38\%$.. Thus,

$$P[A|B] = \frac{0.03}{0.38} = .0789 \rightarrow 7.89\%.$$

A is incorrect. It is the probability that the bond defaults and market returns decrease by 20% in 1 year.

B is incorrect. It is the unconditional probability that the bond defaults.

D is incorrect. It uses the unconditional probability that the bond defaults in the numerator of the Bayes' theorem equation:

$$\frac{0.04}{0.38} = 0.1053.$$

Section: Quantitative Analysis

Reference: Global Association of Risk Professionals. Quantitative Analysis. New York, NY: Pearson, 2022. Chapter 1. Fundamentals of Probability.

Learning Objective: Explain and apply Bayes' rule.

9. For a sample of 400 firms, the relationship between corporate revenue (Y_i) and the average years of experience per employee (X_i) is modeled as follows:

$$Y_i = \beta_1 + \beta_2 * X_i + \varepsilon_i \qquad i = 1, 2 ..., 400$$

An analyst wants to test the joint null hypothesis that $\beta_1 = 0$ and $\beta_2 = 0$ at the 95% confidence level. The p-value for the t-statistic for β_1 is 0.07, and the p-value for the t-statistic for β_2 is 0.06. The p-value for the F-statistic for the regression is 0.045. Which of the following statements is correct?

A. The analyst can reject the joint null hypothesis because each β is different from 0 at the 95% confidence level.
B. The analyst cannot reject the joint null hypothesis because neither β is different from 0 at the 95% confidence level.
C. The analyst can reject the joint null hypothesis because the F-statistic is significant at the 95% confidence level.
D. The analyst cannot reject the joint null hypothesis because the F-statistic is not significant at the 95% confidence level.

Correct Answer: C

Explanation: C is correct. The t-test would not be sufficient to test the joint null hypothesis. In order to test the joint null hypothesis, examine the F-statistic, which in this case is statistically significant at the 95% confidence level. Thus, the joint null hypothesis can be rejected.

A, B, and D are incorrect per the explanation for C above.

Section: Quantitative Analysis

Reference: Global Association of Risk Professionals. Quantitative Analysis. New York, NY: Pearson, 2022. Chapter 8. Regression with Multiple Explanatory Variables.

Learning Objective: Construct, apply, and interpret joint hypothesis tests and confidence intervals for multiple coefficients in a regression.

10. A fixed-income portfolio manager currently holds a portfolio of bonds of various companies. The manager assumes that all these bonds have the same annualized probability of default and that the defaults are independent. What type of distribution would best describe the number of defaults in this portfolio over the next year?

A. Bernoulli
B. Lognormal
C. Binomial
D. Exponential

Correct Answer: C

Explanation: C is correct. The result would follow a binomial distribution as there is a fixed number of random variables, each with the same annualized probability of default.

A is incorrect. A Bernoulli distribution would describe the likelihood of default of one of the individual bonds rather than of the entire portfolio (i.e. a binomial distribution essentially describes a group of Bernoulli distributed variables).

B is incorrect. The lognormal distribution is used in constructing various models, including those for an asset's price, but a binomial distribution would be more appropriate in this case.

D is incorrect. The exponential distribution is most commonly used to model the time until a particular event occurs.

Section: Quantitative Analysis

Reference: Global Association of Risk Professionals. Quantitative Analysis. New York, NY: Pearson, 2022. Chapter 3. Common Univariate Random Variables.

Learning Objective: Distinguish the key properties and identify the common occurrences of the following distributions: uniform distribution, Bernoulli distribution, binomial distribution, Poisson distribution, normal distribution, lognormal distribution, Chi-squared distribution, Student's *t* and F-distributions.

11. An analyst has been asked to check for arbitrage opportunities in the Treasury bond market by comparing the cash flows of selected bonds with the cash flows of combinations of other bonds. A 1-year zero-coupon bond is priced at USD 98 and a 1-year bond paying an 8% coupon semi-annually is priced at USD 103. Using a replication approach, what should be the price of a 1-year Treasury bond that pays a coupon of 6% semi-annually?

A. USD 99.3
B. USD 101.1
C. USD 101.8
D. USD 103.9

Correct Answer: C

Explanation: C is correct. To determine the price (F_3) of the 6% coupon bond by replication, where F_1 and F_2 are the weight factors in the replicating portfolio for the zero-coupon bond and the 8% coupon bond, respectively, corresponding to the proportions of the zero-coupon bond and the 8% coupon bond to be held, and given a 1-year horizon:

The three equations below express the requirement that the cash flows of the replicating portfolio, on each cash flow date (t, in years), be equal to the cash flow of the 6% coupon bond:

Time (t=0): $98*F_1 + 103*F_2 = F_3$ …… Equation (1)

Time (t=0.5): $0*F_1 + 4*F_2 = 3$..... Equation (2)

Time (t=1.0): $100*F_1 + 104*F_2 = 103$ …….. Equation (3)

From Equation (2), $F_2 = 3/4 = 0.75$

Substituting the value of F_2 in Equation (3): $100*F_1 + 104*0.75 = 103$, giving, $F_1 = 0.25$

Plugging the values of F_1 and F_2 in Equation (1), we determine $F_3 = 98*0.25 + 103*0.75 = 101.75$

A is incorrect. USD 99.25 is the price of the 1-year 6% coupon Treasury bond if the weight factors, F_1 and F_2, are switched in Equation (1).

B is incorrect. USD 101.07 is the price of the 1-year 6% coupon Treasury bond if the yield-to-maturity of the 1-year 8% coupon Treasury bond is used in its pricing and the zero-coupon Treasury bond is ignored in the replication.

D is incorrect. USD 103.91 is the price of the 1-year 6% coupon Treasury bond if the yield-to-maturity of the zero-coupon Treasury bond is used in its pricing and the 1-year 8% coupon Treasury bond is ignored in the replication.

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 9. Pricing Conventions, Discounting, and Arbitrage.

Learning Objective: Construct a replicating portfolio using multiple fixed-income securities to match the cash flows of a given fixed-income security.

12. A risk manager on the derivatives trading desk of an investment bank is monitoring the sensitivity measures for several of the desk's positions in options on stock FIR. The current market price of the stock is USD 60. Which of the following options on stock FIR has the highest gamma?

A. Long call option expiring in 5 days with strike price of USD 30
B. Long call option expiring in 5 days with strike price of USD 60
C. Long call option expiring in 30 days with strike price of USD 30
D. Long call option expiring in 30 days with strike price of USD 60

Correct Answer: B

Explanation: B is correct. Gamma is defined as the rate of change of an option's delta with respect to the price of the underlying asset, or the second derivative of the option price with respect to the asset price. Therefore, the highest gamma is observed in shorter maturity and at-the-money options, since options with these characteristics are much more sensitive to changes in the underlying asset price. The gamma is highest for a shorter maturity call option because delta's move toward either 0 or +1.00 is more imminent.

A, C, and D are incorrect. The option in choice B either has a shorter maturity, is closer to at-the-money, or both.

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 16. Option Sensitivity Measures: The "Greeks".

Learning Objective: Define and describe theta, gamma, vega, and rho for option positions and calculate the gamma and vega for a portfolio.

13. An investment advisor is advising a wealthy client. The client would like to invest USD 500,000 in a bond rated at least AA. The advisor is considering bonds issued by Company X, Company Y, and Company Z, and wants to choose a bond that satisfies the client's rating requirement, but also has the highest yield to maturity. The advisor has gathered the following information:

	Company/Bond		
	X	**Y**	**Z**
Bond rating	AA+	A+	AAA
Annual coupon rate (%)	3.50	3.56	3.38
Time to maturity in years	5	5	5
Price (USD)	975	973	989
Par value (USD)	1,000	1,000	1,000

Assuming semi-annual coupon payments, which bond should the investment advisor purchase for the client?

A. Bond X
B. Bond Y
C. Bond Z
D. Either Bond X or Bond Z

Correct Answer: A

Explanation: A is correct. To reach the correct answer, find the bond with the highest yield to maturity (YTM) that qualifies for inclusion in the client's portfolio. Although we can calculate the YTM for each bond using a business/financial calculator, it is unnecessary to do so in this case. Of the three bonds, Bond Y does not qualify for the portfolio as its rating of A+ is below the AA rating required by the client. This leaves Bond X and Bond Z only. Comparing the two bonds, Bond X pays a higher coupon than Bond Z, yet it is cheaper as well. Therefore, the YTM on Bond X is higher.

To formally calculate the YTM, you could also use the following equation describing the relationship between price and YTM:

$$P = \frac{F}{100}\left[\frac{c}{2}\sum_{i=1}^{2T}\left(\frac{1}{1+y/2}\right)^{i} + \frac{100}{(1+y/2)^{2T}}\right]$$

where:

P= Bond price
y= YTM
c= Coupon rate
T= Term to maturity in years
F= Face value of the bond

Using this equation (or an equivalent calculator function), the YTM for the X bond equals 4.06%, while the YTM for the Z bond equals 3.62%. Using a business/financial calculator for:

Bond X: N = 2*5 = 10; FV = 1,000; PMT = (0.0350/2)*1,000 = 17.5; PV = -975; y = 2.0287*2 = 4.0575%

Bond Y: N = 2*5 = 10; FV = 1,000; PMT = (0.0356/2)*1,000 = 17.8; PV = -973; y = 2.0819*2 = 4.1637%

Bond Z: N = 2*5=10; FV=1,000; PMT=(0.0338/2)*1,000=16.9; PV=-989; y = 1.8113*2 = 3.6225%

B, C, and D are incorrect per the explanation for A above.

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 11. Bond Yields and Return Calculations.

Learning Objective: Compute a bond's YTM given a bond structure and price.

14. The CFO and CRO at a French property-casualty insurer are discussing the impact recent flooding in Europe is having on their company. They are concerned about a surge in property insurance claims causing the company's regulatory capital to fall below the solvency capital requirement (SCR) prescribed under Solvency II. Which of the following would be a result of this situation?

A. The company will be prevented from writing new property-casualty policies.
B. A plan to bring capital above the minimum capital requirement must be formulated.
C. The company can lower the capital charges assessed for determining the capital requirement by decreasing investment risk.
D. A waiver of capital requirements can be granted by the French insurance regulator.

Correct Answer: C

Explanation: C is correct. Solvency II provides for capital charges for investment risk, underwriting risk, and operational risk. Lowering any of these risks will lower the related capital charges assessed for determining the capital requirement levels.

A is incorrect. An insurer whose capital falls below the minimum capital requirement may be prevented from taking new business.

B is incorrect. The minimum capital requirement is lower than the solvency capital requirement, so breaching the solvency capital requirement may still leave the company above the minimum capital requirement.

D is incorrect. European insurers are regulated by a European Union regulator, not by state regulators.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 2. Insurance Companies and Pension Plans.

Learning Objective: Evaluate the capital requirements for life insurance and property-casualty insurance companies.

15. A portfolio manager bought 600 call options on a non-dividend-paying stock, with a strike price of USD 60, for USD 3 each. The current stock price is USD 62 with a daily stock return volatility of 1.82%, and the delta of the option is 0.5. Using the delta-normal approach to calculate VaR, what is an approximation of the 1-day 95% VaR of this position?

A. USD 54
B. USD 557
C. USD 787
D. USD 1,114

Correct Answer: B

Explanation: B is correct. The delta of the option is 0.5. The 1-day 95% VaR of 1 share of the underlying = 1.82% * 1.645 * 62 = USD 1.8562

Therefore, the VaR of one option is:

0.5 * 1.8562 = USD 0.9281, and multiplying by 600 units provides the 1-day 95% VaR of the entire position: USD 556.86.

A is incorrect. USD 53.8902 is the result obtained by ignoring delta and using the call option price, not stock price, to determine VaR of position: VaR = 0.0182*1.645*600*3 = USD 53.8902.

C is incorrect. USD 787.40 is the result obtained when the VaR of the position is incorrectly calculated at the 99% confidence level (VaR = 0.0182*2.326*62*0.5*600 = USD 787.3975).

D is incorrect. USD 1,113.72 is the result obtained when delta is not applied to the formula (VaR = 1.8562*600 = USD 1,113.72).

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 2. Calculating and Applying VaR.

Learning Objective: Describe the delta-normal approach and use it to calculate VaR for non-linear derivatives.

16. The CRO of a large bank is interviewing a candidate for an operational risk analyst position. The CRO asks the candidate several questions about various aspects of operational risk measurement. Which of the following responses given by the candidate is correct?

A. Economic capital of a bank should be sufficient to cover both the expected and the worst-case operational risk losses of the bank.
B. Loss severity and loss frequency are often modeled with lognormal and Poisson distributions, respectively.
C. Operational loss data available from data vendors tend to be biased toward small losses but are particularly useful in determining loss frequency.
D. The standardized approach used by banks in calculating operational risk capital requires the calculation of unexpected as well as expected losses.

Correct Answer: B

Explanation: B is correct. It is true that loss frequency is typically modeled using a Poisson distribution and loss severity tends to be modeled with a lognormal distribution.

A is incorrect. Economic capital covers the difference between the worst-case loss and the expected loss.

C is incorrect. Operational loss data available from data vendors tends to be biased towards large losses and are most useful for determining relative loss severity.

D is incorrect. In the standardized approach to calculating operational risk capital, a percentage is applied to the gross income of each of a bank's business lines. The bank does not have to estimate unexpected losses under the standardized approach.

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 7. Operational Risk.

Learning Objective: Explain how a loss distribution is derived from an appropriate loss frequency distribution and loss severity distribution using Monte Carlo simulation.

17. A financial analyst is using ordinary least squares (OLS) estimation to explain the behavior of a financial variable. The analyst notes that the proper selection of regressors to include in an OLS estimation is critical to the accuracy of the result. When does omitted variable bias occur?

A. Omitted variable bias occurs when the omitted variable is correlated with an included regressor and is a determinant of the dependent variable.
B. Omitted variable bias occurs when the omitted variable is correlated with an included regressor but is not a determinant of the dependent variable.
C. Omitted variable bias occurs when the omitted variable is independent of an included regressor and is a determinant of the dependent variable.
D. Omitted variable bias occurs when the omitted variable is independent of an included regressor but is not a determinant of the dependent variable.

Correct Answer: A

Explanation: A is correct. Omitted variable bias occurs when a model improperly omits one or more variables that are critical determinants of the dependent variable and are correlated with one or more of the other included independent variables. Omitted variable bias results in an over- or under-estimation of the regression parameters.

B, C, and D are incorrect per the explanation of A above.

Section: Quantitative Analysis

Reference: Global Association of Risk Professionals. Quantitative Analysis. New York, NY: Pearson, 2022. Chapter 9. Regression Diagnostics.

Learning Objective: Describe the consequences of excluding a relevant explanatory variable from a model and contrast those with the consequences of including an irrelevant regressor.

18. A treasury risk manager working for a large bank is responsible for liquidity risk management. The manager is particularly interested in processes for funding liquidity risk management. Which of the following is the most appropriate process used for funding liquidity risk management?

A. Building VaR models
B. Purchasing credit default swaps
C. Implementing asset-liability management
D. Calculating loss given default

Correct Answer: C

Explanation: C is correct. Asset/liability management is a process used in managing banks' funding liquidity risk, with techniques including gap and duration analysis. This is important because maturity mismatches on banks' balance sheets (for example, if a bank funds longer-term loans using short-term deposits) can create risk for a bank if short-term interest rates rise faster than longer term rates.

A is incorrect. VaR models are used to manage market risk.

B is incorrect. Credit default swaps are used to hedge against counterparty risk, which is a form of credit risk.

D is incorrect. Calculating loss given default is used to quantify credit risk.

Section: Foundations of Risk Management

Reference: Global Association of Risk Professionals. Foundations of Risk Management. New York, NY: Pearson, 2022. Chapter 1. The Building Blocks of Risk Management.

Learning Objective: Evaluate, compare, and apply tools and procedures used to measure and manage risk, including quantitative measures, qualitative risk assessment techniques, and enterprise risk management.

19. A junior analyst has just started working for a national banking supervisor and is training for a position as a bank examiner. As part of the training program, the analyst is asked to explain how banking regulations evolved as a result of the 2007 – 2009 financial crisis to encourage better risk governance. Which of the following correctly describes an impact of regulations that were introduced as a result of the crisis?

A. Banks were required to securitize all the mortgages they originate in order to distribute risk across financial institutions.
B. Banks were encouraged to establish an independent risk management function with access to the board of directors.
C. Proprietary trading operations were merged with traditional banking operations to provide banks better governance over their trading desks.
D. Derivatives were encouraged to be traded OTC rather than centrally cleared to provide greater transparency.

Correct Answer: B

Explanation: B is correct. One of the key governance recommendations is that banks should establish an independent risk management function with access to the board of directors. This prevents the risk function from being suppressed, as it would be if it was subordinate to other divisions such as trading operations, and ensures that the board is advised of risk issues.

A is incorrect. Securitization was a key contributor to the crisis, as many tranches of securitized mortgages had very high credit ratings but collapsed during the crisis as investors and rating agencies underestimated the potential for all the mortgages in a securitization to go down together. Post-crisis governance did not encourage increased securitization.

C is incorrect. Dodd-Frank's Volcker rule, for example, prohibited banks from proprietary trading, and around the world many trading operations were required to be (or were voluntarily) divested from banking operations.

D is incorrect. Post-crisis regulation encouraged central clearing when possible.

Section: Foundations of Risk Management

Reference: Global Association of Risk Professionals. Foundations of Risk Management. New York, NY: Pearson, 2022. Chapter 3. The Governance of Risk Management.

Learning Objective: Explain changes in regulations and corporate risk governance that occurred as a result of the 2007-2009 financial crisis.

20. A newly hired risk analyst at a bank is a certified FRM. The analyst is reviewing the bank's policies and procedures related to employee conduct and notices areas where they conflict with the GARP Code of Conduct. Which of the following is a potential consequence of violating the GARP Code of Conduct once a formal determination is made that such a violation has occurred?

A. Formal notification of a violation sent to the GARP Member's employer
B. Suspension of the GARP Member's right to work in the risk management profession
C. Removal of the GARP Member's right to use the FRM designation
D. Required participation by the GARP Member in ethics training

Correct Answer: C

Explanation: According to the GARP Code of Conduct, "violation(s) of this Code may result in, among other things, the temporary suspension or permanent removal of the GARP Member from GARP's Membership roles, and may also include temporarily or permanently removing from the violator the right to use or refer to having earned the FRM designation or any other GARP granted designation, following a formal determination that such a violation has occurred."

A, B, and D are incorrect. The GARP Code of Conduct does not state that these consequences would result from a violation.

Section: Foundations of Risk Management

Reference: Global Association of Risk Professionals. Foundations of Risk Management. New York, NY: Pearson, 2022. Chapter 11. GARP Code of Conduct.

Learning Objective: Describe the potential consequences of violating the GARP Code of Conduct.

21. A risk manager at a major global bank is conducting a time series analysis of equity returns. The manager wants to know whether the time series is covariance stationary. Which of the following statements describes one of the requirements for a time series to be covariance stationary?

A. The distribution of a time series should have a kurtosis value near 3.0, ensuring no fat tails will distort stationarity.
B. The distribution of a time series should have a skewness value near 0, so that its mean will fall in the center of the distribution.
C. The autocovariance of a covariance stationary time series depends only on the lag, h, between observations, not on time.
D. When the autocovariance function is asymmetric with respect to lag, h, forward looking stationarity can be achieved.

Correct Answer: C

Explanation: C is correct. One requirement for a series to be covariance stationary is that its covariance structure be stable over time. If the covariance structure is stable, then the autocovariances depend only on the lag, h, between observations, not on time, t.

A and B are incorrect. Covariance stationarity does not place restrictions on other aspects of the distributions or the series, such as kurtosis and skewness.

D is incorrect. Covariance stationarity does not depend on the symmetry of the autocovariance function.

Section: Quantitative analysis

Reference: Global Association of Risk Professionals. Quantitative Analysis. New York, NY: Pearson, 2022. Chapter 10. Stationary Time Series.

Learning Objective: Describe the requirements for a series to be covariance stationary.

22. A risk manager at a pension fund is analyzing the risk profile of several of the fund's portfolios. The portfolios are invested in different asset classes and have the same current market value. Which of the following portfolios would likely have the highest potential level of unexpected loss during a sharp broad-based downturn in financial markets?

A. A portfolio of US Treasury notes with 2 to 5 years to maturity
B. A portfolio of long stock positions in an international large cap stock index combined with long put options on the same index
C. A portfolio of mezzanine tranche MBS structured by a large regional bank
D. A short position in futures for industrial commodities such as copper and steel

Correct Answer: C

Explanation: C is correct. The portfolio of mortgage-backed securities would have the highest unexpected loss since the securities should have the highest correlation (covariance) and should have the most risk of moving downward simultaneously in a crisis situation.

Section: Foundations of Risk Management

Reference: Global Association of Risk Professionals. Foundations of Risk Management. New York, NY: Pearson, 2022. Chapter 1. The Building Blocks of Risk Management.

Learning Objective: Distinguish between expected loss and unexpected loss and provide examples of each.

23. An investor is assessing the market risk of Andromeda Fund. The fund has an expected annual return of 6.8% and volatility of 7.0% and is benchmarked against the S&P 500 Index. The investor assumes the S&P 500 Index has an expected annual return of 7.2% and volatility of 8.2%. According to the CAPM, if the risk-free rate is 2.2% per year, what is the beta of Andromeda Fund?

A. 0.92
B. 0.95
C. 1.13
D. 1.23

Correct Answer: A

Explanation: A is correct. Since the correlation or covariance between the Andromeda Fund and the S&P 500 Index is not known, CAPM must be used to back out the beta:

$$E(R_i) = R_F + \beta_i[E(R_M) - R_F]$$

where,
$E(R_i)$ is the expected annual return of the fund
β_i is the beta of the fund with the market index (the S&P 500 Index)
R_F is the risk-free rate per year
$E(R_M)$ is the expected annual return of the market (in this case, the S&P 500 Index)

Therefore,

$$6.8\% = 2.2\% + \beta_i * (7.2\% - 2.2\%)$$

Hence,

$$\beta_i = (6.8\% - 2.2\%)/(7.2\% - 2.2\%) = 0.92$$

Section: Foundations of Risk Management

Reference: Global Association of Risk Professionals. Foundations of Risk Management. New York, NY: Pearson, 2022. Chapter 5. Modern Portfolio Theory (MPT) and the Capital Asset Pricing Model (CAPM).

Learning Objective: Apply the CAPM in calculating the expected return on an asset.

Interpret beta and calculate the beta of a single asset or portfolio.

24. A risk consultant is presenting to a group of junior risk managers on how risk management failures contributed to financial disasters. The consultant focuses on the lessons learned from examining historical financial disasters in the US and around the world. Which of the following correctly describes a lesson learned from the given case?

A. The Orange County case emphasizes the importance of fully understanding complex derivative contracts before entering into them.
B. The London Whale case emphasizes the importance of recognizing that correlations can increase sharply during a global financial crisis.
C. The Northern Rock case emphasizes the importance of having a strong cybersecurity framework.
D. The LTCM case emphasizes the importance of meeting regulatory capital requirements.

Correct Answer: A

Explanation: A is correct. Orange County imploded when Robert Citron made a large bet on inverse floating swaps, which was not fully understood by the county's board of directors, and blew up when interest rates rose. Citron later admitted that he did not understand either the position that he took or the risk exposure of the fund.

B is incorrect. Poor correlation modeling was more a central theme of the subprime crisis or Long Term Capital Management (although the LTCM incident did not occur during a crisis.) The London Whale case took place in 2012, well after the end of the crisis, and its main themes were poor corporate governance with respect to risk concentration limits, position limits and VaR models.

C is incorrect. This refers to the SWIFT case. The Northern Rock case was a run on the bank which occurred partly due to an overreliance on repurchase agreements and liquidity risk when repo financing dried up.

D is incorrect. The LTCM case was a case of incorrect correlation modeling and inadequate stress testing. As a hedge fund, LTCM was not covered by regulatory capital requirements at the time.

Section: Foundations of Risk Management

Reference: Global Association of Risk Professionals. Foundations of Risk Management. New York, NY: Pearson, 2022. Chapter 9. Learning from Financial Disasters.

Learning Objective: Analyze the key factors that led to and derive the lessons learned from case studies involving the following risk factors:

- Funding liquidity risk, including Lehman Brothers, Continental Illinois, and Northern Rock.
- Model risk, including the Niederhoffer case, Long Term Capital Management, and the London Whale case.
- Financial engineering and complex derivatives, including Bankers Trust, the Orange County case, and Sachsen Landesbank.

25. An analyst is evaluating the performance of a portfolio of Mexican equities that is benchmarked to the IPC Index. The analyst collects the information about the portfolio and the benchmark index, shown below:

Expected return of the portfolio	8.7%
Volatility of returns of the portfolio	12.0%
Expected return of the IPC	4.0%
Volatility of returns of the IPC	8.7%
Risk-free rate of return	2.0%
Beta of portfolio relative to IPC	1.4%

What is the Sharpe ratio of this portfolio?

A. 0.036
B. 0.047
C. 0.389
D. 0.558

Correct Answer: D

Explanation: D is correct. The Sharpe ratio for the portfolio is:

$$\frac{Expected\ return\ of\ portfolio - Risk\ free\ rate}{Volatility\ of\ returns\ of\ portfolio} = \frac{8.7\% - 2.0\%}{12.0\%} = 0.5583$$

Section: Foundations of Risk Management

Reference: Global Association of Risk Professionals. Foundations of Risk Management. New York, NY: Pearson, 2022. Chapter 5. Modern Portfolio Theory (MPT) and the Capital Asset Pricing Model (CAPM).

Learning Objective: Calculate, compare and interpret the following performance measures: the Sharpe performance index, the Treynor performance index, the Jensen performance index, the tracking error, information ratio, and Sortino ratio.

26. A risk manager has estimated a regression of a firm's monthly portfolio returns against the returns of three US domestic equity indexes: the Russell 1000 Index, the Russell 2000 Index, and the Russell 3000 Index. The results are shown below:

Regression statistics	
Multiple R	0.951
R-squared	0.905
Adjusted R-squared	0.903
Standard error	0.009
Observations	192

Regression output	Coefficients	Standard error	t-stat	P-value
Intercept	0.0023	0.0006	3.5305	0.0005
Russell 1000	0.1093	1.5895	0.0688	0.9452
Russell 2000	0.1055	0.1384	0.7621	0.4470
Russell 3000	0.3533	1.7274	0.2045	0.8382

Correlation matrix	Portfolio returns	Russell 1000	Russell 2000	Russell 3000
Portfolio returns	1.000			
Russell 1000	0.937	1.000		
Russell 2000	0.856	0.813	1.000	
Russell 3000	0.945	0.998	0.845	1.000

Based on the regression results, which statement is correct?

A. The estimated coefficient of 0.3533 indicates that the returns of the Russell 3000 Index are more statistically significant in determining the portfolio returns than the other two indexes.
B. The high adjusted R^2 indicates that the estimated coefficients on the Russell 1000, Russell 2000, and Russell 3000 Indexes are statistically significant.
C. The high p-value of 0.9452 indicates that the regression coefficient of the returns of the Russell 1000 Index is more statistically significant than the other two indexes.
D. The high correlations between each pair of index returns indicate that multicollinearity exists between the variables in this regression.

Correct Answer: D

Explanation: D is correct. This is an example of multicollinearity, which arises when one of the regressors is very highly correlated with the other regressors. In this case, all three regressors are highly correlated with each other, so multicollinearity exists between all three. Since the variables are not perfectly correlated with each other this is a case of imperfect, rather than perfect, multicollinearity.

A is incorrect. The p-value of a regression coefficient indicates whether the coefficient is statistically significant.

B is incorrect. Adjusted R^2, like R^2, measures the percentage of the variation in the data that can be explained by the model as a whole. It gives no indication of the statistical significance of the individual regression coefficients.

C is incorrect. A p-value less than the test size indicates that a regression coefficient is statistically significant.

Section: Quantitative Analysis

Reference: Global Association of Risk Professionals. Quantitative Analysis. New York, NY: Pearson, 2022. Chapter 8. Regression with Multiple Explanatory Variables.

Global Association of Risk Professionals. Quantitative Analysis. New York, NY: Pearson, 2022. Chapter 9. Regression Diagnostics.

Learning Objective: Interpret regression coefficients in a multiple regression.

Interpret goodness-of-fit measures for single and multiple regressions, including R^2 and adjusted-R^2.

Characterize multicollinearity and its consequences; distinguish between multicollinearity and perfect collinearity.

27. An analyst is examining a portfolio that consists of 1,000 subprime mortgages and 600 prime mortgages. Of the subprime mortgages, 200 are late on their payments. Of the prime mortgages, 48 are late on their payments. If the analyst randomly selects a mortgage from the portfolio and it is currently late on its payments, what is the probability that it is a subprime mortgage?

A. 60%
B. 67%
C. 75%
D. 81%

Correct Answer: D

Explanation: D is correct. In order to solve this conditional probability question, first calculate the probability that any one mortgage in the portfolio is late. This is:

$$P(\text{Mortgage is late}) = (200+48)/(1000+600) = 15.5\%.$$

Next, use the conditional probability relationship as follows:

$$P(\text{Subprime mortgage} \mid \text{Mortgage is late})$$

$$= P(\text{Subprime mortgage and late})/P(\text{Mortgage is late}).$$

Since P(Subprime mortgage and late) = 200/1600 = 12.5%;

P(Subprime mortgage | Mortgage is late) = 12.5% / 15.5% = 0.81 = 81%.

Hence the probability that a random late mortgage selected from this portfolio turns out to be subprime is 81%.

Section: Quantitative Analysis

Reference: Global Association of Risk Professionals. Quantitative Analysis. New York, NY: Pearson, 2022. Chapter 1. Fundamentals of Probability.

Learning Objective: Define and calculate a conditional probability.

Distinguish between conditional and unconditional probabilities.

28. An analyst is testing a hypothesis that the beta, β, of stock CDM is 1. The analyst runs an ordinary least squares regression of the monthly returns of CDM, R_{CDM}, on the monthly returns of the S&P 500 Index, R_m, and obtains the following relation:

$$R_{CDM} = 0.86R_m - 0.32$$

The analyst also observes that the standard error of the coefficient of R_m is 0.80. In order to test the hypothesis H_0: $\beta = 1$ against H_1: $\beta \neq 1$, what is the correct statistic to calculate?

A. t-statistic
B. Chi-squared test statistic
C. Jarque-Bera test statistic
D. Sum of squared residuals

Correct Answer: A

Explanation: A is correct.

The t-statistic is defined by:

$$t = \frac{\beta^{estimated} - \beta}{SE_{(estimated\ \beta)}} = \frac{0.86 - 1}{0.8} = -0.175$$

In this case t = -0.175. Since |t| < 1.96 we cannot reject the null hypothesis.

B, C, and D are incorrect. Tests of a hypothesis about a regression parameter are implemented using a t-test.

Section: Quantitative Analysis

Reference: Global Association of Risk Professionals. Quantitative Analysis. New York, NY: Pearson, 2022. Chapter 7. Linear Regression.

Learning Objective: Construct, apply, and interpret hypothesis tests and confidence intervals for a single regression coefficient in a regression.

Explain the steps needed to perform a hypothesis test in a linear regression.

29. A data analyst at a large bank is assessing the valuation of a unique stock option with few known properties. The analyst is considering using simulation to model the option's potential value. The analyst considers whether to use Monte Carlo simulation or bootstrapping to conduct the analysis. Which of the following statements about bootstrapping is correct?

A. Data used for bootstrapping must follow a standard normal distribution.
B. Data used for bootstrapping must be resampled with replacement.
C. Data used for bootstrapping must come from a variable with known properties.
D. Data used for bootstrapping must be resampled such that all possible outcomes in a probability space are present.

Correct Answer: B

Explanation: B is correct. In bootstrapping, data are resampled with replacement in order to empirically estimate the sampling distribution.

A is incorrect. One advantage of bootstrapping over Monte Carlo simulation is that the data do not have to follow any distribution.

C is incorrect. Same explanation as A.

D is incorrect. This would be ideal but not always possible.

Section: Quantitative Analysis

Reference: Global Association of Risk Professionals. Quantitative Analysis. New York, NY: Pearson, 2022. Chapter 13. Simulation and Bootstrapping.

Learning Objective: Describe the bootstrapping method and its advantage over Monte Carlo simulation.

30. A risk analyst is assessing the correlation between the returns of two financial assets. The analyst wants to determine if the two sets of returns are dependent. Which of the following is correct regarding correlation and dependence?

A. Returns on financial assets tend to be independent.
B. Pearson's correlation measures both linear and nonlinear dependence.
C. Correlation and the regression slope are closely related.
D. If the returns of the two assets are normally distributed, their rank correlation and Pearson's correlation would not be equal.

Correct Answer: C

Explanation: C is correct. Correlation and the slope of the regression are intimately related, as regression explains the sense in which correlation measures linear dependence.

A is incorrect. Financial assets are highly dependent and exhibit both linear and nonlinear dependence.

B is incorrect. Pearson's correlation only measures linear dependence.

D is incorrect. The rank correlation is virtually identical to the Pearson's (also known as linear) correlation for normal random variables.

Section: Quantitative Analysis

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 12. Measuring Returns, Volatility, and Correlation.

Learning Objective: Define correlation and covariance and differentiate between correlation and dependence.

31. A quantitative analyst at a foreign exchange (FX) trading company is developing a new factor model to be used for estimating potential risk exposures on FX trades. The analyst is evaluating potential factors to use in the model, and their effects on the performance of the model. Which of the following statements is most likely correct for the analyst to consider when developing the model?

A. Using a large number of underlying factors will allow the model to correctly predict future exchange rates.
B. The most important factor in predicting a country's interest rates is the political stability of the country.
C. The pair-wise exchange rates for currencies of developed countries can be assumed to be constant for terms shorter than 3 months.
D. The value of a country's currency will be negatively correlated with a factor representing changes in that country's money supply.

Correct Answer: D

Explanation: D is correct. As described on p. 116, "If Country A increases its money supply by 25% while Country B keeps its money supply unchanged, the value of Country A's currency will tend to decline by 25% relative to Country B's currency."

A is incorrect. Future exchange rates cannot be predicted with any precision (p. 115).

B is incorrect. While political instability would weaken a currency, supply and demand are the most important factors.

C is incorrect. Exchange rates should be assumed to change even in short-term time horizons.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 9. Foreign Exchange Markets.

Learning Objective: Identify and explain the factors that determine exchange rates.

32. A portfolio manager holds USD 88 million face value of zero-coupon bonds maturing in 5 years and yielding 4%. The portfolio manager expects that interest rates will increase. To hedge the exposure, the portfolio manager wants to sell part of the 5-year bond position and use the proceeds from the sale to purchase zero-coupon bonds maturing in 1.5 years and yielding 3%. Assuming continuous compounding, what is the market value of the 1.5-year bonds that the portfolio manager should purchase to reduce the duration on the combined position to 3 years?

A. USD 31.00 million
B. USD 37.72 million
C. USD 41.17 million
D. USD 50.28 million

Correct Answer: C

Explanation: C is correct. In order to find the proper amount, we first need to calculate the current market value of the portfolio (P).

Assuming continuous compounding, the current value of the portfolio is:

$P = 88 * e^{-0.04*5}$ = USD 72.05 million

The desired portfolio duration (after the sale of the 5-year bond and purchase of the 1.5-year bond) can be expressed as follows, where W is the weight of the 1.5-year maturity bond and (1 – W) is the weight of the 5-year maturity zero-coupon bond. Thus, the weighted duration of the new bond portfolio should be equal to 3 years:

$$1.5*W + 5*(1 – W) = 3$$

which gives W = 0.5714 and (1 – W) = 0.4286. Therefore, the value of the 1.5-year maturity bond = 0.5714*72.05 = USD 41.17 million.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 16. Properties of Interest Rates.

Learning Objective: Calculate the change in a bond's price given its duration, its convexity, and a change in interest rates.

33. A 15-month futures contract on an equity index is currently trading at USD 3,759.52. The underlying equity index is currently valued at USD 3,625 and has a continuously compounded dividend yield of 2% per year. The continuously compounded risk-free rate is 5% per year. Assuming no transactions costs, what is the appropriate strategy to earn potential arbitrage profit?

A. Buy the futures contract and buy the underlying.
B. Buy the futures contract and sell the underlying.
C. Sell the futures contract and buy the underlying.
D. Sell the futures contract and sell the underlying.

Correct Answer: B

Explanation: B is correct. This is an example of index arbitrage. Arbitrage exists if the parity condition between the equity index price and the price of the futures contract underlying the index does not hold. The parity relationship is expressed by the theoretical value of the futures price:

$$(F_{0,t}) = S_0 * e^{(\text{risk-free rate} - \text{dividend yield}) * t}$$

where S_0 equals the current spot price of the index (USD 3,625) and t equals the time in years (= 15/12 = 1.25). Therefore,

$$\text{Theoretical futures price} = S_0 * e^{[(\text{risk free rate} - \text{dividend yield}) * 1.25]} = \text{USD } 3{,}763.52$$

Since this theoretical (computed) futures price (value) is different from the current futures contract price, a potential arbitrage situation exists. Since the current futures price (USD 3,625) is lower than the theoretical futures price (USD 3,763.52) in this case, one can short the higher priced stocks underlying the equity index (or short the index) and buy the index futures contract at the current price.

A, C, and D are incorrect per the explanation for B above.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 10. Pricing Financial Forwards and Futures.

Learning Objective: Calculate the forward price given the underlying asset's spot price and describe an arbitrage argument between spot and forward prices.

34. Savers Bancorp entered into a 2-year interest rate swap on August 9, 2014, in which it received a 4.00% fixed rate and paid LIBOR plus 1.20% on a notional amount of USD 6.5 million. Payments were to be made every 6 months. The table below displays the actual annual 6-month LIBOR rates over the 2-year period:

Date	6-month LIBOR
Aug 9, 2014	3.11%
Feb 9, 2015	1.76%
Aug 9, 2015	0.84%
Feb 9, 2016	0.39%
Aug 9, 2016	0.58%

Assuming no default, how much did Savers Bancorp receive on August 9, 2016?

A. USD 72,150
B. USD 78,325
C. USD 117,325
D. USD 156,650

Correct Answer: B

Explanation: B is correct. The proper interest rate to use is the 6-month LIBOR rate at February 9, 2016, since it is the 6-month LIBOR that will yield the payoff on August 9, 2016. Therefore, the net settlement amount on August 9, 2016 is as follows:

Savers Bancorp receives: USD 6,500,000 * 4.00% * 0.5, or USD 130,000

Savers Bancorp pays: 6,500,000 * (0.39% + 1.20%) * 0.5, or USD 51,675.

Therefore, Savers Bancorp would receive the difference of USD 78,325.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 20. Swaps.

Learning Objective: Explain the mechanics of a plain vanilla interest rate swap and compute its cash flows.

35. A commodity trader observes that the 6-month forward price of commodity X is USD 1,000. The trader also notes that there is a 6-month zero-coupon risk-free bond with face value USD 1,000 that trades in the secondary fixed-income market. Which of the following strategies creates a synthetic long position in commodity X for a period of 6 months?

A. Buy the forward contract and buy the zero-coupon bond.
B. Buy the forward contract and short the zero-coupon bond.
C. Short the forward contract and buy the zero-coupon bond.
D. Short the forward contract and short the zero-coupon bond.

Correct Answer: A

Explanation: A is correct. A synthetic commodity position for a period of T years can be constructed by entering into a long futures contract with T years to expiration and buying a zero-coupon bond expiring in T years with a face value of the present value of the futures price. The payoff function at time T is as follows:

Payoff from long futures position = $S_T - F_{0,T}$, where S_T is the spot price of the commodity at time T and $F_{0,T}$ is the current futures price.

Payoff from zero coupon bond = $F_{0,T}$

Hence, the total payoff function equals $(S_T - F_{0,T}) + F_{0,T}$ or S_T. This creates a synthetic commodity position.

B, C, and D are incorrect per the explanation for A above.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 11. Commodity Forwards and Futures.

Learning Objective: Explain how to create a synthetic commodity position and use it to explain the relationship between the forward price and the expected future spot price.

36. Bank A and Bank B are two competing investment banks. The banks are calculating the 1-day 99% VaR for a long position in an at-the-money call option on a non-dividend-paying stock with the following information:

- Current stock price: USD 120
- Estimated annual stock return volatility: 18%
- Current Black-Scholes-Merton call option value: USD 5.20
- Call option delta: 0.6

To compute VaR, Bank A uses the delta-normal model, while Bank B uses a Monte Carlo simulation method for full revaluation. Which bank will estimate a higher value for the 1-day 99% VaR?

A. Bank A
B. Bank B
C. Both banks will have the same VaR estimate
D. Insufficient information to determine

Correct Answer: A

Explanation: A is correct. The option's price function is convex with respect to the value of the underlying. However, for such a non-linear portfolio, the delta-normal model provides only a linear approximation which does not capture the positive effect of this curvature on the portfolio value. Therefore, the delta-normal model will overstate the probability of low option values, and the VaR will always be higher under the delta-normal model than a full revaluation conducted by Monte Carlo simulation analysis.

B, C, and D are incorrect per the explanation for A above.

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 2. Calculating and Applying VaR.

Learning Objective: Describe the delta-normal approach and use it to calculate VaR for non-linear derivatives.

Explain the structured Monte Carlo method for computing VaR and identify its strengths and weaknesses.

37. A trader on the derivatives trading desk of an investment bank holds a portfolio of short option positions. The trader limits the risk of these exposures by maintaining a delta hedging strategy. In evaluating the dynamic nature of this strategy, which of the following is correct about the interest cost of carrying the delta hedge?

A. The cost will be highest when the options are deep out-of-the-money.
B. The cost will be highest when the options are deep in-the-money.
C. The cost will be highest when the options are at-the-money.
D. The cost will be lowest when the options are at-the-money.

Correct Answer: B

Explanation: B is correct. The deeper the options are in-the-money, the larger their deltas and therefore the more expensive to delta hedge.

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 16. Option Sensitivity Measures: The “Greeks”.

Learning Objective: Describe the dynamic aspects of delta hedging and distinguish between dynamic hedging and hedge-and-forget strategy.

38. A junior analyst at a banking supervisory agency is taking an internal training class on the Vasicek model. The analyst reviews the following equations related to the model:

$$U_i = aF + \sqrt{1 - a^2 Z_i}$$

$$Default\ rate\ as\ a\ function\ of\ F = N\left(\frac{N^{-1}(PD) - aF}{\sqrt{1 - a^2}}\right)$$

Which of the following statements regarding the Vasicek model is correct?

A. The default probabilities of the individual loans in a portfolio are each mapped to the standard normal distribution U_i, of which values in the extreme right tail represent default.
B. A low value of the factor *F* indicates that the economy is strong, while a high value of *F* represents economic weakness.
C. For corporate borrowers, the value of the factor *F* is higher for loans to companies with more cyclical businesses.
D. The model coefficient *a* directly relates to the correlations between the default probability distributions U_i of the loans in the portfolio.

Correct Answer: D

Explanation: D is correct. The correlation between each pair of U_i distributions is equal to a^2.

A is incorrect. The default probabilities are each mapped to the standard normally distributed variable U_i, however, values in the extreme left tail represent default. As such, low values of *F* or Z_i correspond with a higher likelihood of default.

B is incorrect. High values of *F* indicate a strong economy, and low values of *F* indicate a weak economy. As such, low values of *F* correspond with a higher likelihood of default.

C is incorrect. *F* is a common factor and is equal for all loans in the portfolio.

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 6. Measuring Credit Risk.

Learning Objective: Describe and apply the Vasicek model to estimate default rate and credit risk capital for a bank.

39. A team of risk analysts is conducting an independent review of a recent stress test. As part of this process, the team evaluates the stress testing models used as well as the supporting assumptions in the models. Which of the following, if found in the review, should the analysts identify as the greatest deficiency relating to the models or their assumptions?

A. Relationships between core and peripheral variables in the model are found by regressing their past behavior during stressed market conditions only.
B. Credit risk losses are modeled by mapping historical default rate data provided by credit rating agencies to estimates of gross domestic product.
C. The stress test does not account for the likely responses of other financial institutions to changes in the core variables of the test.
D. A scenario used in the stress test was developed using reverse stress testing.

Correct Answer: C

Explanation: C is correct. In addition to a scenario's immediate impacts, analysts should consider its knock-on effects, or the impacts of how firms (particularly other financial institutions) respond to the scenario.

A is incorrect. When using regression to determine how peripheral variables respond to changes in a scenario's core variables, it is important to recognize that the focus is on the relationship between variables in stressed market conditions rather than normal market conditions.

B is incorrect. This is an appropriate method for modeling credit risk losses in a stress test.

D is incorrect. Reverse stress testing can be an input to the work of a stress testing committee in selecting scenarios for investigation.

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 8. Stress Testing.

Learning Objective: Explain key considerations and challenges related to stress testing, including choice of scenarios, regulatory specifications, model building, and reverse stress testing.

40. A fixed-income portfolio manager currently holds a bullet 7-year US Treasury position with USD 60 million face value. The manager would like to create a cost matching barbell portfolio by purchasing a combination of a 2-year Treasury and a 15-year Treasury that would have the same duration as the 7-year US Treasury position. The data for the three US Treasuries are listed below:

Maturity	Price	Duration
2 years	100.972	1.938
7 years	106.443	6.272
15 years	122.175	11.687

Which of the following combinations correctly describes the weights of the two bonds that the manager will use to construct the barbell portfolio?

	Weight of 2-Year Treasury	Weight of 15-Year Treasury
A.	14.22%	85.78%
B.	44.46%	55.54%
C.	55.54%	44.46%
D.	85.78%	14.22%

Correct Answer: C

Explanation: C is correct. To construct a barbell portfolio with the same cost and same duration as the bullet:

$$\text{Cost of bullet} = (106.443/100)*\text{USD } 60{,}000{,}000 = \text{USD } 63{,}865{,}800$$

If V_2 and V_{15} are values (costs) of the 2-Year and 15-Year Treasuries, respectively, then,

$$V_2 + V_{15} = \text{USD } 63{,}865{,}800 \quad \ldots\ldots (1)$$

Therefore, to match duration:

Duration of bullet = weighted-average duration of 2-year and 15-year Treasuries

$$6.272 = (V_2/63{,}865{,}800)*1.938 + (V_{15}/63{,}865{,}800)*11.687 \quad \ldots\ldots (2)$$

From Equation (1), $V_2 = 63{,}865{,}800 - V_{15}$.

Then, Equation (2) becomes:

$$6.272 = [(63{,}865{,}800 - V_{15})/63{,}865{,}800)]*1.938 + (V_{15}/63{,}865{,}800)*11.687$$

$$400{,}566{,}297.6 = 123{,}771{,}920.4 - 1.938V_{15} + 11.687V_{15}$$

$$276{,}794{,}377.2 = 9.749V_{15}$$

And so, $V_{15} = \text{USD } 28{,}392{,}078.90$

And so, $V_2 = 63{,}865{,}800 - V_{15} = 63{,}865{,}800 - 28{,}392{,}078.90 = \text{USD } 35{,}473{,}721.10$

Giving weight of 2-Year Treasury

= 35,473,721.10/63,865,800 = 55.54%

And weight of 15-year Treasury

= 28,392,078.90/63,865,800 = 44.46%

A is incorrect. It incorrectly calculates the weights based on duration as: weight of 2-Year T = 1.938/(1.938 + 11.687) = 14.22%; and weight of 15-year T = 1 – 0.1422 = 85.78%.

B is incorrect. It switches the weights derived in C above.

D is incorrect. It switches the weights explained in A above.

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 12. Applying Duration, Convexity, and DV01.

Learning Objective: Construct a barbell portfolio to match the cost and duration of a given bullet investment and explain the advantages and disadvantages of bullet versus barbell portfolios.

41. A junior risk analyst is modeling the volatility of a certain market variable. The analyst considers using either the EWMA or the GARCH (1,1) model. Which of the following statements is correct?

A. The EWMA model is a special case of the GARCH (1,1) model with the additional assumption that the long-run volatility is zero.
B. A variance estimated from the GARCH (1,1) model is a weighted average of the prior day's estimated variance and the prior day's squared return.
C. The GARCH (1,1) model assigns a higher weight to the prior day's estimated variance than the EWMA model.
D. A variance estimated from the EWMA model is a weighted average of the prior day's estimated variance and the prior day's squared return.

Correct Answer: D

Explanation: D is correct. The EWMA estimate of variance is a weighted average of the variance rate estimated for the prior day and the prior day's observed squared return.

A is incorrect. EWMA is a particular case of GARCH (1,1) with the weight assigned to the long-run average variance rate as zero and the sum of the weights of the other two parameters equal to 1.

B is incorrect because there is also weight assigned to the long-run average variance rate.

C is incorrect because such a comparison can only be done under specific parameter configurations.

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 3. Measuring and Monitoring Volatility.

Learning Objective: Compare and contrast different approaches for estimating conditional volatility.

42. A risk manager is estimating the sensitivity of a stock's return to the return on the S&P 500 Index. The manager performs this task using an ordinary least squares (OLS) regression. Which of the following descriptions of the OLS procedure is correct?

A. OLS minimizes the square of the sum of differences between the actual and estimated S&P 500 Index returns.
B. OLS minimizes the square of the sum of differences between the actual and estimated stock returns.
C. OLS minimizes the sum of differences between the actual and estimated squared S&P 500 Index returns.
D. OLS minimizes the sum of squared differences between the actual and estimated stock returns.

Correct Answer: D

Explanation: D is correct. The OLS procedure is a method for estimating the unknown parameters in a linear regression model. The method minimizes the sum of squared differences between the actual, observed, returns and the returns estimated by the linear approximation. The smaller the sum of the squared differences between observed and estimated values, the better the estimated regression line fits the observed data points.

A, B, and C are incorrect. None of these is the approach used for OLS estimators. Each of these approaches (regardless of which of the given variables is explanatory and which is dependent) would allow positive and negative differences to cancel each other out.

Section: Quantitative Analysis

Reference: Global Association of Risk Professionals. Quantitative Analysis. New York, NY: Pearson, 2022. Chapter 7. Linear Regression.

Learning Objective: Interpret the results of an ordinary least squares (OLS) regression with a single explanatory variable.

43. A market risk analyst is projecting a range of returns on stock XYZ for the next month. Using the returns of the prior 12 months, the analyst estimates the mean monthly return of the stock to be -0.75% with a standard error of 2.70%.

One-tailed t-distribution table			
Degrees of freedom	**α**		
	0.100	**0.050**	**0.025**
8	1.397	1.860	2.306
9	1.383	1.833	2.262
10	1.372	1.812	2.228
11	1.363	1.796	2.201
12	1.356	1.782	2.179

Using the t-table above, which of the following is the 95% confidence interval for the mean return of stock XYZ?

A. -6.69% and 5.19%
B. -6.63% and 5.13%
C. -5.60% and 4.10%
D. -5.56% and 4.06%

Correct Answer: A

Explanation: A is correct. The confidence interval is equal to the mean monthly return plus or minus the t-statistic times the standard error. To get the proper t-statistic, the 0.025 column must be used since this is a two-tailed interval. Since the mean return is being estimated using the sample observations, the appropriate degrees of freedom to use is equal to the number of sample observations minus 1, which is 11. Therefore, the proper statistic to use from the t-distribution is 2.201. The 95% confidence interval is between -0.75% - 2.201*2.70% and -0.75% + 2.201*2.70%.

B is incorrect. This uses the value of the t-statistic of 2.179 from the table given above.

C is incorrect. This uses the value of the t-statistic of 1.796 from the table given above.

D is incorrect. This uses the value of the t-statistic of 1.782 from the table given above.

Section: Quantitative Analysis

Reference: Global Association of Risk Professionals. Quantitative Analysis. New York, NY: Pearson, 2022. Chapter 6. Hypothesis Testing.

Learning Objective: Construct and apply confidence intervals for one-sided and two-sided hypothesis tests, and interpret the results of hypothesis tests with a specific confidence level.

44. A financial analyst is concerned about the market risk of a stock. Based on the stock's return data of the most recent 12 months, it has been estimated that the historical volatility of the monthly returns is 4.5%. Which of the following is most likely correct?

A. The implied volatility of the annual returns is 15.6%.
B. The implied volatility of the annual returns is 54.0%.
C. The volatility of the annual returns is 15.6%.
D. The volatility of the annual returns is 54.0%.

Correct Answer: C

Explanation: C is correct.

This is $\sqrt{12} * 0.045 = 0.156$.

A and B are incorrect. The implied volatility depends on the option price and it does not depend on the historical volatilities.

D is incorrect. This incorrectly scales the volatility linearly with time instead of by the square root of time, giving $12 * 0.045 = 0.54$.

Section: Quantitative Analysis

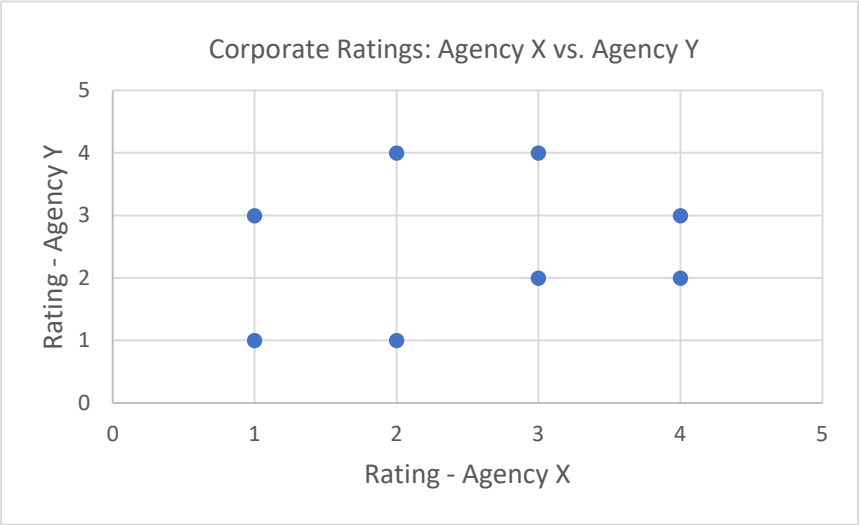
Reference: Global Association of Risk Professionals. Quantitative Analysis. New York, NY: Pearson, 2022. Chapter 12. Measuring Returns, Volatility, and Correlation.

Learning Objective: Define and distinguish between volatility, variance rate, and implied volatility.

45. A credit risk manager is in charge of credit risk analysis of large corporates at Bank XYZ. The manager is in possession of credit ratings provided by two rating agencies, X and Y, for 30 companies the manager oversees. The ratings are classified into four categories:

Rating categories	Description
1	High investment grade
2	Mid investment grade
3	Low investment grade
4	Non-investment grade

The manager plots the rating categories from the two agencies as shown below:



Which of the following statistical measures could best help the manager approximate the link between rating categories from the two agencies?

A. Spearman correlation
B. Pearson correlation
C. Structured correlation matrix
D. Covariance

Correct Answer: A

Explanation: A is correct. The credit ratings in this question are ordinal data and have a nonlinear relationship as showed in the graph. Hence, the Spearman correlation is the best of the given measures to indicate if one variable is monotonically related to the other variable.

B, C, and D are incorrect. Pearson correlation, correlation matrix and covariance are used to measure the degree of the relationship between linearly related variables.

Section: Quantitative Analysis

Reference: Global Association of Risk Professionals. Quantitative Analysis. New York, NY: Pearson, 2022. Chapter 4. Multivariate Random Variables.

Global Association of Risk Professionals. Quantitative Analysis. New York, NY: Pearson, 2022. Chapter 12. Measuring Returns, Volatility, and Correlation.

Learning Objective: Explain the relationship between the covariance and correlation of two random variables and how these are related to the independence of the two variables.

Define correlation and covariance and differentiate between correlation and dependence.

46. An analyst is evaluating a dataset of annual returns for a financial asset. The analyst decides to use the Jarque-Bera test to determine if the returns of the asset are normally distributed. Which of the following is correct regarding the Jarque-Bera test?

A. The Jarque-Bera test statistic follows a Student's t distribution.
B. The Jarque-Bera test only takes into account the skewness and kurtosis of a distribution.
C. The Jarque-Bera test requires that a Gaussian copula be applied to the returns data before conducting the test.
D. The Jarque-Bera test statistic does not depend on the sample size of the returns dataset.

Correct Answer: B

Explanation: B is correct. The Jarque-Bera test statistic is used to formally test whether the sample skewness and kurtosis are compatible with an assumption that the returns are normally distributed.

A is incorrect. The Jarque-Bera test assumes a normal distribution.

C is incorrect. There is no need for a Gaussian copula to be applied prior to testing.

D is incorrect. The test statistic is also a function of the sample size.

Section: Quantitative Analysis

Reference: Global Association of Risk Professionals. Quantitative Analysis. New York, NY: Pearson, 2022. Chapter 12. Measuring Returns, Volatility, and Correlation.

Learning Objective: Explain how the Jarque-Bera test is used to determine whether returns are normally distributed.

47. An analyst is conducting a Monte Carlo simulation to estimate the expected value of a random variable. The analyst wants to reduce the standard error of the simulated expectation. Which of the following correctly describes a method for reducing the standard error?

A. Increasing the expected value of the simulation
B. Increasing the number of replications
C. Increasing the variance of the distribution
D. Increasing the confidence level of the simulation

Correct Answer: B

Explanation: B is correct. One way to increase the accuracy of estimation from Monte Carlo simulation is to increase the number of replications.

A is incorrect. Increasing the expected value does not affect the accuracy of the simulation.

C is incorrect. Increasing the variance does not improve accuracy of the simulation; the opposite effect occurs.

D is incorrect. Increasing the confidence level only provides a wider range of values but does not improve accuracy.

Section: Quantitative Analysis

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 13. Simulation and Bootstrapping.

Learning Objective: Describe ways to reduce Monte Carlo sampling error.

48. An investment advisor is analyzing the range of potential expected returns of a new fund designed to replicate the directional moves of the China Shanghai Composite Stock Market Index (SHANGHAI) but with twice the volatility of the index. SHANGHAI has an expected annual return of 7.6% and a volatility of 14.0%, and the risk-free rate is 3.0% per year. Assuming the correlation between the fund's returns and that of the index is 1.0, what is the expected return of the fund using the CAPM?

A. 12.2%
B. 19.0%
C. 22.1%
D. 24.6%

Correct Answer: A

Explanation: A is correct. If the CAPM holds, then $R_i = R_f + \beta_i * (R_m - R_f)$.

Beta (β_i), which determines how much the return of the fund fluctuates in relation to the index return is expressed as follows:

$$\beta_i = \frac{\text{Cov}(R_i, R_m)}{\sigma_m^2} = \frac{\text{Corr}(R_i, R_m) * \sigma_i \sigma_m}{\sigma_m^2} = \frac{\text{Corr}(R_i, R_m) * \sigma_i}{\sigma_m}$$

Where *i* and *m* denote the new fund and the index, respectively, and R_i = expected return on the fund, R_m = expected return on the index, R_f = risk-free rate, σ_i = volatility of the fund, σ_m = volatility of the index, $\text{Cov}(R_i,R_m)$ = covariance between the fund and the index returns, and $\text{Corr}(R_i,R_m)$ = correlation between the fund and the index returns.

If the new fund has twice the volatility of the index, then $\sigma_i = 2\sigma_i = 2\sigma_m$, and given that $\text{Corr}(R_i,R_m) = 1.0$, the beta of the new fund then becomes:

$$\beta_i = \frac{\text{Corr}(R_i, R_m) * 2\sigma_m}{\sigma_m} = 1.0 * 2.0 = 2.0$$

Therefore, using CAPM, $R_i = R_f + \beta_i * (R_m - R_f) = 0.03 + 2.0*(0.076 - 0.03)$
$= 0.1220 = 12.2\%$.

Section: Foundations of Risk Management

Reference: Global Association of Risk Professionals. Foundations of Risk Management. New York, NY: Pearson, 2022. Chapter 5. Modern Portfolio Theory (MPT) and the Capital Asset Pricing Model (CAPM).

Learning Objective: Apply the CAPM in calculating the expected return on an asset.

49. The board of directors of a growing asset management company is conducting a review of the firm's approach to risk management. The board concludes that the firm should establish an ERM framework. Which of the following represents a key benefit that the firm will likely attain after establishing an ERM framework?

A. Allowing the company to determine and make use of a higher risk appetite
B. Finding the optimal reporting methodology for each risk function
C. Improving the top-down communication and coordination in the company
D. Taking advantage of the new opportunities that create value on a standalone basis

Correct Answer: C

Explanation: C is correct. Implementation of ERM requires integration. Appointing a CRO and establishing a centralized, integrated risk management team can better address the interdependencies among individual risks faced by the company and thus increase efficiency.

A is incorrect because ERM does not necessarily allow the company to determine and make use of a higher risk appetite.

B is incorrect because ERM suggests the opposite of a fragmented approach in risk management.

D is incorrect because ERM improves business performance by taking a portfolio view of all risks rather than on a standalone basis.

Section: Foundations of Risk Management

Reference: Global Association of Risk Professionals. Foundations of Risk Management. New York, NY: Pearson, 2022. Chapter 8. Enterprise Risk Management and Future Trends.

Learning Objective: Describe the motivations for a firm to adopt an ERM initiative.

50. A risk analyst is estimating the variance of returns on a stock index for the next trading day. The analyst uses the following GARCH (1,1) model:

$$\sigma_n^2 = \alpha r_{n-1}^2 + \beta \sigma_{n-1}^2 + \gamma V_L,$$

where σ_n^2, r_{n-1}, and σ_{n-1} represent the index variance on day n, return on day n-1, and volatility on day n-1, respectively. If the expected value of the return is constant over time, which combination of values for α and β would result in a stable GARCH (1,1) process?

A. α = 0.073637 and β = 0.927363
B. α = 0.075637 and β = 0.923363
C. α = 0.084637 and β = 0.916363
D. α = 0.086637 and β = 0.914363

Correct Answer: B

Explanation: B is correct. For a GARCH (1,1) process to be stable, the parameters α, β, and γ must be positive and sum to 1. Therefore, the sum of α and β needs to be less than 1.

A, C, and D are incorrect. In each of these cases, the sum of α and β is greater than 1.

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 3. Measuring and Monitoring Volatility.

Learning Objective: Apply the GARCH (1,1) model to estimate volatility.

51. An analyst wants to price a 1-year, European-style call option on company CZC's stock using the Black-Scholes-Merton (BSM) model. CZC announces that it will pay a dividend of USD 0.50 per share on an ex-dividend date 1 month from now and has no further dividend payout plans for at least 1 year. The relevant information for the BSM model inputs is in the following table:

Current stock price	USD 40
Stock price volatility	16% per year
Risk-free rate	3% per year
Call option exercise price	USD 40
$N(d_1)$	0.5750
$N(d_2)$	0.5116

What is the price of the 1-year call option on the stock?

A. USD 1.52
B. USD 1.78
C. USD 1.95
D. USD 2.85

Correct Answer: D

Explanation: D is correct. The value of a European call is equal to:

$$S_0*N(d_1) - K*e^{-rT}*N(d_2)$$

where S_0 is the current price of the stock. In the case that dividends are introduced, S_0 in the formula is reduced by the present value of the dividends.

The present value of the dividends = 0.5 * exp(-3%/12) = 0.4988. Thus,

$$S_0 = 40 - 0.4988 = 39.5012$$

$$\text{Call option price} = S_0*N(d_1) - K*e^{-rT}*N(d_2)$$

$$= 39.5012*0.5750 - 40*e^{-0.03*1}*0.5116 = 22.7132 - 19.8592 = \text{USD } 2.8540$$

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 15. The Black-Scholes-Merton Model.

Learning Objective: Compute the value of a European option using the Black-Scholes-Merton model on a dividend-paying stock, futures, and exchange rates.

52. The treasurer of a London-based insurance company expects that 3 years from today the company will receive GBP 800,000. The treasurer plans to invest the funds for 1 year after that and decides to lock in a rate of return on the funds at today's forward rate for the period. The current 3-year and 4-year spot rates are 1.5% and 2% respectively, and the company can borrow and lend at these rates. Assuming continuous compounding, how much interest income will the company earn in the 1-year period beginning 3 years from today, and what transactions should the treasurer enter into today in order to lock in this return?

A. Borrow at the 3-year spot rate and lend at the 4-year spot rate to earn a return of GBP 28,000.
B. Lend at the 3-year spot rate and borrow at the 4-year spot rate to earn a return of GBP 28,000.
C. Borrow at the 3-year spot rate and lend at the 4-year spot rate to earn a return of GBP 28,119.
D. Lend at the 3-year spot rate and borrow at the 4-year spot rate to earn a return of GBP 28,119.

Correct Answer: A

Explanation: A is correct. The forward rate for the period from the end of year 3 to the end of year 4 is:

$$F = \frac{R_2 T_2 - R_1 T_1}{T_2 - T_1}$$

$$= \frac{0.02 * 4 - 0.015 * 3}{4 - 3} = 0.035 \; or \; 3.5\%$$

(Alternatively, $F = ln\big(exp(0.02 * 4)/exp(0.015 * 3)\big)$.)

3.5% interest on the GBP 800,000 invested equals GBP 28,000 in 1 year. To earn this interest, the company would need to borrow GBP 800,000 today at 1.5% for 3 years and invest the proceeds at 2% for 4 years.

B is incorrect. The company needs to borrow at the 3-year spot rate and lend at the 4-year spot rate.

C and D are incorrect. GBP 28,119 is the interest income if annual compounding is used instead of continuous compounding.

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 10. Interest Rates.

Learning Objective: Interpret the forward rate and compute forward rates given spot rates.

53. A derivative trading firm that previously used only the Black-Scholes-Merton (BSM) model to value options has recently decided to use the binomial tree option pricing model as well. An analyst at the firm is reviewing the different features of the two models to compare and contrast their inputs and assumptions. In comparing the two models, which of the following statements is correct?

A. The BSM model uses an underlying asset's implied volatility as an input but the binomial tree approach uses its historical volatility.
B. The binomial tree approach, but not the BSM model, assumes that the expected return from the underlying asset is the risk-free rate of interest.
C. In the binomial tree approach, delta is equal at each node since the probabilities of the price moving up or down during a period are constant and equal for both the underlying asset and the option.
D. If the assumptions of the BSM model hold, the implied volatility of a longer-term option and the implied volatility of a shorter-term option on the same underlying asset will be the same.

Correct Answer: D

Explanation: D is correct. If all the BSM model assumptions hold, then all options on the same underlying asset will have the same implied volatility at all times.

A is incorrect. Both the BSM model and the binomial tree approach use asset volatility computed from historical prices.

B is incorrect. Both the BSM model and the binomial tree approach use the risk-neutral valuation, that is, assume that the expected return from the underlying asset is the risk-free rate of interest.

C is incorrect. In the binomial tree approach, delta does not remain constant at every node (through time) even though the approach takes the probability of the price moving up and the probability of the price moving down not to change during a given period.

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 14. Binomial Trees

Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 15. The Black-Scholes-Merton Model.

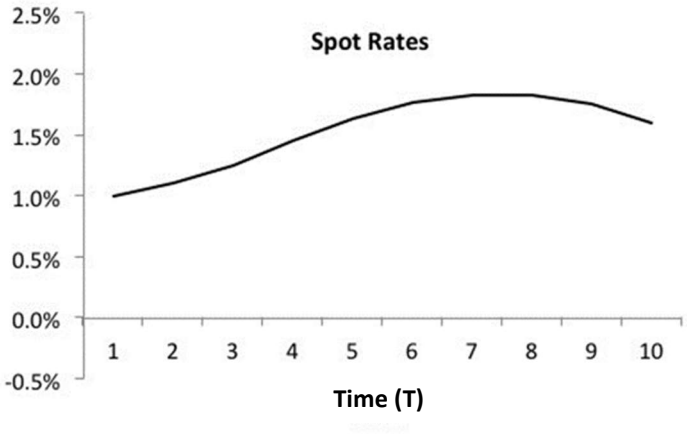
Learning Objective: Calculate the value of an American and a European call or put option using a one-step and two-step binomial model.

Describe the assumptions underlying the Black-Scholes-Merton option pricing model.

Define and calculate delta of a stock option.

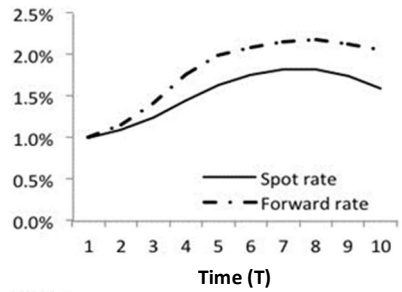
Define implied volatilities and describe how to compute implied volatilities from market prices of options using the Black-Scholes-Merton model.

54. An analyst for a fixed-income investment fund is constructing the risk-free forward rate curve. The analyst observes the following term structure of risk-free spot rates:

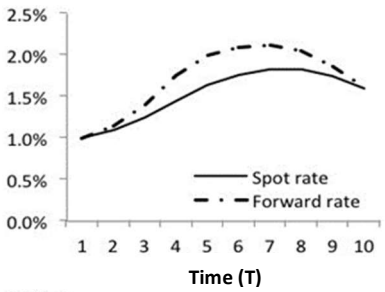


Which of the charts below presents the correctly derived curve for the 1-year forward rate beginning at time T?

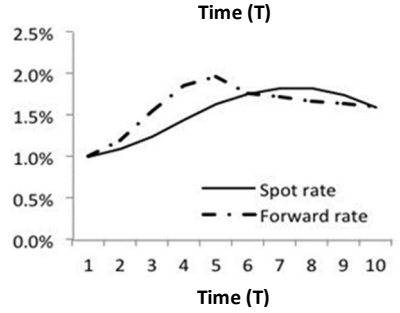
A.



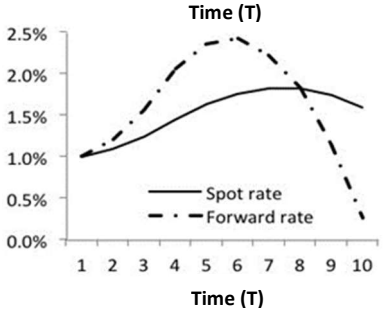
B.



C.



D.



Correct Answer: D

Explanation: D is correct. Where the term structure of spot rates is upward(downward)-sloping, forward rates for a period starting at time T are greater(less) than the spot rate for maturity T. Therefore, the forward curve will be above the spot curve when the spot curve is rising and below the spot curve when the spot curve is declining. The only chart that reflects these conditions is choice D.

A, B, and C are incorrect per the explanation for D above.

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 10. Interest Rates.

Learning Objective: Interpret the forward rate and compute forward rates given spot rates.

55. A hedge fund manager who holds a portfolio of interest rate-sensitive positions has just received an economist's report forecasting a significant shift in interest rates. Accordingly, the manager wants to change the fund's interest rate exposure by investing in fixed-income securities with negative duration. Which of the following positions should the fund manager take?

A. A long position in a callable corporate bond
B. A long position in a putable corporate bond
C. An interest rate swap paying fixed and receiving LIBOR plus a spread
D. An interest rate swap paying LIBOR plus a spread and receiving fixed

Correct Answer: C

Explanation: C is correct. In order to change the interest rate exposure by taking a position with negative duration, the manager will need to invest in securities that decrease in value as interest rates fall (and increase in value as interest rates rise). An interest rate swap paying fixed and receiving LIBOR plus a spread will increase in value as interest rates rise.

A is incorrect. Although the call feature of a callable bond decreases the bond's duration in comparison to an otherwise identical option-free bond, the overall duration of the bond remains positive.

B is incorrect. Similarly to a callable bond, the duration of a putable bond remains positive despite being lower than that of an otherwise identical option-free bond .

D is incorrect. An interest rate swap paying LIBOR plus a spread and receiving fixed will decrease in value as interest rates rise.

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 12. Applying Duration, Convexity, and DV01.

Learning Objective: Define, compute, and interpret the effective duration of a fixed income security given a change in yield and the resulting change in price.

56. A junior credit risk analyst at a US firm is preparing a research report on the attributes and performance of corporate bonds. The analyst assesses corporate bond default rates, credit spread risk, recovery rates, and their impact on portfolio returns for a typical class of investment grade bonds. Which of the following statements would the analyst be correct to include in the report?

A. The distribution of recovery rates of corporate issues is best described as a binomial distribution.
B. The size of a bond issuance is not empirically related to its recovery rates.
C. Measured over the same time period, US Treasury securities always outperform a portfolio of corporate bonds that experiences defaults.
D. Spread duration is best measured by the change in the corporate bond yield for a given 100 bp change in the Treasury rate.

Correct Answer: B

Explanation: B is correct. Recovery rates are not related to bond issuance size.

A is incorrect. The empirical distribution of recovery rates is bimodal, and not binomial, normal or lognormal.

C is incorrect. It is possible for a corporate bond that experiences defaults to outperform US Treasury securities.

D is incorrect. While measuring a corporate's credit-spread risk, the Treasury rate (risk-free rate) is held unchanged. One of the measures of credit-spread risk is "spread duration," which is the approximate percentage change in a bond's price for a 100 bp change in the credit-spread assuming that the Treasury rate is unchanged.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 17. Corporate Bonds.

Learning Objective: Differentiate between credit default risk and credit spread risk.

Define recovery rate and default rate, and differentiate between an issue default rate and a dollar default rate.

57. A fixed-income portfolio manager purchases a seasoned 5% agency MBS with a weighted average loan age of 60 months. The current balance on the loans at the beginning of this month is USD 32 million, and the conditional prepayment rate is assumed to be constant at 0.6% per year. Which of the following is closest to the expected principal prepayment this month?

A. USD 3,210
B. USD 9,600
C. USD 16,000
D. USD 16,045

Correct Answer: D

Explanation: D is correct. The conditional prepayment rate (CPR) is related to the single monthly mortality rate (SMM) as follows:

$$CPR = 1 - (1 - SMM)^{12}$$

And so,

$$SMM = 1 - (1 - CPR)^{1/12} = 1 - (1 - 0.006)^{1/12} = 0.0005014 = 0.05014\%$$

Therefore,

The expected principal prepayment is equal to the percentage of principal outstanding at the beginning of the month that is prepaid during the month = 32,000,000 * 0.0005014 = USD 16,044.80

A is incorrect. USD 3209.60 is the result of using an incorrect formula: $SMM = 1 - (1 - CPR)^{1/60}$.

B is incorrect. USD 9,600 is the outcome of computing 5% of the annual coupon payment based on the current balance = USD 32,000,000*0.006*0.05 = USD 9,600.

C is incorrect. USD 16,000 is the result of multiplying USD 32,000,000 by 0.6%/12.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 18. Mortgages and Mortgage-Backed Securities.

Learning Objective: Calculate a fixed-rate mortgage payment and its principal and interest components.

Describe the mortgage prepayment option and factors that affect it; explain prepayment modeling and its four components: refinancing, turnover, defaults, and curtailments.

58. An operational risk analyst is attempting to estimate a bank's loss severity distribution. However, there is a limited amount of historical data on operational risk losses. Which of the following is the best way to address this issue?

A. Generate additional data using Monte Carlo simulation and merge it with the bank's internal historical data.
B. Estimate the parameters of a Poisson distribution to model the loss severity of operational losses.
C. Estimate relevant probabilities using loss information that is published by credit rating agencies.
D. Merge external data from other banks with the bank's internal data after making appropriate scale adjustments.

Correct Answer: D

Explanation: D is correct. Using external data obtained from other banks is one good way to increase the data set of historical operational losses. Data from other banks need to be adjusted for size, based on the relative size of the banks' revenues, before being merged with the bank's internal data.

A is incorrect. Using distributions does not help resolve the issue of incomplete underlying data.

B is incorrect. Lognormal distributions, not Poisson distributions, are generally used for modeling loss severity. Also, using distributions does not help resolve the issue of incomplete underlying data.

C is incorrect. Credit losses are generally much better documented than operational losses inside the bank. External credit ratings publish probability of default and expected loss data that provides additional data. Operational loss is generally documented much less rigorously, and regulatory initiatives are now pushing banks to document operational loss data.

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 7. Operational Risk.

Learning Objective: Describe the common data issues that can introduce inaccuracies and biases in the estimation of loss frequency and severity distributions.

59. A French bank enters into a 6-month forward contract with an importer to sell GBP 60 million in 6 months at a rate of EUR 1.15 per GBP 1. If in 6 months the exchange rate is EUR 1.13 per GBP 1, what is the payoff for the bank from the forward contract?

A. EUR -2,000,000
B. EUR -1,200,000
C. EUR 1,200,000
D. EUR 2,000,000

Correct Answer: C

Explanation: C is correct. The value of the contract for the bank at expiration:
GBP 60,000,000 * 1.15 EUR/GBP = EUR 69,000,000. The cost to close out the contract for the bank at expiration: GBP 60,000,000 * 1.13 EUR/GBP = EUR 67,800,000.

Therefore, the final payoff in EUR to the bank = 69,000,000 – 67,800,000
= EUR 1,200,000, which can also be calculated as: 60,000,000 * (1.15 – 1.13)
= EUR 1,200,000.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 4. Introduction to Derivatives.

Learning Objective: Calculate and compare the payoffs from hedging strategies involving forward contracts and options.

60. An oil driller recently issued USD 250 million of fixed-rate debt at 4.0% per year to help fund a new project. It now wants to convert this debt to a floating-rate obligation using a swap. A swap desk analyst for a large investment bank that is a market maker in swaps has identified four firms interested in swapping their debt from floating-rate to fixed-rate. The following table quotes available loan rates for the oil driller and each firm:

Firm	Fixed rate (in %)	Floating rate (in %)
Oil driller	4.0	6-month LIBOR + 1.5
Firm A	3.5	6-month LIBOR + 1.0
Firm B	6.0	6-month LIBOR + 3.0
Firm C	5.5	6-month LIBOR + 2.0
Firm D	4.5	6-month LIBOR + 2.5

A swap between the oil driller and which firm offers the greatest possible combined benefit?

A. Firm A
B. Firm B
C. Firm C
D. Firm D

Correct Answer: C

Explanation: C is correct. Since the oil driller is swapping out of a fixed-rate and into a floating-rate, the larger the difference between the fixed spread and the floating spread, the greater the combined benefit. See table below:

Firm	Fixed-rate	Floating-rate	Fixed-spread	Floating-spread	Possible Benefit
Oil driller	4.0	1.5			
Firm A	3.5	1.0	-0.5	-0.5	0.0
Firm B	6.0	3.0	2.0	1.5	0.5
Firm C	5.5	2.0	1.5	0.5	1.0
Firm D	4.5	2.5	0.5	1.0	-0.5

A, B, and D are incorrect per the explanation of C above.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 20. Swaps.

Learning Objective: Describe the comparative advantage argument for the existence of interest rate swaps and evaluate some of the criticisms of this argument.

61. An analyst at a hedge fund is evaluating an American-style call option and an American-style put option, each with 3 months to maturity, written on a non-dividend-paying stock currently priced at USD 40. The strike price for both options is USD 35 and the risk-free rate is 1.5%. What are the lower and upper bounds on the difference between the prices of the call and put options?

Scenario	Lower bound (USD)	Upper bound (USD)
A	0.13	34.87
B	5.00	5.13
C	5.13	40.00
D	34.87	40.00

A. Scenario A
B. Scenario B
C. Scenario C
D. Scenario D

Correct Answer: B

Explanation: B is correct. The put-call parity in case of American options leads to the inequality:

$$S_0 - K \leq (C - P) \leq S_0 - Ke^{-rT}$$

The lower and upper bounds are given by:

$$= 40 - 35 \leq (C - P) \leq 40 - 35e^{-0.015 * 3/12}$$

$$= 5 \leq (C - P) \leq 5.13$$

Alternatively, the upper and lower bounds for American options are given by:

Option	Minimum Value	Maximum Value
American Call	$C \geq \max(0, S_0 - Ke^{-rT}) = 5.13$	$S_0 = 40$
American Put	$P \geq \max(0, K - S_0) = 0$	$K = 35$

Subtracting the put values from the call values in the table above, we get the same result:

$$= 5 \leq C - P \leq 5.13$$

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 13. Properties of Options.

Learning Objective: Identify and compute upper and lower bounds for option prices on non-dividend and dividend paying stocks.

Explain put-call parity and apply it to the valuation of European and American stock options, with dividends and without dividends, and express it in terms of forward prices.

62. A German housing corporation needs to hedge against rising interest rates. It has chosen to use futures on 10-year German government bonds. Which position in the futures should the corporation take, and why?

A. Take a long position in the futures because rising interest rates lead to rising futures prices.
B. Take a long position in the futures because rising interest rates lead to declining futures prices.
C. Take a short position in the futures because rising interest rates lead to rising futures prices.
D. Take a short position in the futures because rising interest rates lead to declining futures prices.

Correct Answer: D

Explanation: D is correct. Government bond futures decline in value when interest rates rise, so the housing corporation should short futures to hedge against rising interest rates.

A, B, and C are incorrect per the explanation for D above.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 8. Using Futures for Hedging.

Learning Objective: Define and differentiate between short and long hedges and identify their appropriate uses.

63. A newly hired risk analyst at a bank is studying historical cases of financial disasters to learn how financial risks can arise in practice. The analyst focuses on the example of Barings Bank, which was forced to declare bankruptcy after reporting over USD 1 billion in unauthorized trading losses by the trader Nick Leeson. Which of the following statements would the analyst be correct to make concerning the collapse of Barings Bank?

A. Leeson avoided reporting the unauthorized trades by convincing the head of his back office that they did not need to be reported.
B. Management failed to investigate high levels of reported profits even though they were associated with a low-risk trading strategy.
C. Leeson traded primarily in OTC foreign currency swaps that allowed Barings Bank to delay cash payments on losing trades until the first payment was due.
D. The loss at Barings Bank was detected when several customers complained of losses on trades that were booked to their accounts.

Correct Answer: B

Explanation: B is correct. Leeson was supposed to be running a low-risk, limited return arbitrage business out of his Singapore office, but in actuality he was investing in large speculative positions in Japanese stocks and interest rate futures and options. When Leeson fraudulently declared very substantial reported profits on his positions, management did not investigate the stream of large profits even though it was supposed to be associated with a low-risk strategy.

A, C, and D are incorrect.

Section: Foundations of Risk Management

Reference: Global Association of Risk Professionals. Foundations of Risk Management. New York, NY: Pearson, 2022. Chapter 9. Learning from Financial Disasters.

Learning Objective: Analyze the key factors that led to and derive the lessons learned from case studies involving the following risk factors:

- Rogue trading and misleading reporting, including the Barings case.

64. For a sample of the past 30 monthly stock returns for McCreary, Inc., the mean return is 4% and the sample standard deviation is 20%. The population variance is unknown but the standard error of the sample mean is estimated to be:

$$S_x = \frac{20\%}{\sqrt{30}} = 3.651\%$$

The related t-table values are shown below ($t_{i,j}$ denotes the (100-*j*)th percentile of t-distribution value with *i* degrees of freedom):

$t_{29,2.5}$	2.045
$t_{29,5.0}$	1.699
$t_{30,2.5}$	2.042
$t_{30,5.0}$	1.697

What is the 95% confidence interval for the mean monthly return?

A. [-3.466%, 11.466%]
B. [-3.453%, 11.453%]
C. [-2.201%, 10.201%]
D. [-2.194%, 10.194%]

Correct Answer: A

Explanation: A is correct. Here the *t*-reliability factor is used since the population variance is unknown. Since there are 30 observations, the degrees of freedom are 30 - 1 = 29. The t-test is a two-tailed test. So, the correct critical *t*-value is $t_{29,2.5}$ = 2.045, thus the 95% confidence interval for the mean return is:

$$[4\% - 2.045(3.651\%), 4\% + 2.045(3.651\%)] = [-3.466\%, 11.466\%]$$

Section: Quantitative Analysis

Reference: Global Association of Risk Professionals. Quantitative Analysis. New York, NY: Pearson, 2022. Chapter 6. Hypothesis Testing.

Learning Objective: Construct and apply confidence intervals for one-sided and two-sided hypothesis tests, and interpret the results of hypothesis tests with a specific confidence level.

65. An analyst on the fixed-income trading desk observed that the number of defaults per year in the bond portfolio follows a Poisson process. The average number of defaults is four per year. Assuming defaults are independent, what is the probability that there is at most one default next year?

A. 6.58%
B. 7.33%
C. 9.16%
D. 25.00%

Correct Answer: C

Explanation: C is correct. Using the Poisson distribution approach, and assuming the average number of defaults is λ per year, the probability of n defaults over a period (year) t is given as:

$$P(K = n) = \left[\frac{(\lambda * t)^n}{n!} * e^{-\lambda * t}\right]$$

Therefore,

P(at most one default) = P(one default) + P(no default) =

$$\left[\frac{(4 * 1)^1}{1!} * e^{-4*1} + \frac{(4 * 1)^0}{0!} * e^{-4*1}\right] = 0.0733 + 0.0183 = 9.16\%$$

Section: Quantitative Analysis

Reference: Global Association of Risk Professionals. Quantitative Analysis. New York, NY: Pearson, 2022. Chapter 3. Common Univariate Random Variables.

Learning Objective: Distinguish the key properties and identify the common occurrences of the following distributions: uniform distribution, Bernoulli distribution, binomial distribution, Poisson distribution, normal distribution, lognormal distribution, Chi-squared distribution, Student's *t* and F-distributions.

66. A quantitative analyst is building a model whose output depends on the value of a financial variable, X. The analyst assumes X is a random variable that follows a normal distribution with a mean of 40 and a standard deviation of 14. What is the probability that X lies outside the range between 12 and 61?

A. 4.56%
B. 6.18%
C. 8.96%
D. 18.15%

Correct Answer: C

Explanation: C is correct. First, we must find the standardized (z) values for 12 and 61.

$$z = \frac{X - \mu}{\sigma}$$

$$\frac{12 - 40}{14} = -2$$

$$\frac{61 - 40}{14} = 1.5$$

Next, using a Z table we find the probability that z is less than -2:

$$P(z < -2) = 0.0228$$

And we find the probability that z is greater than 1.5:

$$P(z > 1.5) = 0.0668$$

Finally we add these values to find the probability that z is less than -2 or greater than 1.5:

$$P(z < -2) \text{ or } P(z > 1.5) = 0.0228 + 0.0668 = 0.0896.$$

Section: Quantitative Analysis

Reference: Global Association of Risk Professionals. Quantitative Analysis. New York, NY: Pearson, 2022. Chapter 3. Common Univariate Random Variables.

Learning Objective: Distinguish the key properties and identify the common occurrences of the following distributions: uniform distribution, Bernoulli distribution, binomial distribution, Poisson distribution, normal distribution, lognormal distribution, Chi-squared distribution, Student's *t* and F-distributions.

67. An insurance company estimates that 40% of policyholders who have only an auto policy will renew next year, and 70% of policyholders who have only a homeowner policy will renew next year. The company estimates that 80% of policyholders who have both an auto and a homeowner policy will renew at least one of those policies next year. Company records show that 70% of policyholders have an auto policy, 50% of policyholders have a homeowner policy, and 20% of policyholders have both an auto and a homeowner policy. Using the company's estimates, what is the percentage of policyholders that will renew at least one policy next year?

A. 29%
B. 41%
C. 53%
D. 57%

Correct Answer: D

Explanation: D is correct. Let:

A = event that a policyholder has an auto policy

H = event that a policyholder has a homeowner policy

Then, based on the information given:

$P(A \cap H) = 0.20$

$P(A \cap H^c) = P(A) - P(A \cap H) = 0.70 - 0.20 = 0.50$

$P(A^c \cap H) = P(H) - P(A \cap H) = 0.50 - 0.20 = 0.30$

Therefore, the proportion of policyholders that will renew at least one policy is shown below:

$0.40 * P(A \cap H^c) + 0.70 * P(A^c \cap H) + 0.80 * P(A \cap H)$

$= 0.40 * 0.50 + 0.70 * 0.30 + 0.80 * 0.20 = 0.57$

Section: Quantitative Analysis

Reference: Global Association of Risk Professionals. Quantitative Analysis. New York, NY: Pearson, 2022. Chapter 1. Fundamentals of Probability.

Learning Objective: Define and calculate a conditional probability.

Distinguish between conditional and unconditional probabilities.

68. A risk manager is calculating the VaR of a fund with a data set of 25 weekly returns. The mean weekly return is 7% and the standard deviation of the return series is 15%. Assuming that weekly returns are independent and identically distributed, what is the standard deviation of the mean weekly return?

A. 0.4%
B. 0.7%
C. 3.0%
D. 10.0%

Correct Answer: C

Explanation: C is correct. In order to calculate the standard deviation of the mean weekly returns, we must divide the standard deviation of the return series by the square root of the sample size. Therefore, the correct answer is 15%/sqrt (25) = 3%.

Section: Quantitative Analysis

Reference: Global Association of Risk Professionals. Quantitative Analysis. New York, NY: Pearson, 2022. Chapter 5. Sample Moments.

Learning Objective: Estimate the mean, variance, and standard deviation using sample data.

69. The recent performance of Prudent Fund, a fund with USD 50 million of assets under management, has been weak and the institutional sales group is recommending that it be merged with Aggressive Fund, a USD 200 million fund. The returns on Prudent Fund are normally distributed with a mean of 3% and a standard deviation of 7%, and the returns on Aggressive Fund are normally distributed with a mean of 7% and a standard deviation of 15%. Assuming the returns on the two funds are independent, what is the probability that the returns on the combined fund will exceed 26%?

A. 1.0%
B. 2.5%
C. 5.0%
D. 10.0%

Correct Answer: C

Explanation: C is correct. Since these are independent normally distributed random variables, the combined expected mean return is:

$$\mu = 0.2 * 3\% + 0.8 * 7\% = 6.2\%$$

Combined volatility is:

$$\sigma = \sqrt{0.2^2 0.07^2 + 0.8^2 0.15^2} = 0.121 = 12.1\%$$

The appropriate Z-statistic is:

$$Z = \frac{26\% - 6.2\%}{12.1\%} = 1.64$$

Therefore, $P(Z > 1.64) = 1 - 0.95 = 0.05 = 5.0\%$

Section: Quantitative Analysis

Reference: Global Association of Risk Professionals. Quantitative Analysis. New York, NY: Pearson, 2022. Chapter 1. Fundamentals of Probability.

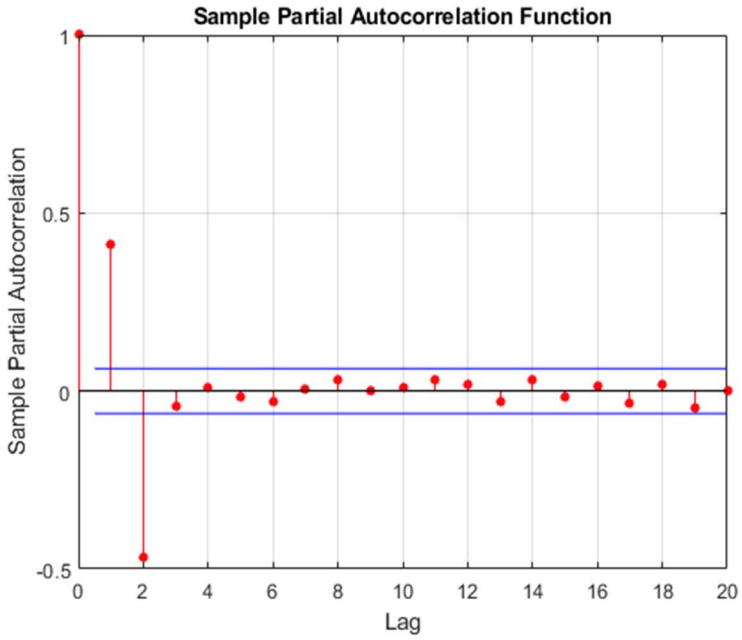
Global Association of Risk Professionals. Quantitative Analysis. New York, NY: Pearson, 2022. Chapter 4. Multivariate Random Variables.

Learning Objective: Calculate the probability of an event for a discrete probability function.

Compute the variance of a weighted sum of two random variables.

Explain how the iid property is helpful in computing the mean and variance of a sum of iid random variables.

70. A market risk manager would like to analyze and forecast a security performance and has obtained the historical time series for that security. The manager consults a colleague from the quantitative analytic team who provides the following Partial Autocorrelation Function (PACF) plot:



Based on the plot above, which of the following is the best regression approach for the security?

A. AR(1)
B. MA(1)
C. AR(2)
D. MA(2)

Correct Answer: C

Explanation: C is correct. The PACF cuts off after the second lag. This behavior indicates an AR(2) process.

Section: Quantitative Analysis

Reference: Global Association of Risk Professionals. Quantitative Analysis. New York, NY: Pearson, 2022. Chapter 10. Stationary Time Series.

Learning Objective: Define and describe the properties of autoregressive (AR) processes.

71. An analyst wants to price a 6-month futures contract on a stock index. The index is currently valued at USD 750 and the continuously compounded risk-free rate is 3.5% per year. If the stocks underlying the index provide a continuously compounded dividend yield of 2.0% per year, what is the price of the 6-month futures contract?

A. USD 744.40
B. USD 755.65
C. USD 763.24
D. USD 770.91

Correct Answer: B

Explanation: B is correct. The formula for computing the forward price on a financial asset is:

$$F_{0,T} = S_0 e^{(r-q)T}$$

where S_0 is the spot price of the asset, r is the continuously compounded risk-free interest rate, q is the continuous dividend yield on the asset and T is time until delivery date in years.

The no-arbitrage futures price is computed as follows:

$$F_0 = 750 * e^{(0.035 - 0.02) * 0.5} = 755.65$$

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 10. Pricing Financial Forwards and Futures.

Learning Objective: Calculate the forward price given the underlying asset's spot price and describe an arbitrage argument between spot and forward prices.

72. On November 1, the fund manager of a USD 60 million US mid-to-large cap equity portfolio, considers locking in the profit from a recent market rally. The S&P 500 Index is trading at 2,110. The S&P 500 Index futures with a multiplier of 250 is trading at 2,120. Instead of selling the holdings, the fund manager would rather hedge two-thirds of the market exposure over the remaining 2 months. Given that the correlation between the equity portfolio and the S&P 500 Index futures is 0.89 and the volatilities of the equity portfolio and the S&P 500 futures are 0.51 and 0.48 per year, respectively, what position should the manager take to achieve the objective?

A. Sell 71 futures contracts of the S&P 500 Index
B. Sell 103 futures contracts of the S&P 500 Index
C. Sell 148 futures contracts of the S&P 500 Index
D. Sell 167 futures contracts of the S&P 500 Index

Correct Answer: A

Explanation: A is correct. The optimal hedge ratio is the product of the correlation coefficient between the change in the spot price and the change in futures price and the ratio of the volatility of the equity fund to the volatility of the futures.

Computing the optimal hedge ratio: h = 0.89 * (0.51/0.48) = 0.9456

Two-thirds of the equity fund valued at USD 60 million is equivalent to USD 40 million. Computing the number of futures contracts: N = (hedge ratio)*(portfolio value)/futures value = 0.9456 * 40,000,000/(2,120 * 250) = 71.3679 = 71, rounded to nearest integer.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 8. Using Futures for Hedging.

Learning Objective: Compute the optimal number of futures contracts needed to hedge an exposure and explain and calculate the “tailing the hedge” adjustment.

73. A risk analyst at a commodity trading firm is examining the supply and demand conditions for various commodities and is concerned about the volatility of the forward prices for silver in the medium term. Currently, silver is trading at a spot price of USD 20.35 per troy ounce and the 6-month forward price is quoted at USD 20.50 per troy ounce. Assuming that after 6 months the lease rate rises above the continuously compounded risk-free interest rate, which of the following statements is correct about the shape of the silver forward curve after 6 months?

A. The forward curve will be downward sloping.
B. The forward curve will be upward sloping.
C. The forward curve will be flat.
D. The forward curve will be humped.

Correct Answer: A

Explanation: A is correct. The forward price is computed as:

$$F = S(1 + R)^T$$

where R is the risk-free rate, T is the time to maturity of the forward (measured in years), and S is the spot price.

The commodity lease rate is computed as

$$l = \left(\frac{S}{F}\right)^{\frac{1}{T}}(1 + R) - 1$$

So, the forward price can alternatively be expressed in terms of risk-free rate and lease rate as:

$$F = S\left(\frac{1 + R}{1 + l}\right)^T$$

Therefore, as the risk-free rate falls below the lease rate, we can see from the forward price formula above that F < S, and the forward curve will be downward sloping (in backwardation).

B, C, and D are incorrect per the explanation for A above.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 11. Commodity Forwards and Futures.

Learning Objective: Define and apply commodity concepts such as storage costs, carry markets, lease rate, and convenience yield.

74. Company XYZ operates in the US. On June 1, 2019, it has a net trade receivable of EUR 5,000,000 from an export contract to Germany. The company expects to receive this amount on December 1, 2019. The CFO of XYZ wants to protect the value of this receivable. On June 1, 2019, the EUR spot rate is USD 1.19 per EUR 1, and the 6-month EUR forward rate is USD 1.17 per EUR 1. The CFO can lock in an exchange rate by taking a position in the forward contract. Alternatively, the CFO can sell a 6-month EUR 5,000,000 call option with strike price of USD 1.19 per EUR 1.

In assessing the potential hedging strategy, the CFO thinks that selling an option is better than taking a forward position because if the EUR appreciates against the USD, XYZ can take delivery of the USD at USD 1.19 per EUR 1, while if the EUR depreciates against the USD, the contract will not be exercised and XYZ will pocket the premium obtained from selling the call option. What can be concluded about the CFO's analysis?

A. The CFO's analysis is correct and the company is better off whichever way the EUR rate goes.
B. The CFO's analysis is not correct and the company will suffer if the EUR appreciates sharply against the USD.
C. The CFO's analysis is not correct and the company will suffer if the EUR moves within a narrow range.
D. The CFO's analysis is not correct and the company will suffer if the EUR depreciates sharply against the USD.

Correct Answer: D

Explanation: D is correct. The CFO's analysis is incorrect because there is unlimited downside risk. The option premium received is a fixed amount, and if the EUR depreciates sharply, the value of the underlying receivable goes down as well. If instead the EUR moves in a narrow range, that would be good, but there is no guarantee, of course, that this will occur.

A, B, and C are incorrect per the explanation of D above.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 12. Options Markets.

Learning Objective: Describe the various types and uses of options; define moneyness.

75. A portfolio manager at an asset management firm is examining an existing portfolio to determine if it still holds an optimal asset mix based on the firm's latest market expectations. The manager identifies a long position in a futures contract that is no longer consistent with the goals of the portfolio and wants to close out the position using a market-if-touched order. Which of the following actions would be consistent with the use of this type of order?

A. Execute at the best available price once a trade occurs at the specified price or a better price.
B. Execute at the best available price once a bid or offer occurs at the specified price or a worse price.
C. Allow a broker to delay execution of the order to get a better price.
D. Execute the order immediately or not at all.

Correct Answer: A

Explanation: A is correct. A market-if-touched order executes at the best available price once a trade occurs at the specified or better price. A stop order executes at the best available price once a bid/offer occurs at the specified or worse price. A discretionary order allows a broker to delay execution of the order to get a better price. A fill-or-kill order executes the order immediately or not at all.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 7. Futures Markets.

Learning Objective: Describe and compare different trading order types.

76. A bond trader is using current zero rates to calculate forward rates. The trader gathers the following information on the current term structure of continuously compounded zero rates:

Maturity in years	Zero rate (%)
1	1.50
2	2.00
3	2.50
4	3.00
5	3.50

Which of the following is closest to the 2-year forward rate starting in 3 years?

A. 3.50%
B. 4.17%
C. 5.00%
D. 6.09%

Correct Answer: C

Explanation: C is correct. The 2-year forward rate starting in 3 years is given by

$$ {}_3F_2 = (R_5 * 5 - R_3 * 3)/ (5 - 3) = 5\% $$

where:

R_3 = 3-year zero rate = 2.50%,

R_5 = 5-year zero rate = 3.50%,

${}_3F_2$ = 2-year forward rate in year 3.

A is incorrect. 3.50% is the zero rate (spot rate) for a 5-year investment.

B is incorrect. 4.17% is the annualized 3-year forward rate starting in 2 years. That is, it is the result obtained when the formula is misrepresented as follows: ${}_3F_2 = (R_5 * 5 - R_3 * 2)/ (5 - 2)$.

D is incorrect. 6.09% is the result when the following wrong formula is applied to determine the 2-year forward rate starting in year 3 $(1 + {}_3R_2) = (1 + R_5)*(1 + R_3)$.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 16. Properties of Interest Rates.

Learning Objective: Derive forward interest rates from a set of spot rates.

77. A portfolio manager is analyzing the impact of yield changes on two portfolios: portfolio ASD and portfolio BTE. Portfolio ASD has two zero-coupon bonds and portfolio BTE has only one zero-coupon bond. Additional information on the portfolio is provided in the table below:

	Portfolio components	Yield per year	Maturity (years)	Face value
Portfolio ASD	Bond 1	10%	3	USD 1,000,000
	Bond 2	10%	9	USD 1,000,000
Portfolio BTE	Bond 3	8%	6	USD 1,000,000

To assess the potential effect of a parallel shift in the yield curve on portfolio values, the manager runs a scenario in which yields increase by 200 bps across all points of the yield curve. In addition, the manager estimates a convexity of 34.51 for portfolio ASD and 36.00 for portfolio BTE. Assuming continuous compounding, which of the following are the best estimates of the decrease in the values of the two portfolios due to the combined effects of duration and convexity?

	Portfolio ASD	Portfolio BTE
A.	USD 102,000	USD 65,000
B.	USD 110,000	USD 70,000
C.	USD 118,000	USD 74,000
D.	USD 127,000	USD 79,000

Correct Answer: B

Explanation: B is correct.

Step 1 - Calculate the values of the two portfolios before increases in yield:

Portfolio ASD

P_A = Value before yield increase: 1,000,000*exp(-0.1*3) + 1,000,000*exp(-0.1*9)

= USD 740,818.22 + USD 406,569.66 = USD 1,147,387.88

Portfolio BTE

P_B = Value before yield increase: 1,000,000*exp(-0.08*6) = 618,783.39

Step 2 - Calculate the duration of the two portfolios before increases in yield:

Portfolio ASD

D_A = weighted-average durations of the two zero-coupon bonds

= D_A*W_A + D_B*W_B = 3*(740,818.22/1,147,387.88) + 9*(406,569.66/1,147,387.88) = 5.13

Alternatively,

$$D_A = \frac{\sum_{i=1}^{n} t_i * c_i * e^{-yt}}{P_A}$$

= [3*1,000,000*exp(-0.1*3) + 9*1,000,000*exp(-0.1*9)]/[1,147,387.88] = 5.13

Portfolio BTE

D_B = duration of portfolio BTE = 6.00 (duration is approximately same as maturity for a zero-coupon bond).

Step 3 – Note the convexities given for the two portfolios (no need to calculate):
C_A = 34.51; and C_B = 36.00

Step 4 - Estimate the changes in portfolio values due to the yield change (Δy) and the effects of duration and convexity:

Change in bond value = $\Delta P = -P*D*\Delta y + ½*P*C*(\Delta y)^2$

Thus,

Portfolio ASD

$\Delta P_A = -P_A*D_A*\Delta y + ½*P_A*C_A*(\Delta y)^2$

$= -1{,}147{,}387.88*5.13*0.02 + 0.5*1{,}147{,}387.88*34.51*(0.02)^2$

$= -117{,}722.00 + 7{,}919.27 = \text{USD } -109{,}802.73$

Portfolio BTE

$\Delta P_B = -P_B*D_B*\Delta y + ½*P_B*C_B*(\Delta y)^2$

$= -618{,}783.39*6.00*0.02 + 0.5*618{,}783.39*36*(0.02)^2$

$= -74{,}254.00 + 4{,}455.24 = \text{USD } -69{,}798.76$

A is incorrect. The change in value for both portfolios are wrongly computed as the parameter 0.5 is left out in the convexity formula.

C is incorrect. The changes in value for both portfolios do not consider the effect of convexity.

D is incorrect. Changes in value for both portfolios are wrongly computed by inserting a negative sign (rather than a positive) in the convexity part of the formula.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 16. Properties of Interest Rates.

Learning Objective: Calculate the change in a bond's price given its duration, its convexity, and a change in interest rates.

78. A US financial institution entered into a 4-year currency swap contract with an industrial company located in France. Under the terms of the swap, the financial institution receives interest at 3% per year in EUR and pays interest at 2% per year in USD. The principal amounts are EUR 50 million and USD 60 million, and interest payments are exchanged once at the end of each year. Immediately before cash flow payments and receipts are exchanged at the end of year 3, the exchange rate is USD 1.044 per EUR 1, the 1-year risk-free rate in France is 3.0%, and the 1-year risk-free rate in the US is 2.0%. Assuming continuous compounding, what is the value of the swap to the financial institution at the end of year 3?

A. USD -7.603 million
B. USD -7.445 million
C. USD -7.068 million
D. USD -6.921 million

Correct Answer: B

Explanation: B is correct.

Step 1 - calculate the forward exchange rate as of the end of year 3: 1-year forward exchange rate (USD per EUR):

$F = S*\exp[(r_{usd} - r_{eur})*T] = 1.044*\exp[(0.02 - 0.03)*1] = 1.0336$ (i.e., Year 4 FX rate)

Step 2 - calculate the expected cash flows as of the end of year 3:

Receipts:

Year 3: EUR 50mil*0.03 = EUR 1.5mil

Year 4: EUR 50mil*0.03 + EUR 50mil = EUR 51.5mil

Payments:

Year 3: USD 60mil*0.02 = USD 1.2mil

Year 4: USD 60mil*0.02 + USD 60mil = USD 61.2mil

Step 3 - convert the EUR cash flows into base currency, i.e. USD:

Receipts:

Year 3: (EUR 1.5mil)*1.0440= USD 1.566mil

Year 4: (EUR 51.5mil)*1.0336 = USD 53.2304mil

Step 4 - Net the cash flows per year:

Year 3: USD 1.566mil – USD 1.2mil = USD 0.366mil

Year 4: USD 53.230 – USD 61.2mil = USD -7.969mil

Step 5 - discount to year 3 and sum the cash flows in USD:

Year 3: Present value = USD 0.366mil

Year 4: Present value = USD -7.969*exp(-0.02*1) = USD -7.8112mil

Net value to the financial institution = 0.366 – 7.8112 = USD -7.4452mil

A is incorrect. USD -7.603 million uses the appropriate exchange rates but does not discount back to year 3.

C is incorrect. USD -7.068 million uses the current USD per EUR rate (USD 1.044) to convert the EUR cash flows and does not discount back to year 3.

D is incorrect. USD -6.921 million uses the current USD per EUR rate (USD 1.044) to convert the EUR cash flows; however, it does discount back to year 3.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 20. Swaps.

Learning Objective: Explain the mechanics of a currency swap and compute its cash flows.

79. The investment banking division of a large German bank recently engaged a new client whose business is in direct competition with an existing client of the commercial banking division of the bank. A manager in the commercial banking division is concerned about conflicts of interest that may arise from providing both clients with a high level of customer service. What is of greatest concern to the manager regarding this situation?

A. The investment banking division pressuring the banks brokers to buy certain securities for clients
B. The investment banking division pressuring researchers to generate buy recommendations for the new client
C. The investment banking division pressuring commercial bankers to confirm material nonpublic information
D. The investment banking division pressuring commercial bankers to open a banking relationship with the new client

Correct Answer: C

Explanation: C is correct. An investment banker could be advising the new client on an acquisition involving the existing client as either a target or a competing bidder. Investment bankers might ask commercial bankers to confirm material nonpublic information about the existing client.

A is incorrect. While this is a conflict of interest, this is not likely the concern of the commercial banking manager as this conflict deals with the brokerage division.

B is incorrect. While this is a conflict of interest, this is not likely the concern of the commercial banking manager as this conflict deals with the research department of the brokerage division.

D is incorrect. This is not a conflict of interest.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 1. Banks.

Learning Objective: Describe the potential conflicts of interest among commercial banking, securities services, and investment banking divisions of a bank, and recommend solutions to the conflict of interest problems.

80. A risk manager wishes to hedge an investment in zirconium using futures. Unfortunately, there are no futures that are based on this asset. To determine the best futures contract to hedge with, the risk manager runs a regression (as shown below) of daily changes in the price of zirconium against daily changes in the prices of similar assets that have futures contracts associated with them:

$$\text{Change in Price of Zirconium} = \alpha + \beta*(\text{Change in Price of Asset}_t) + \varepsilon_t$$

Asset	α	β	R^2
A	1.25	1.03	0.62
B	0.67	1.57	0.81
C	0.01	0.86	0.35
D	4.56	2.30	0.45

Based on the results shown in the table above, futures tied to which asset would likely introduce the least basis risk into the hedging position?

A. Asset A
B. Asset B
C. Asset C
D. Asset D

Correct Answer: B

Explanation: B is correct. Futures on an asset whose price changes are most closely correlated with the asset you are looking to hedge will have the least basis risk. This is determined by examining the R^2 of the regressions and choosing the highest one. R^2 is the most applicable statistic in the above chart to determine correlation with the price of zirconium.

A, C, and D are incorrect per the explanation for B above.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 8. Using Futures for Hedging.

Learning Objective: Define cross hedging and compute and interpret hedge ratio and hedge effectiveness.

81. A risk manager asks a junior risk analyst to assess the prepayment risk on a pool of fixed-rate mortgages. In order to calculate the conditional prepayment rate (CPR) for the pool, the analyst begins by estimating the monthly prepayments on one selected mortgage. At origination, the 30-year mortgage was a USD 1,750,000 loan making monthly mortgage payments at a fixed mortgage rate of 8% per year. Assuming the borrower made a total payment on the mortgage of USD 15,950.00 in one specific month, and the loan balance at the beginning of that month was USD 1,644,235.78, what is the correct estimate of the prepayment amount for that month?

A. USD 3,060.29
B. USD 4,933.62
C. USD 11,016.38
D. USD 14,076.60

Correct Answer: A

Explanation: A is correct. Prepayment for any given month is defined as "principal payment" in excess of "scheduled principal payment" and is computed as:

(i) month's total payment, less
(ii) month's scheduled interest payment, less
(iii) month's scheduled principal payment.

or,

(i) month's total payment, less
(ii) month's scheduled total payment

To compute scheduled total payment, consider an amortizing fixed-rate loan with particulars as follows: PV = 1,750,000; N = 12x30 = 360; FV = 0; I/Y = 8%/12 = 0.67. Therefore, using a calculator, PMT = 12,889.71 = constant scheduled total payment per month.

Therefore,

prepayment in the specified month = total payment made – scheduled total payment = 15,950.00 – 12,889.71 = USD 3,060.29.

(Also, given the specified month,

Interest payment = 0.67% * beginning balance = 0.0067 * 1,644,235.78 = USD 11,016.38)

B is incorrect. USD 4,933.62 is the total payment less scheduled interest payment for the month. It is incorrect because it includes the scheduled principal payment.

C is incorrect. USD 11,016.38 is the scheduled interest payment for the month = 0.0067 * 1,644,235.78.

D is incorrect. USD 14,076.60 is the total payment made less the scheduled principal payment for the month = USD 15,950.00 – (12,889.71 – 11,016.38). It is incorrect because it includes the scheduled interest payment.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 18. Mortgages and Mortgage-Backed Securities.

Learning Objective: Calculate a fixed-rate mortgage payment and its principal and interest components.

Calculate the weighted average coupon, weighted average maturity, single monthly mortality rate (SMM), and conditional prepayment rate (CPR) for a mortgage pool.

82. A derivatives trader is determining the bounds for prices of several options on a stock. The current share price of the stock is USD 100.00, and the continuously compounded risk-free rate is 12% per year. What are the upper bounds for the prices of a 3-month European-style call option, American-style call option, European-style put option, and American-style put option, respectively, if the strike price for each option is USD 90.00?

A. USD 97.04; USD 97.04; USD 87.34; USD 87.34
B. USD 97.04; USD 100.00; USD 90.00; USD 90.00
C. USD 100.00; USD 100.00; USD 87.34; USD 90.00
D. USD 100.00; USD 100.00; USD 90.00; USD 90.00

Correct Answer: C

Explanation: C is correct. For European and American call options, the maximum possible price is equal to current stock price. The option price can never be higher than the stock price. The stock price is thus the "upper bound." For a European Put, the upper bound is the present value of the strike price, while for an American put, it is equal to the strike price.

A is incorrect. This incorrectly gives the upper bound for the European and American call options as the present value of the current stock price, and incorrectly gives the upper bound for the American put option as the present value of the strike price.

B is incorrect. This incorrectly gives the upper bound for the European call option as the present value of the current stock price, and incorrectly gives the upper bound for the European put option as the strike price.

D is incorrect. This incorrectly gives the upper bound for the European put option as the strike price.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 13. Properties of Options.

Learning Objective: Identify and compute upper and lower bounds for option prices on non-dividend and dividend paying stocks.

83. An analyst has been asked to estimate the VaR of a long position in a put option on the stock of Big Pharma, Inc. The stock is trading at USD 26.00 with a daily volatility of 1.5%, and the option is at-the-money with a delta of -0.5. Using the delta-normal method, which of the following choices is closest to the 1-day 95% VaR of the option position?

A. USD 0.32
B. USD 0.45
C. USD 0.64
D. USD 0.91

Correct Answer: A

Explanation: A is correct. The variance of a portfolio with respect to its *n* risk factors is

$$\sigma_P^2 = \sum_{i=1}^{n}\sum_{j=1}^{n} a_i a_j \rho_{ij} \sigma_i \sigma_j$$

where a_i is the delta of the portfolio with respect to the *i*th risk factor and σ_i is the standard deviation of the *i*th risk factor. The option's standard deviation is therefore

$$\sigma_P = \sqrt{\sigma_P^2} = \sqrt{a_i^2 \sigma_i^2} = |a_i| * \sigma_i = |-0.5| * (0.015 * 26) = 0.195$$

A common assumption is that the mean change in each risk factor is zero and therefore the average change in a linear portfolio is zero. Therefore, when *U* equals 1.645, the point of the standard normal distribution corresponding to the 95th percentile, the delta-normal VaR of the option at the 95% confidence level is

$$\sigma_P U = 0.195 * 1.645 = USD\ 0.3208$$

B is incorrect. USD 0.45 is the 1-day 99% VaR of the option.

C is incorrect. USD 0.64 is the 1-day 95% VaR if the delta of the option is 1.0.

D is incorrect. USD 0.91 is the 1-day 99% VaR of the option if the delta of the option is 1.0

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 2. Calculating and Applying VaR.

Learning Objective: Describe the delta-normal approach and use it to calculate VaR for non-linear derivatives.

84. A newly hired quantitative analyst at a financial institution has been asked by a portfolio manager to calculate the VaR of a portfolio for 10-, 15-, 20-, and 25-day periods. The portfolio manager notices something wrong with the analyst's calculations. Assuming the annualized volatilities of daily returns for the four periods are equal, and that the daily returns are independently and identically normally distributed with a mean of zero, which of the following VaR estimates for this portfolio is inconsistent with the others?

A. VaR(10-day) = USD 474 million
B. VaR(15-day) = USD 503 million
C. VaR(20-day) = USD 671 million
D. VaR(25-day) = USD 750 million

Correct Answer: B

Explanation: B is correct. Calculate VaR(1-day) from each choice:

$$\text{VaR(10-day)} = 474 \rightarrow \text{VaR(1-day)} = 474/\sqrt{10} = 150$$

$$\text{VaR(15-day)} = 503 \rightarrow \text{VaR(1-day)} = 503/\sqrt{15} = 130$$

$$\text{VaR(20-day)} = 671 \rightarrow \text{VaR(1-day)} = 671/\sqrt{20} = 150$$

$$\text{VaR(25-day)} = 750 \rightarrow \text{VaR(1-day)} = 750/\sqrt{25} = 150$$

Thus, the VaR(1-day) calculated for a 15-day period is different from those calculated for 10-, 20-, and 25-day periods.

A, C, and D are incorrect per the explanation for B above.

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 3. Measuring and Monitoring Volatility.

Learning Objective: Explain and apply approaches to estimate long horizon volatility/VaR and describe the process of mean reversion according to a GARCH (1,1) model.

85. A portfolio manager uses a valuation model to estimate the value of a bond portfolio at USD 125.00 million. The term structure is flat. Using the same model, the portfolio manager estimates that the value of the portfolio would increase to USD 127.70 million if all interest rates fall by 20 bps and would decrease to USD 122.20 million if all interest rates rise by 20 bps. Using these estimates, which of the following is the effective duration of the bond portfolio closest to?

A. 5.5
B. 11.0
C. 22.0
D. 44.0

Correct Answer: B

Explanation: B is correct. Effective duration is commonly reported as the approximate percentage change in price for every 100 bp change in rates. The calculation follows:

$$D = -\frac{\Delta P/P}{\Delta r} = -\frac{\Delta P}{P\Delta r} = \frac{127.70 - 122.20}{125.00 * (2 * 0.002)} = 11.0$$

A is incorrect. 5.5 is the result of using switching the prices of USD 122.20 and USD 125.00 in the formula.

C is incorrect. 22 is the result when the "2" multiple in the denominator is not applied.

D is incorrect. 44 is the result obtained if the "2" multiple is applied to the numerator instead of the denominator.

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 12. Applying Duration, Convexity, and DV01.

Learning Objective: Define, compute, and interpret the effective duration of a fixed income security given a change in yield and the resulting change in price.

86. A portfolio manager is calculating the realized return and the historical volatility of returns for the stock of company VMG. The stock ended the month of June 2021 at a price per share of INR 280, and ended the month of December 2021 at INR 320. The manager reports that the monthly volatility of the stock returns over the 6-month period was 2.76%. Assuming continuous compounding, and that the stock's returns are independent over time, what are the realized return over the 6-month period and the volatility of the stock returns per year?

A. The realized return is 12.5%, and the annual volatility is 9.6%.
B. The realized return is 12.5%, and the annual volatility is 33.1%.
C. The realized return is 26.7%, and the annual volatility is 9.6%.
D. The realized return is 26.7%, and the annual volatility is 33.1%.

Correct Answer: C

Explanation: C is correct:

Given:

T = 6 months = 6/12 = 0.5

S_0 = 280

S_T = 360

Therefore,

- Realized return = $(1/T)*ln(S_T/S_0)$ = 2*ln(320/280) = 0.2671 = 26.7%
- Volatility per year = $s/sqrt(\Delta t)$ = 0.0276*(sqrt(12)) = 0.0276*(sqrt(0.08333)) = 0.0956 = 9.6%.

A is incorrect. 12.5% incorrectly calculates the realized return on the stock as the price change over the period divided by the price at the end of the period (INR 40 / INR 320).

B is incorrect. 33.1% (= 2.76% * 12) is the result of not using the square root rule to determine the annual volatility. The return of 12.5% is calculated as described in A above.

D is incorrect. The annual volatility is incorrectly calculated as described in B above.

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 15. The Black-Scholes-Merton Model.

Learning Objective: Compute the realized return and historical volatility of a stock.

87. The CRO of a small bank is estimating the volatility of the bank's asset portfolio using its key rate 01s, in preparation for calculating the bank's market risk capital. The portfolio is only exposed to 2-year and 10-year spot rates. Relevant information on market rates and the portfolio is as follows:

	2-year	10-year
Standard deviation of daily changes in the spot rate (in bps)	4	11
Correlation between spot rate	0.6	0.6
Portfolio key rate 01s (CAD)	52	97

Given the above information, what is the standard deviation of the daily change in portfolio value?

A. CAD 516
B. CAD 988
C. CAD 1,026
D. CAD 1,203

Correct Answer: D

Explanation: D is correct. The equation for the variance of the change in portfolio value is:

$$\sigma_P^2 = \sum_{i=1}^{n}\sum_{j=1}^{n} \rho_{ij}\sigma_i\sigma_j * KR01_i * KR01_j$$

$$= (1 * \sigma_{2Y} * \sigma_{2Y} * KR01_{2Y} * KR01_{2Y}) + (\rho_{2Y,10Y} * \sigma_{2Y} * \sigma_{10Y} * KR01_{2Y} * KR01_{10Y}) + (\rho_{10Y,2Y} * \sigma_{10Y} * \sigma_{2Y} * KR01_{10Y} * KR01_{2Y}) + (1 * \sigma_{10} * \sigma_{10Y} * KR01_{10Y} * KR01_{10Y})$$

$$= \sigma_{2Y}^2 * KR01_{2Y}^2 + 2 * (1 * \sigma_{2Y} * \sigma_{2Y} * KR01_{2Y} * KR01_{2Y}) + \sigma_{10}^2 * KR01_{10Y}^2$$

$$= [(4)^2 * (52)^2] + [0.6 * 4 * 11 * 52 * 97] + [0.6 * 11 * 4 * 97 * 52] + [(11)^2 * (97)^2]$$

$$= 1{,}448{,}076$$

The standard deviation is therefore: $\sqrt{1{,}448{,}076} = 1{,}203.36$.

A is incorrect. This calculates the variance as

$$= [0.6 * 4 * 11 * 52 * 97] + [0.6 * 11 * 4 * 97 * 52].$$

B is incorrect. This calculates the variance as

$$= [0.6 * (4)^2 * (52)^2] + [0.6 * (11)^2 * (97)^2].$$

C is incorrect. This calculates the variance without the KR01 terms, and then multiplies the result by the average of the KR01s.

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 13. Modeling Non-Parallel Term Structure Shifts and Hedging.

Learning Objective: Apply key rate and multi-factor analysis to estimating portfolio volatility.

88. The CRO of a major bank is reviewing a new risk measure, W, with the risk team. The CRO runs a test on the new risk measure to determine if the measure is coherent and satisfies the property of translation invariance. Which of the following tests would correctly determine that the risk measure W exhibits translation invariance?

A. When cash is added to a portfolio, the value of W for that portfolio should decrease by the amount of cash that is added.
B. When W is used to measure the risk of two portfolios A and B, then W(A) + W(B) should be less than or equal to W(A+B).
C. When W is used to measure the risk of two portfolios A and B, and if portfolio A always produces a worse outcome than portfolio B, then W(A) should always be higher than W(B).
D. When W is used to measure the risk of portfolio A, and if all exposures in portfolio A are increased by a constant factor, then W(A) should increase proportionally by that factor.

Correct Answer: A

Explanation: A is correct. According to the property of translation invariance, adding an amount of cash, K, into a portfolio will decrease the risk measure by K. Therefore, choice A correctly describes translation invariance.

B is incorrect. This is a test for subadditivity. According to the property of subadditivity, given two portfolios A and B, the risk measure for the portfolio formed by merging A and B will be less than or equal to the sum of the risk measures for A and B.

C is incorrect. This is a test for monotonicity. According to the property of monotonicity, a portfolio that produces consistently worse results in comparison to another portfolio will have a higher risk measure.

D is incorrect. This is a test of homogeneity. According to the property of homogeneity, changing the size of a portfolio by multiplying the amount of all components by λ results in the risk measure being multiplied by λ.

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 1. Measures of Financial Risk.

Learning Objective: Define the properties of a coherent risk measure and explain the meaning of each property.

89. A risk analyst at a financial institution is preparing a report on capital requirements for the senior management team to be used in risk appetite discussions. The analyst compares regulatory capital and economic capital requirements in the report. Which of the following statements is correct for the analyst to include in the report?

A. The regulatory capital for credit risk is designed to be sufficient to cover a loss that is expected to be exceeded only once every ten years.
B. Regulatory capital is sometimes referred to as going concern capital because it absorbs losses incurred while the bank is still in business.
C. The most important capital for a bank is regulatory capital, which equals the bank's estimate of its expected losses.
D. Economic capital is an internal risk measure that reflects the amount of capital needed to ensure a company remains solvent with a high level of confidence, given its risk profile.

Correct Answer: C

Explanation: D is correct. Economic capital is a bank's own estimate of the capital it requires. In both cases, capital can be thought of as funds that are available to absorb unexpected losses. A common objective in calculating economic capital is to maintain a high credit rating. Economic capital is allocated to a bank's business units so that they can be compared using a return on allocated economic capital metric.

A is incorrect. The regulatory capital for credit risk is designed to be sufficient to cover a loss that is expected to be exceeded only once every thousand years.

B is incorrect. Equity capital is sometimes referred to as going concern capital because it absorbs losses while the bank is a going concern (i.e., it remains in business).

C is incorrect. The most important capital is equity capital.

Section: Financial Markets and Products

Reference: Global Association of Risk Professionals. Financial Markets and Products. New York, NY: Pearson, 2022. Chapter 1. Banks.

Learning Objective: Identify the major risks faced by banks and explain ways in which these risks can arise.

90. A risk analyst at a bank is calculating credit risk for various types of assets in the bank's portfolio. The analyst begins by estimating the parameters used as inputs to these calculations, and encounters several challenges while doing so. Which of the following will the analyst find to be correct regarding the estimated inputs for credit risk calculations?

A. The probability of default of a derivative counterparty often increases as the bank's exposure at default with respect to that derivative position increases.
B. The loss given default for a derivative transaction is typically negatively correlated with the counterparty's probability of default.
C. Banks must make both through-the-cycle and point-in-time estimates of loss given default to comply with both regulatory requirements and accounting standards.
D. Current exposure is typically used to estimate exposure at default for a line of credit in order to provide a conservative estimate.

Correct Answer: A

Explanation: A is correct. This is what is termed wrong-way risk. This is the risk associated with the fact that a counterparty to a company may be more likely to default when the value of outstanding derivatives is negative to the counterparty (and therefore positive to the company).

B is incorrect. The loss given default is positively correlated with probability of default (recovery rate is negatively correlated with probability of default).

C is incorrect. Banks must make both through-the-cycle and point-in-time estimates of the probability of default, not the loss given default, to comply with both regulatory requirements and accounting standards.

D is incorrect. In the case of a line of credit, EAD can be conservatively estimated as the customer's borrowing limit, not the current amount drawn down.

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 6. Measuring Credit Risk.

Learning Objective: Describe challenges to quantifying credit risk.

91. A market risk manager at a pension fund is calculating the annual VaR of a portfolio of investment securities. The portfolio has a current market value equal to USD 7,444,000 with a daily variance of 0.0002. Assuming there are 250 trading days in a year and the daily portfolio returns are independent and follow the same normal distribution with a mean of zero, what is the estimate of the 1-year VaR at the 95% confidence level?

A. USD 38,723
B. USD 173,150
C. USD 2,737,737
D. USD 3,871,110

Correct Answer: C

Explanation: C is correct. This is an implementation of the "square root rule":

$$\text{Daily standard deviation} = 0.0002^{0.5} = 0.01414.$$

$$\text{Annual VaR} = \text{USD } 7{,}444{,}000 * 250^{0.5} * 0.01414 * 1.645 = \text{USD } 2{,}737{,}737$$

A is incorrect. USD 38,723 is the result obtained when variance, instead of the standard deviation, is used in the VaR formula.

B is incorrect. USD 173,150 is the 1-day VaR at the 95% confidence level.

D is incorrect. USD 3,871,110 is the 1-year VaR at the 99% confidence level.

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 3. Measuring and Monitoring Volatility.

Learning Objective: Explain and apply approaches to estimate long horizon volatility/VaR and describe the process of mean reversion according to a GARCH (1,1) model.

92. A fixed-income portfolio manager at a pension fund is investigating the information contained in credit ratings and credit default swap spreads. The manager reviews the literature on the subject and finds research by Hull, Predescu, and White examining the impact of rating changes on credit default swap spreads. According to this study, which of the following ratings actions is found to have the greatest impact on credit default swap spreads when announced?

A. Watchlist reviews for ratings upgrades
B. Ratings upgrades
C. Watchlist reviews for ratings downgrades
D. Ratings downgrades

Correct Answer: C

Explanation: C is correct. Hull, Predescu, and White (2004) looked at the impact of rating changes on credit default swap spreads and found that watchlist reviews for a downgrade contain significant information, but downgrades and negative outlooks to not. Positive rating events were much less significant. Generally, credit default swap changes seem to anticipate rating changes.

A, B, and D are incorrect per the explanation for C above.

Section: Valuation and Risk Models

Reference: Global Association of Risk Professionals. Valuation and Risk Models. New York, NY: Pearson, 2022. Chapter 4. External and Internal Credit Ratings.

Learning Objective: Describe the relationships between changes in credit ratings and changes in stock prices, bond prices, and credit default swap spreads.

93. Two risk analysts are attending a seminar on the topic of modern portfolio theory. One of the presentations in the seminar focuses on the efficient frontier, the capital market line, and the CAPM. Assuming the CAPM holds, which of the following observations is correct for the analysts to make?

A. The capital market line always has a positive slope and its steepness depends on the market risk premium and the volatility of the market portfolio.
B. The capital market line is the straight line connecting the risk-free asset with the zero-beta minimum-variance portfolio.
C. The portfolio of risky assets with the lowest standard deviation on the efficient frontier is typically held by the least risk averse investors.
D. The efficient frontier indicates that different individuals hold different portfolios of risky assets based upon their individual forecasts for asset returns.

Correct Answer: A

Explanation: A is correct. The capital market line connects the risk-free asset with the market portfolio, which is the efficient portfolio at which the capital market line is tangent to the efficient frontier. The equation of the capital market line is as follows:

$$\bar{R}_e = R_F + \left(\frac{\bar{R}_M - R_F}{\sigma_M}\right) * \sigma_e$$

where the subscript e denotes an efficient portfolio. Since the shape of the efficient frontier is dictated by the market risk premium, $\bar{R}_M - R_F$, and the volatility of the market, the slope of the capital market line will also be dependent on these two factors.

B is incorrect. As said in A above, the capital market line connects the risk-free asset with the market portfolio (which by definition has a beta of 1).

C is incorrect. The implication of the CML is that all investors should allocate to two investments: the risk-free asset and the market portfolio. Investors with little tolerance for risk will allocate most of their funds to the risk-free asset.

D is incorrect. One of the crucial assumptions for the derivation of CAPM is that all market participants have the same expectations, and therefore have the same forecast for asset returns. Additionally, as mentioned above, all investors hold the same portfolio of risky assets, which is the market portfolio.

Section: Foundations of Risk Management

Reference: Global Association of Risk Professionals. Foundations of Risk Management. New York, NY: Pearson, 2022. Chapter 5. Modern Portfolio Theory (MPT) and the Capital Asset Pricing Model (CAPM).

Learning Objective: Understand the derivation and components of the CAPM.

Interpret and compare the capital market line and the security market line.

94. A wealth manager is calculating the beta of a portfolio of large-cap industrial company stocks. The manager determines that the correlation between the return of the portfolio and the return of its benchmark is 0.8, the volatility of portfolio returns is 5%, and the volatility of the benchmark is 4%. What is the beta of the portfolio with respect to its benchmark?

A. -1.00
B. 0.64
C. 0.80
D. 1.00

Correct Answer: D

Explanation: D is correct. The following equation is used to calculate beta:

$$\beta = \rho \frac{\sigma(portfolio)}{\sigma(benchmark)} = 0.8 * \frac{0.05}{0.04} = 1.00$$

Where ρ represents the correlation coefficient and σ the volatility.

Section: Foundations of Risk Management

Reference: Global Association of Risk Professionals. Foundations of Risk Management. New York, NY: Pearson, 2022. Chapter 5. Modern Portfolio Theory (MPT) and the Capital Asset Pricing Model (CAPM).

Learning Objective: Understand the derivation and components of the CAPM.

95. The CRO of a bank is evaluating the bank's practices for the management of risk data. The CRO notes that in characterizing various dimensions of a bank's data, the Basel Committee has suggested several principles to promote strong and effective risk data aggregation capabilities. Which statement correctly describes a recommendation that a bank should follow in accordance with the Basel Committee's principles for effective risk data aggregation and risk reporting?

A. The integrity principle recommends that data aggregation should be completely automated without any manual intervention.
B. The completeness principle recommends that a financial institution should capture data on its entire universe of material risk exposures.
C. The adaptability principle recommends that a bank should frequently update its risk reporting systems to incorporate changes in best practices.
D. The accuracy principle recommends that the risk data be reconciled with management's estimates of risk exposure prior to aggregation.

Correct Answer: B

Explanation: B is correct. The completeness principle recommends that a bank be able to capture and aggregate all data on the material risks to which it is exposed across the organization. This will allow it to identify and report risk exposures, concentrations, and set exposure limits.

Section: Foundations of Risk Management

Reference: Global Association of Risk Professionals. Foundations of Risk Management. New York, NY: Pearson, 2022. Chapter 7. Principles for Effective Data Aggregation and Risk Reporting.

Learning Objective: Describe key governance principles related to risk data aggregation and risk reporting.

96. A risk analyst at a growing bank is concerned about a loan exposure to a large manufacturing company which is losing significant market share in its industry. The analyst considers the use of different credit risk transfer mechanisms, including CDS, to manage this exposure. Which of the following statements correctly describes an appropriate benefit of using CDS in this situation?

A. CDS quantify the manufacturing company's default risk and allow the bank to monitor changes in this risk on a real-time basis.
B. CDS provide an agreement to periodically revalue the loan and transfer any net value change.
C. CDS require the manufacturing company to pay back the loan in full at an earlier point in time.
D. CDS allow the bank to offset its exposure to the company with loan exposures to other manufacturing companies.

Correct Answer: A

Explanation: A is correct. CDS (or credit default swaps) are credit derivatives that quantify a company's default risk and allow the bank to monitor changes in the company's default risk on a real-time basis. This is an improvement over credit ratings, which only update assessments of companies' default risk on a periodic basis.

B is incorrect. This would be a feature of marking-to-market/margining.

C is incorrect. This would be an example of a termination/put option mechanism.

D is incorrect. CDS do not provide an offset using loan exposures to other counterparties. A separate transfer mechanism, netting, can be used to offset negative and positive exposures to the same counterparty but this statement does not correctly describe netting either.

Section: Foundations of Risk Management

Reference: Global Association of Risk Professionals. Foundations of Risk Management. New York, NY: Pearson, 2022. Chapter 4. Credit Risk Transfer Mechanisms.

Learning Objective: Compare different types of credit derivatives, explain their applications, and describe their advantages.

97. An investment performance analyst is calculating some performance measures on portfolio LCM. Portfolio LCM has an expected return of 9%, volatility of 21%, and a beta of 0.3. If the risk-free rate is 3%, what is the Treynor measure of portfolio LCM?

A. 0.08
B. 0.15
C. 0.20
D. 0.40

Correct Answer: C

Explanation: C is correct. The Treynor measure can be calculated using the following equation:

$$T_p = \frac{E(R_p) - R_F}{\beta_p}$$

In this example, T_p = (9% - 3%)/0.3 = 0.20

Section: Foundations of Risk Management

Reference: Global Association of Risk Professionals. Foundations of Risk Management. New York, NY: Pearson, 2022. Chapter 5. Modern Portfolio Theory (MPT) and the Capital Asset Pricing Model (CAPM).

Learning Objective: Calculate, compare, and interpret the following performance measures: the Sharpe performance index, the Treynor performance index, the Jensen performance index, the tracking error, information ratio, and Sortino ratio.

98. A risk consultant is advising a pension fund to revise its asset allocation approach to be more consistent with the theory of CAPM. The consultant prepares a list of the assumptions of CAPM to support the advice. Which of the following is an assumption of CAPM?

A. There are transaction costs associated with buying and selling assets.
B. An individual investor can affect the price of a stock by buying or selling that stock.
C. Investors make their investment decisions by taking into account their personal income taxes.
D. Investors have the same expectations regarding the expected returns and the variance of returns of all assets.

Correct Answer: D

Explanation: D is correct. CAPM assumes investors have identical expectations with respect to expected returns, the variance of returns, and the correlation matrix representing the correlation structure between all pairs of stocks. The other choices are not assumptions of the CAPM.

A is incorrect. CAPM assumes no transaction costs, taxes, or other frictions.

B is incorrect. CAPM assumes any individual investor's allocation decision cannot change the market prices.

C is incorrect. As said above, CAPM assumes no transaction costs, taxes, or other frictions.

Section: Foundations of Risk Management

Reference: Global Association of Risk Professionals. Foundations of Risk Management. New York, NY: Pearson, 2022. Chapter 5. Modern Portfolio Theory (MPT) and the Capital Asset Pricing Model (CAPM).

Learning Objective: Describe the assumptions underlying the CAPM.

99. An analyst is analyzing the historical performance of two commodity funds tracking the Reuters/Jefferies-CRB® Index as benchmark. The analyst collated the data on the monthly returns and decided to use the information ratio (IR) to assess which fund achieved higher returns more efficiently, and presented the findings as shown below:

	Fund 1	Fund 2	Benchmark returns
Average monthly return	1.488%	1.468%	1.415%
Average excess return	0.073%	0.053%	0.000%
Standard deviation of returns	0.294%	0.237%	0.238%
Tracking error	0.344%	0.341%	0.000%

What is the information ratio for each fund, and what conclusion can be drawn?

A. IR for Fund 1 = 0.212, IR for Fund 2 = 0.155; Fund 1 performed better as it has a higher IR.
B. IR for Fund 1 = 0.212, IR for Fund 2 = 0.155; Fund 2 performed better as it has a lower IR.
C. IR for Fund 1 = 0.248, IR for Fund 2 = 0.224; Fund 1 performed better as it has a higher IR.
D. IR for Fund 1 = 0.248, IR for Fund 2 = 0.224; Fund 2 performed better as it has a lower IR.

Correct Answer: A

Explanation: A is correct. The information ratio may be calculated by either a comparison of the residual return to residual risk or the excess return to tracking error. The higher the IR, the better 'informed' the manager is at picking assets to invest in. Since neither residual return nor risk is given, only the latter is an option.

$$IR = E(R_p - R_b)/\text{Tracking Error}$$

For Fund 1: IR = 0.00073/0.00344 = 0.212; For Fund 2: IR = 0.00053/0.00341 = 0.155

Section: Foundations of Risk Management

Reference: Global Association of Risk Professionals. Foundations of Risk Management. New York, NY: Pearson, 2022. Chapter 5. Modern Portfolio Theory (MPT) and the Capital Asset Pricing Model (CAPM).

Learning Objective: Calculate, compare, and interpret the following performance measures: the Sharpe performance index, the Treynor performance index, the Jensen performance index, the tracking error, information ratio, and Sortino ratio.

100. An analyst is estimating the sensitivity of the return of stock A to different macroeconomic factors. The following estimates for the factor betas are prepared:

$\beta_{\text{Industrial production}} = 1.30$ $\beta_{\text{interest rate}} = -0.75$

Under baseline expectations, with industrial production growth of 3.0% and an interest rate of 1.5%, the expected return for Stock A is estimated to be 5.0%. The economic research department is forecasting an acceleration of economic activity for the following year, with industrial production forecast to grow 4.2% and interest rates increasing 25 bps to 1.75%. According to this forecast, what return of Stock A can be expected for next year?

A. 4.8%
B. 6.4%
C. 6.8%
D. 7.8%

Correct Answer: B

Explanation: B is correct. The expected return for Stock A equals the expected return for the stock under the baseline scenario, plus the impact of "shocks," or excess returns of, both factors. Since the baseline scenario incorporates 3% industrial production growth and a 1.5% interest rate, the "shocks" are 1.2% for the industrial production factor and 0.25% for the interest rate factor.

Therefore, the expected return for the new scenario = $\beta_{\text{Industrial production}}$ * Industrial production shock + $\beta_{\text{interest rate}}$ * Interest rate shock or 5% + (1.3 * 1.2%) + (-0.75 * 0.25%) = 6.37%.

Section: Foundations of Risk Management

Reference: Global Association of Risk Professionals. Foundations of Risk Management. New York, NY: Pearson, 2022. Chapter 6. The Arbitrage Pricing Theory and Multifactor Models of Risk and Return.

Learning Objective: Calculate the expected return of an asset using a single-factor and a multifactor model.

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