GARP | FRM

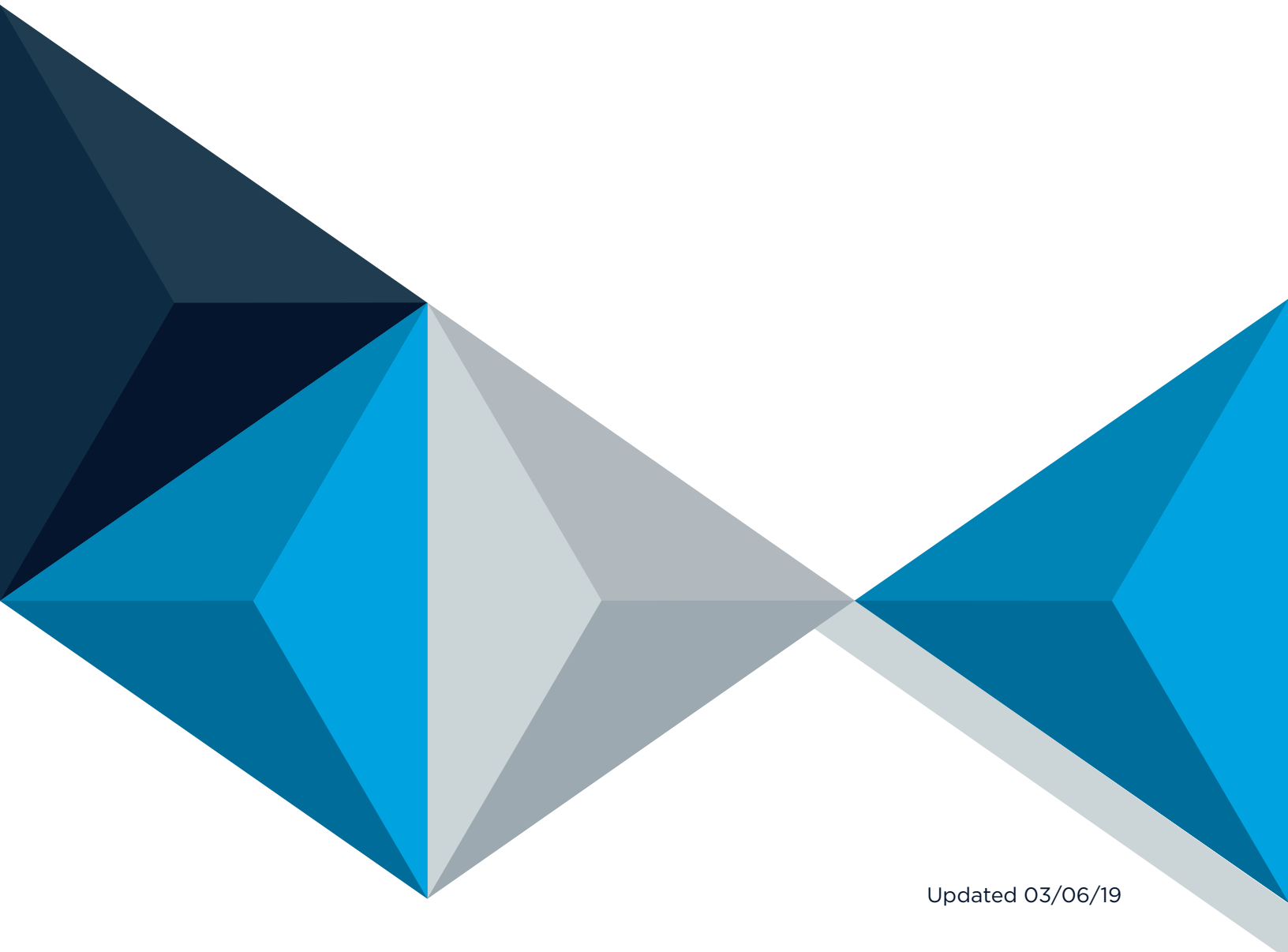
FINANCIAL RISK MANAGER

2019

FRM®

PRE-STUDY

Practice Exam Part I



Updated 03/06/19

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

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

The 2019 FRM Practice Exams do not necessarily cover all topics to be tested in the 2019 FRM Exam as any test samples from the universe of testable possible knowledge points. However, the questions selected for inclusion in the Practice Exams were chosen to be broadly reflective of the material assigned for 2019 as well as to represent the style of question that the FRM Committee considers appropriate based on assigned material.

For a complete list of current topics, core readings, and key learning objectives, candidates should refer to the 2019 FRM Exam Study Guide and 2019 FRM Learning Objectives.

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

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

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

Special Instructions and Definitions

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

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

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

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

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1. An analyst is evaluating the performance of a portfolio of Singaporean equities that is benchmarked to the Straits Times Index (STI). The analyst collects the following information about the portfolio and the benchmark index:

Expected return of the portfolio	7.6%
Volatility of returns of the portfolio	11.5%
Expected return of the STI	4.0%
Volatility of returns of the STI	8.7%
Risk-free rate of return	2.3%
Beta of portfolio relative to STI	1.7%

What is the Sharpe ratio of this portfolio?

A. 0.036
B. 0.047
C. 0.389
D. 0.461

2. An analyst wants to price a 9-month futures contract on a stock index. The current price of the index is USD 700 and the continuously compounded risk-free rate is 4.0% per year. If the stocks underlying the index provide a continuously compounded dividend yield of 2.5% per year, what is the no-arbitrage price of the 9-month futures contract?

A. USD 692.17
B. USD 707.92
C. USD 710.58
D. USD 721.32

3. Suppose the Russell 2000 Index has an expected annual return of 7.8% and volatility of 9.8%. Suppose the Alpha Industrial Fund has an expected annual return of 7.1% and volatility of 7.9% and is benchmarked against the Russell 2000 Index. According to the CAPM, if the risk-free rate is 3.2% per year, what is the beta of the Alpha Industrial Fund?

A. 0.85
B. 0.95
C. 1.13
D. 1.23

4. A risk manager is evaluating the price sensitivity of an investment-grade callable bond using the firm's valuation system. The table below presents information on the bond as well as on the embedded option. The current interest rate environment is flat at 4%.

	Value in USD per USD 100 face value	
Interest Rate Level	**Callable Bond**	**Call Option**
3.95%	97.9430	2.1972
4.00%	97.8910	2.1090
4.05%	97.8566	2.0035

The convexity of the callable bond can be estimated as:

A. 0.180
B. 0.360
C. 179.792
D. 719.167

5. A fixed-income portfolio manager purchases a seasoned 6% agency MBS with a weighted average loan age of 50 months. The current balance on the loans at the beginning of this month is USD 22 million, and the conditional prepayment rate is assumed to be constant at 5% per year. Which of the following is closest to the anticipated principal prepayment this month?

A. USD 22,558
B. USD 66,000
C. USD 91,667
D. USD 93,830

6. A portfolio manager is examining data regarding various index futures contracts traded at the CME Group. Which of the following observations would the portfolio manager most likely view as a potential problem?

A. The volume in a specific contract is greater than the open interest.
B. One specific contract is of a much smaller size than the others.
C. The prior settlement price for a specific contract is above the opening price.
D. In a specific contract, the last day on which trading can occur is not specified.

7. An analyst is examining a portfolio that consists of 2,500 subprime mortgages and 800 prime mortgages. Of the subprime mortgages, 500 are late on their payments. Of the prime mortgages, 64 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. 89%

8. TRSC, a trust company specializing in corporate investments, is brought in as a corporate trustee for a recent bond issue made by Banko, a small investment bank. Which of the following statements about TRSC and its role as a third party to the indenture is correct?

A. TRSC must monitor Banko's financial situation to foresee any covenant breaches.
B. When deemed necessary, TRSC should take action beyond the terms of the indenture in order to protect bondholders.
C. TRSC must take action according to the terms of the indenture whenever it is requested by bondholders.
D. TRSC is paid by Banko to represent the interests of the bondholders.

9. 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. If a 1-year zero-coupon bond is priced at USD 97 and a 1-year 7% coupon bond with semi-annual payments is priced at USD 102, using a replication approach, what should be the price of a 1-year 6% coupon Treasury bond that pays semi-annually?

A. USD 97.71
B. USD 101.04
C. USD 101.29
D. USD 102.86

10. An Italian bank enters into a 6-month forward contract with an importer to sell GBP 80 million in 6 months at a rate of EUR 1.13 per GBP 1. If in 6 months the exchange rate is EUR 1.12 per GBP 1, what is the payoff to the bank from the forward contract?

A. EUR -800,000
B. EUR -400,000
C. EUR 400,000
D. EUR 800,000

11. A risk manager is deciding between buying a futures contract on an exchange and buying a forward contract directly from a counterparty on the same underlying asset. Both contracts would have the same maturity of 2 years and the same delivery specifications. The manager finds that the futures price is higher 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. The forward contract counterparty is less likely to default than the counterparty in the futures transaction.
C. The transaction cost on the futures contract is higher than that on the forward contract.
D. The price of the underlying asset is strongly positively correlated with interest rates.

12. A hedge fund manager is comparing some forecasting models provided by the firm's modeling team and asks the firm's risk manager to suggest a selection criterion that applies the largest penalty for the number of parameters estimated. Which of the following model selection criteria has the largest penalty for the number of parameters estimated?

A. The Akaike information criterion
B. The mean squared error
C. The mean squared error corrected for degrees of freedom
D. The Schwarz information criterion

13. Suppose that the correlation of the return of a portfolio with the return of its benchmark is 0.7, the volatility of the return of the portfolio is 6.5%, and the volatility of the return of the benchmark is 5.0%. What is the beta of the portfolio with respect to its benchmark?

A. -0.91
B. 0.64
C. 0.80
D. 0.91

14. 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 autocovariances of a covariance stationary time series depend only on displacement, τ, not on time.
D. When the autocovariance function is asymmetric with respect to displacement, τ, forward looking stationarity can be achieved.

15. A risk manager is calculating the VaR of a fund with a data set of 50 weekly returns. The mean weekly return estimated from the sample is 8% with a standard deviation of 17%. 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. 2.4%
D. 10.0%

16. An analyst wants to price a 1-year, European-style call option on company REX's stock using the Black-Scholes-Merton (BSM) model. REX announces that it will pay a dividend of USD 1.25 per share on an ex-dividend date 1 month from now and has no further dividend payout plans. The relevant information for the BSM model inputs are in the following table.

Current stock price (S_0)	USD 60
Stock price volatility (σ)	12% per year
Risk-free rate (r)	3.5% per year
Call option exercise price (K)	USD 60
N(d1)	0.570143
N(d2)	0.522623

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

A. USD 2.40
B. USD 3.22
C. USD 3.97
D. USD 4.81

17. An actuary at an insurance company is asked to estimate an ordinary least squares estimation (OLS) regression model to analyze company performance. The actuary is concerned that important variables could be omitted in the OLS regression model, resulting in omitted variable bias which would reduce the accuracy of the result. When does omitted variable bias occur?

A. Omitted variable bias occurs when the omitted variable is correlated with all of the included independent variables and is a determinant of the dependent variable.
B. Omitted variable bias occurs when the omitted variable is correlated with at least one of the included independent variables and is a determinant of the dependent variable.
C. Omitted variable bias occurs when the omitted variable is independent of the included independent variables and is a determinant of the dependent variable.
D. Omitted variable bias occurs when the omitted variable is independent of the included independent variables but is not a determinant of the dependent variable.

18. The current price of a 6-month, USD 30.00 strike price, European-style put option on a stock is USD 4.00. The current stock price is USD 32.00. A special one-time dividend of USD 0.75 per share is expected in 3 months. The continuously compounded risk-free rate for all maturities is 3.5% per year. Which of the following is closest to the no-arbitrage value of a European-style call option on the same underlying stock with a strike price of USD 30.00 and a time to maturity of 6 months?

A. USD 2.22
B. USD 5.26
C. USD 5.78
D. USD 6.52

QUESTIONS 19 AND 20 REFER TO THE FOLLOWING INFORMATION:

A risk manager is considering writing a 6-month American-style put option on a non-dividend paying stock Y. The current stock price is USD 30, and the strike price of the option is USD 32. To find the no-arbitrage price of the option, the manager uses a two-step binomial tree model. The stock price can go up or down by 15% each period. The manager's view is that the stock price has a 60% probability of going up each period and a 40% probability of going down each period. The annual risk-free rate is 4% with continuous compounding.

19. What is the risk-neutral probability of the stock price going up in a single step?

A. 16.0%
B. 46.7%
C. 53.4%
D. 84.0%

20. The no-arbitrage price of the 6-month option is closest to:

A. USD 2.00
B. USD 3.51
C. USD 3.66
D. USD 3.69

21. A risk manager is preparing a report on past financial disasters and is reviewing the factors that led to these failures. Which of the following factors is correct about the Kidder Peabody case study?

A. Kidder Peabody entered into significant amounts of unauthorized derivative trades, which caused the company to experience extreme financial difficulty to the point of being insolvent.
B. Kidder Peabody reported unprofitable trades booked to fictitious customer accounts, which eventually were detected and led to the reporting of a large quarterly loss.
C. Kidder Peabody reported a sudden large accounting loss after reversing previous gains from incorrectly reported trades, which called into question the management team's competence.
D. Kidder Peabody suffered a large loss after obtaining excessive amounts of funds from investors and then losing the funds in the outright positions it took in bond markets.

22. The collapse of Long-Term Capital Management (LTCM) is a classic risk management case study. Which of the following statements about risk management at LTCM is correct?

A. LTCM's traders did not respond quickly enough to changes in market volatility as there were significant barriers that blocked the flow of information.
B. LTCM failed to account for the illiquidity of its largest positions in its risk calculations.
C. LTCM's use of high leverage is evidence of poor risk management.
D. LTCM did not run any stress scenarios on its VaR model.

23. A portfolio of investment securities for a regional bank has a current market value of USD 3,700,000 with a daily variance of 0.0004. Assuming there are 250 trading days in a year and the portfolio returns are independent and follow the same normal distribution with zero mean, what is the estimate of the annual VaR at the 95% confidence level?

A. USD 38,494
B. USD 121,730
C. USD 1,924,720
D. USD 2,721,519

24. Bank PZR entered into a 2-year interest rate swap contract on September 7, 2016. According to the swap, Bank PZR would receive a 4.10% fixed rate and pay LIBOR plus 1.30% on a notional amount of USD 7.5 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
Sep 7, 2016	2.46%
Mar 7, 2017	1.13%
Sept 7, 2017	0.79%
Mar 7, 2018	0.42%
Sep 7, 2018	0.56%

Assuming no default, how much did Bank PZR receive on September 7, 2018?

A. USD 12,750
B. USD 75,375
C. USD 84,000
D. USD 89,250

25. The board of directors of a diversified industrial company has asked the risk management group to prepare a risk appetite framework for the organization. Which of the following activities should take place as part of the process of developing the company's risk appetite?

A. Constructing a list of all risks to which the company could potentially be exposed to
B. Deciding on the types of risks the company is willing to accept across the organization
C. Identifying the instruments that can be used to manage specific risk exposures
D. Estimating the current and future sizes of the risks that the company could face

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

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

1. An analyst is evaluating the performance of a portfolio of Singaporean equities that is benchmarked to the Straits Times Index (STI). The analyst collects the following information about the portfolio and the benchmark index:

Expected return of the portfolio	7.6%
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Expected return of the STI	4.0%
Volatility of returns of the STI	8.7%
Risk-free rate of return	2.3%
Beta of portfolio relative to STI	1.7%

What is the Sharpe ratio of this portfolio?

A. 0.036
B. 0.047
C. 0.389
D. 0.461

Correct Answer: D

Explanation: The Sharpe ratio for the portfolio is:

$$\frac{Expected\ return\ of\ portfolio - Risk\ free\ rate}{Volatility\ of\ returns\ of\ portfolio} = \frac{7.6\% - 2.3\%}{11.5\%} = 0.461$$

Section: Foundations of Risk Management

Reference: Noel Amenc and Veronique Le Sourd, Portfolio Theory and Performance Analysis (West Sussex, England: Wiley & Sons, 2003), Chapter 4, Section 4.2 — Applying the CAPM to Performance Measurement: Single-Index Performance Measurement Indicators.

Learning Objective: Calculate, compare, and evaluate the Treynor measure, the Sharpe measure, and Jensen's alpha.

2. An analyst wants to price a 9-month futures contract on a stock index. The current price of the index is USD 700 and the continuously compounded risk-free rate is 4.0% per year. If the stocks underlying the index provide a continuously compounded dividend yield of 2.5% per year, what is the no-arbitrage price of the 9-month futures contract?

A. USD 692.17
B. USD 707.92
C. USD 710.58
D. USD 721.32

Correct Answer: B

Explanation: The formula for computing the forward price on a financial asset is:

$$\mathrm{F_{0,T}} = \mathrm{S_0 e^{(r-q)T}}$$

where S_0 is the spot price of the asset = USD 700, r is the continuously compounded risk-free interest rate = 4.0%, q is the continuous dividend yield on the asset = 2.5%, and T is time until delivery date in years = 9/12 = 0.75.

The no-arbitrage futures price is computed as follows:

$$F_0 = 700 * e^{(0.04-0.025)*0.75} = 707.9195$$

A is incorrect. USD 692.17 is the result obtained when the risk-free rate and dividend yield are switched in the formula for a 9-month futures price

C is incorrect. USD 710.58 is the futures price in 1 year, not 9 months.

D is incorrect. USD 721.31 is the result obtained when the dividend yield is not considered.

Section: Financial Markets and Products

Reference: John C. Hull, Options, Futures, and Other Derivatives, 10th Edition (New York, NY: Pearson, 2017), Chapter 5 - Determination of Forward and Futures Prices

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

3. Suppose the Russell 2000 Index has an expected annual return of 7.8% and volatility of 9.8%. Suppose the Alpha Industrial Fund has an expected annual return of 7.1% and volatility of 7.9% and is benchmarked against the Russell 2000 Index. According to the CAPM, if the risk-free rate is 3.2% per year, what is the beta of the Alpha Industrial Fund?

A. 0.85
B. 0.95
C. 1.13
D. 1.23

Correct Answer: A

Explanation: Since the correlation or covariance between the Alpha Industrial Fund and the Russell 2000 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 Russell 2000 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 Russell 2000 Index).

Therefore,
$7.1\% = 3.2\% + \beta_i * (7.8\% - 3.2\%)$.
Hence,
$\beta_i = (7.1\% - 3.2\%)/(7.8\% - 3.2\%) = 0.85$.

Section: Foundations of Risk Management

Reference: Edwin J. Elton, Martin J. Gruber, Stephen J. Brown and William N. Goetzmann, Modern Portfolio Theory and Investment Analysis, 9th Edition (Hoboken, NJ: John Wiley & Sons, 2014), Chapter 13 – The Standard Capital Asset Pricing Model

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.

4. A risk manager is evaluating the price sensitivity of an investment-grade callable bond using the firm's valuation system. The table below presents information on the bond as well as on the embedded option. The current interest rate environment is flat at 4%.

	Value in USD per USD 100 face value	
Interest Rate Level	**Callable Bond**	**Call Option**
3.95%	97.9430	2.1972
4.00%	97.8910	2.1090
4.05%	97.8566	2.0035

The convexity of the callable bond can be estimated as:

A. 0.180
B. 0.360
C. 179.792
D. 719.167

Correct Answer: D

Explanation: Convexity is defined as the second derivative of the price-rate function divided by the price of the bond. To estimate convexity, one must first estimate the difference in bond price per difference in the rate for two separate rate environments, one a step higher than the current rate and one a step lower. One must then estimate the change across these two values per difference in rate. This is given by the formula:

$$C = \frac{1}{P_0} * \frac{\frac{P_1 - P_0}{\Delta r} - \frac{P_0 - P_{-1}}{\Delta r}}{\Delta r} = \frac{1}{P_0} * \frac{P_1 - 2P_0 + P_{-1}}{(\Delta r)^2}$$

where Δr is the change in the rate in one step; in this case, 0.05%. Therefore, the best estimate of convexity is:

$$C = \frac{1}{97.8910} * \left[\frac{97.8566 - 2 * 97.8910 + 97.9430}{(0.0005)^2} \right] = 719.1672$$

A is incorrect. 0.1798 is the result obtained when the change in yield in the formula is taken as 0.10% instead of the square of 0.05%.

B is incorrect. 0.3596 is the result obtained when the change in yield in the formula is taken as 0.05% instead of the square of 0.05%.

C is incorrect. 179.7918 is the result obtained when the change in yield in the formula is taken as the square of 0.10% instead of the square of 0.05%.

Section: Valuation and Risk Models

Reference: Bruce Tuckman and Angel Serrat, Fixed Income Securities: Tools for Today's Markets, 3rd Edition (Hoboken, NJ: John Wiley & Sons, 2011), Chapter 4 – One-Factor Risk Metrics and Hedges

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

5. A fixed-income portfolio manager purchases a seasoned 6% agency MBS with a weighted average loan age of 50 months. The current balance on the loans at the beginning of this month is USD 22 million, and the conditional prepayment rate is assumed to be constant at 5% per year. Which of the following is closest to the anticipated principal prepayment this month?

A. USD 22,558
B. USD 66,000
C. USD 91,667
D. USD 93,830

Correct Answer: D

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

$CPR = 1 - (1 - SMM)^{12}$. And so,

$SMM = 1 - (1 - CPR)^{1/12} = 1 - (1 - 0.05)^{1/12} = 0.004265 = 0.4265\%$.

Therefore,

the anticipated principal prepayment is equal to the percentage of principal outstanding at the beginning of the month that is anticipated to be prepaid during the month = 22,000,000 * 0.004265 = USD 93,830.

A is incorrect. USD 22,558 is the result of using an incorrect formula: $SMM = 1 - (1 - CPR)^{1/50}$.

B is incorrect. USD 66,000 is the outcome of computing 5% of the annual coupon payment based on the current balance = USD 22,000,000*0.06*0.05 = USD 66,000.

C is incorrect. USD 91,667 is the result of multiplying USD 22,000,000 by 5%/12.

Section: Financial Markets and Products

Reference: Bruce Tuckman and Angel Serrat, Fixed Income Securities: Tools for Today's Markets, 3rd Edition, (New York: John Wiley & Sons, 2011), Chapter 20 - Mortgages and Mortgage-Backed Securities

Learning Objectives: Calculate a fixed rate mortgage payment, and its principal and interest components. Describe the mortgage prepayment option and the factors that influence prepayments.

Calculate weighted average coupon, weighted average maturity, and conditional prepayment rate (CPR) for a mortgage pool.

6. A portfolio manager is examining data regarding various index futures contracts traded at the CME Group. Which of the following observations would the portfolio manager most likely view as a potential problem?

A. The volume in a specific contract is greater than the open interest.
B. One specific contract is of a much smaller size than the others.
C. The prior settlement price for a specific contract is above the opening price.
D. In a specific contract, the last day on which trading can occur is not specified.

Correct Answer: D

Explanation: For any type of futures contract, the exchange specifies the first day and the last day that trade can occur in a particular month.

Section: Financial Markets and Products

Reference: John C. Hull, Options, Futures, and Other Derivatives, 10th Edition (New York, NY: Pearson, 2017), Chapter 2 - Futures Markets and Central Counterparties.

Learning Objective: Define and describe the key features of a futures contract, including the asset, the contract price and size, delivery, and limits.

7. An analyst is examining a portfolio that consists of 2,500 subprime mortgages and 800 prime mortgages. Of the subprime mortgages, 500 are late on their payments. Of the prime mortgages, 64 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. 89%

Correct Answer: D

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

This is: P(Mortgage is late) = (500+64)/(2500+800) = 17.1%.

Next, use the conditional probability relationship as follows:

P(Subprime mortgage | Mortgage is late) = P(Subprime mortgage and late)/P(Mortgage is late).

Since P(Subprime mortgage and late) = 500/3300 = 15.2%, then

P(Mortgage subprime | Mortgage is late) = 15.2% / 17.1% = 0.89 = 89%.

Hence the probability that a random late mortgage selected from this portfolio turns out to be subprime is 89%.

Section: Quantitative Analysis

Reference: Michael Miller, Mathematics and Statistics for Financial Risk Management, 2nd Edition (Hoboken, NJ: John Wiley & Sons, 2013). Chapter 2 - Probabilities

Learning Objective: Define and calculate a conditional probability, and distinguish between conditional and unconditional probabilities.

8. TRSC, a trust company specializing in corporate investments, is brought in as a corporate trustee for a recent bond issue made by Banko, a small investment bank. Which of the following statements about TRSC and its role as a third party to the indenture is correct?

A. TRSC must monitor Banko's financial situation to foresee any covenant breaches.
B. When deemed necessary, TRSC should take action beyond the terms of the indenture in order to protect bondholders.
C. TRSC must take action according to the terms of the indenture whenever it is requested by bondholders.
D. TRSC is paid by Banko to represent the interests of the bondholders.

Correct Answer: D

Explanation: Trustees are not required to take actions to monitor indenture covenant compliance. Trustees can only perform the actions indicated in the indenture but are typically under no obligation to exercise the powers granted by the indenture even at the request of bondholders. It is true that the trustee is paid by the debt issuer, not by bond holders or their representatives.

Section: Financial Markets and Products

Reference: Frank Fabozzi (editor), The Handbook of Fixed Income Securities, 8th Edition (New York: McGraw Hill, 2012), Chapter 12 - Corporate Bonds

Learning Objective: Describe a bond indenture and explain the role of the corporate trustee in a bond indenture.

9. 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. If a 1-year zero-coupon bond is priced at USD 97 and a 1-year 7% coupon bond with semi-annual payments is priced at USD 102, using a replication approach, what should be the price of a 1-year 6% coupon Treasury bond that pays semi-annually?

A. USD 97.71
B. USD 101.04
C. USD 101.29
D. USD 102.86

Correct Answer: C

Explanation: 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 7% coupon bond, respectively, corresponding to the proportions of the zero-coupon bond and the 7% 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): $97*F_1 + 102*F_2 = F_3$ …… Equation (1)

Time (t=0.5): $0*F_1 + 3.5*F_2 = 3$…… Equation (2)

Time (t=1.0): $100*F_1 + 103.5*F_2 = 103$ …….. Equation (3)

From Equation (2), $F_2 = 3/3.5 = 0.8571$

Substituting the value of F_2 in Equation (3): $100*F_1 + 103.5*0.8571 = 103$, giving, $F_1 = 0.1429$

Plugging the values of F_1 and F_2 in Equation (1), we determine $F_3 = 97*0.1429 + 102*0.8571 = 101.2855$

A is incorrect. USD 97.71 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 101.04 is the price of the 1-year 6% coupon Treasury bond if the yield-to-maturity of the 1-year 7% coupon Treasury bond is used in its pricing and the zero-coupon Treasury bond is ignored.

D is incorrect. USD 102.86 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 7% coupon Treasury bond is ignored.

Section: Valuation and Risk Models

Reference: Bruce Tuckman and Angel Serrat, Fixed Income Securities: Tools for today's markets, 3rd Edition (Hoboken, NJ: John Wiley & Sons, 2011), Chapter 1 - Prices, Discount Factors, and Arbitrage

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

10. An Italian bank enters into a 6-month forward contract with an importer to sell GBP 80 million in 6 months at a rate of EUR 1.13 per GBP 1. If in 6 months the exchange rate is EUR 1.12 per GBP 1, what is the payoff to the bank from the forward contract?

A. EUR -800,000
B. EUR -400,000
C. EUR 400,000
D. EUR 800,000

Correct Answer: D

Explanation: The value of the contract for the bank at expiration: GBP 80,000,000 * 1.13 EUR/GBP = EUR 90,400,000. The cost to close out the contract for the bank at expiration: GBP 80,000,000 * 1.12 EUR/GBP = EUR 89,600,000.

Therefore, the final payoff in EUR to the bank can be calculated as: 90,400,000 – 89,600,000 = EUR 800,000 or 80,000,000 * (1.13 – 1.12) = EUR 800,000.

A is incorrect. The EUR has appreciated against the GBP and in 6 months the forward contract worked in favor of the bank's short position, so the net payoff is positive for the bank, and not negative.

B is incorrect. As explained in D and A, the net payoff is positive for the bank, and not negative. Also, the contract has 6-month terms and there no need to multiply the net payoff by 0.5 ((i.e., GBP 80,000,000*(1.13 – 1.12)EUR/GBP)*0.5 = EUR 400,000).

C is incorrect, as explained in D and B above.

Section: Financial Markets and Products

Reference: John C. Hull, Options, Futures, and Other Derivatives, 10th Edition (New York, NY: Pearson, 2017), Chapter 1 – Introduction

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

11. A risk manager is deciding between buying a futures contract on an exchange and buying a forward contract directly from a counterparty on the same underlying asset. Both contracts would have the same maturity of 2 years and the same delivery specifications. The manager finds that the futures price is higher 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. The forward contract counterparty is less likely to default than the counterparty in the futures transaction.
C. The transaction cost on the futures contract is higher than that on the forward contract.
D. The price of the underlying asset is strongly positively correlated with interest rates.

Correct Answer: D

Explanation: When an asset is strongly positively correlated with interest rates, futures prices whose maturities are more than a few months tend to be slightly higher than forward prices. When the underlying asset increases in price, the long position holder's immediate gain arising from the daily futures settlement will tend to be invested at a higher than average rate of interest due to the positive correlation. In this case, futures would sell for slightly more 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.

The other three choices would all most likely result in the futures price being lower than the forward price.

Section: Financial Markets and Products

Reference: John C. Hull, Options, Futures, and Other Derivatives, 10th Edition (New York, NY: Pearson, 2017), Chapter 5 - Determination of Forward and Futures Prices

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

12. A hedge fund manager is comparing some forecasting models provided by the firm's modeling team and asks the firm's risk manager to suggest a selection criterion that applies the largest penalty for the number of parameters estimated. Which of the following model selection criteria has the largest penalty for the number of parameters estimated?

A. The Akaike information criterion
B. The mean squared error
C. The mean squared error corrected for degrees of freedom
D. The Schwarz information criterion

Correct Answer: D

Explanation: The Schwarz information criterion penalizes degrees of freedom most heavily for a given number of observations compared to the mean squared error, Akaike information criterion, or mean squared error corrected for degrees of freedom.

Section: Quantitative Analysis

Reference: Francis X. Diebold, Elements of Forecasting, 4th Edition (Mason, OH: Cengage Learning, 2006). Chapter 5 - Modeling and Forecasting Trend

Learning Objective: Compare and evaluate model selection criteria, including mean squared error (MSE), s2, the Akaike information criterion (AIC), and the Schwarz information criterion (SIC).

13. Suppose that the correlation of the return of a portfolio with the return of its benchmark is 0.7, the volatility of the return of the portfolio is 6.5%, and the volatility of the return of the benchmark is 5.0%. What is the beta of the portfolio with respect to its benchmark?

A. -0.91
B. 0.64
C. 0.80
D. 0.91

Correct Answer: D

Explanation: The following equation is used to calculate beta:

$$\beta = \rho \frac{\sigma(portfolio)}{\sigma(benchmark)} = 0.7 * \frac{0.065}{0.05} = 0.91$$

where ρ represents the correlation coefficient and σ the volatility.

Section: Foundations of Risk Management

Reference: Edwin J. Elton, Martin J. Gruber, Stephen J. Brown and William N. Goetzmann, Modern Portfolio Theory and Investment Analysis, 9th Edition (Hoboken, NJ: John Wiley & Sons, 2014), Chapter 13 - The Standard Capital Asset Pricing Model

Learning Objective: Understand the derivation and components of the CAPM.

14. 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 autocovariances of a covariance stationary time series depend only on displacement, τ, not on time.
D. When the autocovariance function is asymmetric with respect to displacement, τ, forward looking stationarity can be achieved.

Correct Answer: C

Explanation: 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 displacement, τ, not on time, t. Also, covariance stationarity does not place restrictions on other aspects of the distributions or the series, such as kurtosis and skewness.

Section: Quantitative analysis

Reference: Francis X. Diebold, Elements of Forecasting, 4th Edition (Mason, OH: Cengage Learning, 2006), Chapter 7 – Characterizing Cycles

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

15. A risk manager is calculating the VaR of a fund with a data set of 50 weekly returns. The mean weekly return estimated from the sample is 8% with a standard deviation of 17%. 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. 2.4%
D. 10.0%

Correct Answer: C

Explanation: 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 17%/sqrt(50) = 2.4%.

Section: Quantitative Analysis

Reference: Michael Miller, Mathematics and Statistics for Financial Risk Management, 2nd Edition (Hoboken, NJ: John Wiley & Sons, 2013), Chapter 7 – Hypothesis Testing and Confidence Intervals

Learning Objective: Calculate and interpret the sample mean and sample variance.

16. An analyst wants to price a 1-year, European-style call option on company REX's stock using the Black-Scholes-Merton (BSM) model. REX announces that it will pay a dividend of USD 1.25 per share on an ex-dividend date 1 month from now and has no further dividend payout plans. The relevant information for the BSM model inputs are in the following table.

Current stock price (S_0)	USD 60
Stock price volatility (σ)	12% per year
Risk-free rate (r)	3.5% per year
Call option exercise price (K)	USD 60
N(d1)	0.570143
N(d2)	0.522623

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

A. USD 2.40
B. USD 3.22
C. USD 3.97
D. USD 4.81

Correct Answer: B

Explanation: In the case of no dividends, the value of a European call is equal to

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

where N is the standard normal cumulative function (and $N(d_1)$ and $N(d_2)$ already account for the expected dividend payment). 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 = 1.25 * exp(-3.5%*(1/12)) = 1.2464.

S_0 = 60 – 1.2464 = 58.7536

Call option price = $S_0*N(d_1) - K*e^{-rT}*N(d_2)$ = 58.7536*0.570143 – 60*$e^{-0.035*1}$*0.522623 = 33.4978 – 30.2787 = USD 3.2191.

A is incorrect. USD 2.40 is the value of a European put option on stock REX.

C is incorrect. USD 3.97 is the result when the dividend payment is not accounted for in the formula.

D is incorrect. USD 4.81 is the result obtained if the dividend payment is incorrectly added to the stock price to be paid in 1 year instead of 1 month.

Section: Valuation and Risk Models

Reference: John C. Hull, Options, Futures, and Other Derivatives, 10th Edition (New York, NY: Pearson, 2017), 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.

17. An actuary at an insurance company is asked to estimate an ordinary least squares estimation (OLS) regression model to analyze company performance. The actuary is concerned that important variables could be omitted in the OLS regression model, resulting in omitted variable bias which would reduce the accuracy of the result. When does omitted variable bias occur?

A. Omitted variable bias occurs when the omitted variable is correlated with all of the included independent variables and is a determinant of the dependent variable.
B. Omitted variable bias occurs when the omitted variable is correlated with at least one of the included independent variables and is a determinant of the dependent variable.
C. Omitted variable bias occurs when the omitted variable is independent of the included independent variables and is a determinant of the dependent variable.
D. Omitted variable bias occurs when the omitted variable is independent of the included independent variables but is not a determinant of the dependent variable.

Correct Answer: B

Explanation: 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.

Section: Quantitative Analysis

Reference: James Stock and Mark Watson, Introduction to Econometrics, Brief Edition (Boston, MA: Pearson, 2008), Chapter 6 – Linear Regression with Multiple Regressors

Learning Objective: Define and interpret omitted variable bias, and describe the methods for addressing this bias.

18. The current price of a 6-month, USD 30.00 strike price, European-style put option on a stock is USD 4.00. The current stock price is USD 32.00. A special one-time dividend of USD 0.75 per share is expected in 3 months. The continuously compounded risk-free rate for all maturities is 3.5% per year. Which of the following is closest to the no-arbitrage value of a European-style call option on the same underlying stock with a strike price of USD 30.00 and a time to maturity of 6 months?

A. USD 2.22
B. USD 5.26
C. USD 5.78
D. USD 6.52

Correct Answer: C

Explanation: 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 4.00,

c is the call price = to be determined,

K is the strike price of the put option = USD 30.00,

D is the dividend = USD 0.75,

S_0 is the current stock price = USD 32.00.

t is the time to the one-time dividend = 3/12 = 0.25.

T is the time to expiration of the option = 6/12 = 0.5

r is the annual risk-free rate of interest = 3.5%

Calculating PV(K), the present value of the strike price results in a value of $30.00 * e^{-0.035*0.5}$ or 29.4796, while PV(D) is equal to $0.75 * e^{-0.035*0.25} = 0.7435$.

Hence, c = 32.00 + 4.00 – 29.4796 – 0.7435 = USD 5.7769.

A is incorrect. USD 2.22 is the price of the call option if the put-call parity formula is incorrectly expressed as follows: $c = p + PV(K) - S_0 + PV(D)$. Thus, c = 4.00 + 29.4796 – 32.00 + 0.7435 = 2.2231.

B is incorrect. USD 5.26 is the price of the call option if the strike price, and not the present value of the strike price, is used in the formula. c = 32.00 + 4.00 – 30.00 – 0.7435 = 5.2565.

D is incorrect. USD 6.52 is the price of the call option if dividends are ignored. Using the incorrect formula $c = S_0 + p - PV(K)$, the result is as follows: c = 32.00 + 4.00 – 29.4796 = 6.5204.

Section: Financial Markets and Products

Reference: John C. Hull, Options, Futures, and Other Derivatives, 10th Edition (New York, NY: Pearson, 2017), Chapter 11 - Properties of Stock Options

Learning Objective: Explain put-call parity and apply it to the valuation of European and American stock options with dividends and without dividends.

QUESTIONS 19 AND 20 REFER TO THE FOLLOWING INFORMATION:

A risk manager is considering writing a 6-month American-style put option on a non-dividend paying stock Y. The current stock price is USD 30, and the strike price of the option is USD 32. To find the no-arbitrage price of the option, the manager uses a two-step binomial tree model. The stock price can go up or down by 15% each period. The manager's view is that the stock price has a 60% probability of going up each period and a 40% probability of going down each period. The annual risk-free rate is 4% with continuous compounding.

19. What is the risk-neutral probability of the stock price going up in a single step?

A. 16.0%
B. 46.7%
C. 53.4%
D. 84.0%

Correct Answer: C

Explanation: The calculation of the risk-neutral probability of an upward move in the first step is as follows:

$$P_{\text{up-movement}} = \frac{e^{r\Delta t} - d}{u - d} = \frac{e^{0.04*3/12} - 0.85}{1.15 - 0.85} = 0.5335 = 53.35\%$$

Therefore, p(down-movement) = 1 – 0.5335 = 0.4665 = 46.65%

where,

d = 1 - 0.15 = 0.85 and

u = 1 + 0.15 = 1.15 because the stock price can move up or down by 15% at each time step.

A is incorrect. 16% is the result obtained when only the formula for the probability of the stock going up is used, and the denominator (u – d) in the formula is ignored.

B is incorrect. 46.7% is the risk-neutral probability of the stock going down.

D is incorrect. 84.0% is the risk-neutral probability of the stock going down when the denominator (u – d) in the formula is ignored.

Section: Valuation and Risk Models

Reference: John C. Hull, Options, Futures, and Other Derivatives, 10th Edition (New York, NY: Pearson, 2017), Chapter 13 – Binomial Trees

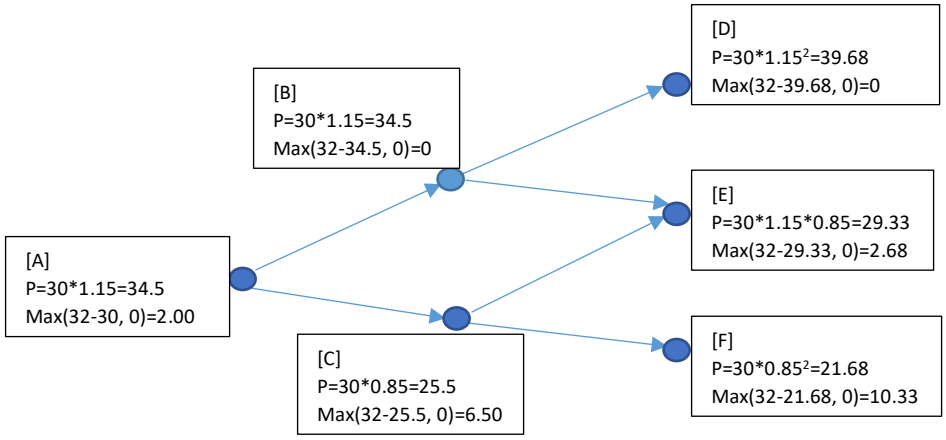
Learning Objective: Calculate the value of an American and a European call or put option using a one-step and two-step binomial model.

20. The no-arbitrage price of the 6-month option is closest to:

A. USD 2.00
B. USD 3.51
C. USD 3.66
D. USD 3.69

Correct Answer: C

Explanation: The risk-neutral probability of an up move is 53.35% (calculated in the previous question) and the risk-neutral probability of the down move is 46.65%.



The figure shows the stock price and the respective option value at each node.

➢ Time - 6 Months:

At the final nodes, the value is calculated as max(0, K-S).

Node [D]: Intrinsic value of the put option = Max(32-39.68, 0) = 0

Node [E]: Intrinsic value of the put option = Max(32-29.33, 0) = 2.68

Node [F]: Intrinsic value of the put option = Max(32-21.68, 0) = 10.33

Next, assess the option values at each of the other nodes as follows:

➢ Time – 3 Months:

Node [B]: The risk-neutral expected future option payoff is given by (0.5335*0+0.4665*2.68)*exp(-0.04*3/12)=1.2378, which is greater than the intrinsic value of the option at this node equal to max(32-34.5, 0)=0, so the option should not be exercised early at this node. That is, it is more valuable to wait until maturity to exercise the option.

Node [C]: The risk-neutral expected future payoff is given by (0.5335*2.68+0.4665*10.33)*exp(-0.04*0.25)=6.1865, which is lower than the intrinsic value of the option at this node equal to max(32-25.5, 0)=6.50, so the option should be exercised early at node C with the value of the option at node C being USD 6.50.

Node [A]: The risk-neutral expected future payoff is given by (0.5335*1.2378+0.4665*6.5)*exp(-0.04*0.25)=3.6570, which is greater than the intrinsic value of the option at this node equal to max(32-30)=2, so the option should not be exercised early at this node.

Therefore, the no-arbitrage price of the option at node A = USD 3.6570.

A is incorrect. USD 2.00 is the intrinsic value of the option at the initial date, node A.

B is incorrect. USD 3.5076 is the value of the option if it is a European put option, and thus only exercised at expiration in 6 months.

D is incorrect. USD 3.6914 is the expected value of the option at the 3-month date, which is not discounted to node A.

Section: Valuation and Risk Models

Reference: John C. Hull, Options, Futures, and Other Derivatives, 10th Edition (New York, NY: Pearson, 2017), Chapter 13 - Binomial Trees

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

21. A risk manager is preparing a report on past financial disasters and is reviewing the factors that led to these failures. Which of the following factors is correct about the Kidder Peabody case study?

A. Kidder Peabody entered into significant amounts of unauthorized derivative trades, which caused the company to experience extreme financial difficulty to the point of being insolvent.
B. Kidder Peabody reported unprofitable trades booked to fictitious customer accounts, which eventually were detected and led to the reporting of a large quarterly loss.
C. Kidder Peabody reported a sudden large accounting loss after reversing previous gains from incorrectly reported trades, which called into question the management team's competence.
D. Kidder Peabody suffered a large loss after obtaining excessive amounts of funds from investors and then losing the funds in the outright positions it took in bond markets.

Correct Answer: C

Explanation: Kidder Peabody's accounting system failed to account for the present value of forward trades, which allowed trader Joseph Jett to book an instant, but fraudulent, accounting profit by purchasing cash bonds to be delivered at a later date. These profits would dissipate as the bonds approached their delivery date, but Jett covered this up by rolling the positions forward with increasingly greater positions and longer lengths to delivery, which created a higher stream of hypothetical profits due to the accounting flaw. Finally, this stream of large profits was investigated, and Kidder Peabody was forced to take a USD 350 million accounting loss to reverse the reported gains, which resulted in a loss of confidence in the firm and General Electric's subsequent sale.

Section: Foundations of Risk Management

Reference: Steve Allen, Financial Risk Management: A Practitioner's Guide to Managing Market and Credit Risk, 2nd Edition (New York: John Wiley & Sons, 2013), Chapter 4 – Financial Disasters

Learning Objective: Analyze the key factors that led to and derive the lessons learned from the following risk management case studies: Kidder Peabody.

22. The collapse of Long-Term Capital Management (LTCM) is a classic risk management case study. Which of the following statements about risk management at LTCM is correct?

A. LTCM's traders did not respond quickly enough to changes in market volatility as there were significant barriers that blocked the flow of information.
B. LTCM failed to account for the illiquidity of its largest positions in its risk calculations.
C. LTCM's use of high leverage is evidence of poor risk management.
D. LTCM did not run any stress scenarios on its VaR model.

Correct Answer: B

Explanation: A major contributing factor to the collapse of LTCM is that it did not account properly for the illiquidity of its largest positions in its risk calculations. LTCM received valuation reports from dealers who only knew a small portion of LTCM's total position in particular securities, therefore understating LTCM's true liquidity risk. When the markets became unsettled due to the Russian debt crisis in August 1998 and a separate firm decided to liquidate large positions which were similar to many at LTCM, the illiquidity of LTCM's positions forced it into a situation where it was reluctant to sell and create an even more dramatic adverse market impact even as its equity was rapidly deteriorating. To avert a full collapse, LTCM's creditors finally stepped in to provide USD 3.65 billion in additional liquidity to allow LTCM to continue holding its positions through the turbulent market conditions in the fall of 1998.

However, as a result, investors and managers in LTCM other than the creditors themselves lost almost all their investment in the fund.

Section: Foundations of Risk Management

Reference: Steve Allen, Financial Risk Management: A Practitioner's Guide to Managing Market and Credit Risk, 2nd Edition (New York: John Wiley & Sons, 2013), Chapter 4 - Financial Disasters

Learning Objective: Analyze the key factors that led to and derive the lessons learned from the following risk management case studies: Long-Term Capital Management (LTCM).

23. A portfolio of investment securities for a regional bank has a current market value of USD 3,700,000 with a daily variance of 0.0004. Assuming there are 250 trading days in a year and the portfolio returns are independent and follow the same normal distribution with zero mean, what is the estimate of the annual VaR at the 95% confidence level?

A. USD 38,494
B. USD 121,730
C. USD 1,924,720
D. USD 2,721,519

Correct Answer: C

Explanation: Daily standard deviation = $0.0004^{0.5}$ = 0.02 = 2%.

Annual VaR = USD 3,700,000 x $250^{0.5}$ x 0.02 x 1.645 = USD 1,924,720

A is incorrect. USD 38,494 is the result obtained when variance, instead of the standard deviation, is used in the VaR formula.

B is incorrect. USD 121,730 is the 1-day VaR at the 95% confidence level.

D is incorrect. USD 2,721,519 is the 1-year VaR at the 99% confidence level.

Section: Valuation and Risk Models

Reference: Linda Allen, Jacob Boudoukh and Anthony Saunders, Understanding Market, Credit and Operational Risk: The Value at Risk Approach (New York: Wiley-Blackwell, 2004), Chapter 2 – Quantifying Volatility in a VaR Model

Learning Objective: Explain long horizon volatility/VaR and the process of mean reversion according to an AR(1) model.

24. Bank PZR entered into a 2-year interest rate swap contract on September 7, 2016. According to the swap, Bank PZR would receive a 4.10% fixed rate and pay LIBOR plus 1.30% on a notional amount of USD 7.5 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
Sep 7, 2016	2.46%
Mar 7, 2017	1.13%
Sept 7, 2017	0.79%
Mar 7, 2018	0.42%
Sep 7, 2018	0.56%

Assuming no default, how much did Bank PZR receive on September 7, 2018?

A. USD 12,750
B. USD 75,375
C. USD 84,000
D. USD 89,250

Correct Answer: D

Explanation: The proper interest rate to use is the 6-month LIBOR rate at March 7, 2018, since it is the 6-month LIBOR that will yield the payoff on September 7, 2018. Therefore, the net settlement amount on September 7, 2018 is as follows:

Bank PZR receives: USD 7,500,000 * 4.10% * 0.5, or USD 153,750.

Bank PZR pays: USD 7,500,000 * (0.42% + 1.30%) * 0.5, or USD 64,500.

Therefore, Bank PZR would receive the difference of USD 89,250.

A is incorrect. It incorrectly uses the LIBOR at September 7, 2016: Net receipt = USD 7,500,000 (0.041 – 0.0246 – 0.013)*0.5 = USD 12,750.

B is incorrect. It incorrectly uses the LIBOR at September 7, 2017: Net receipt = USD 7,500,000 (0.041 – 0.0079 – 0.013)*0.5 = USD 75,375.

C is incorrect. It incorrectly uses the LIBOR at September 7, 2018: Net receipt = USD 7,500,000 (0.041 – 0.0056 – 0.013)*0.5 = USD 84,000.

Section: Financial Markets and Products

Reference: John C. Hull, Options, Futures, and Other Derivatives, 10th Edition (New York, NY: Pearson, 2017), Chapter 7 - Swaps

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

25. The board of directors of a diversified industrial company has asked the risk management group to prepare a risk appetite framework for the organization. Which of the following activities should take place as part of the process of developing the company's risk appetite?

A. Constructing a list of all risks to which the company could potentially be exposed to
B. Deciding on the types of risks the company is willing to accept across the organization
C. Identifying the instruments that can be used to manage specific risk exposures
D. Estimating the current and future sizes of the risks that the company could face

Correct Answer: B

Explanation: B is correct. This is an example of risk appetite. A is incorrect. This is an example of a risk profile as it's a list of all risk factors to which a company can potentially be exposed to. C is incorrect. This step comes way after developing the risk appetite of the company. D is incorrect. This is part of risk mapping and comes after determining the objectives/risk appetite of a company.

Section: Foundations of Risk Management

Reference: Michel Crouhy, Dan Galai, and Robert Mark, The Essentials of Risk Management, 2nd Edition (New York: McGraw-Hill, 2014). Chapter 2. Corporate Risk Management: A Primer

Learning Objective: Explain how a company can determine whether to hedge specific risk factors, including the role of the board of directors and the process of mapping risks.

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