2014 年 05 月 FRM 一级模拟考试（一）参考答案

1. Answer: D

The Monte Carlo approach allows for whatever relationships the VAR modeler would like to take into account It is the most flexible method for generating VAR; however, it comes at a cost of requiring substantial computing power, especially when the model used to generate portfolio relationships is complex.

2. Answer: A

To obtain the d(1.0) discount factor, first solve for d(0.5), In the equation below, the price for Bond A is equated to its terminal cash flow in six months, which is the principal plus the semiannual coupon of $3.00.

101.182 = 103.00×d(0.5)

d(0.5) = 0.9823

Next use the price and cash flows of Bond B to calculate the d(l .0) discount factor. The cash flow in six months is the semiannual coupon of $6.00 and is discounted by d(0.5). The cash flow in one year is the principal plus the semiannual coupon of $6.00.

102.341 = 6.00×d(0.5) + 106.00×d(1.0)

102.341 = 6.00×0.9823 + 106.00×d(1.0)

d(1.0) = 0.9099

3. Answer: D

Sharpe ratio = $[E(R_p) - R_F] / \sigma$

(2.5 -3.5) / 21 = -0.0476

Sortino ratio = $[E(R_p) - R._{min}]$ / (semi-standard deviation)

(2.5 - 3.5) / 16 = -0.0625

The difference between these two ratios is: -0.0625 - (-0.0476) = -0.0 149.

4. Answer: A

The level of significance is the probability of rejecting the null hypothesis when it is true. The null hypothesis will be rejected if the z-statistic is greater than 1.645.

5. Answer: D

To compute the price of the bond, discount each cash flow back to the present at the appropriate spot rates. $1.75 is the coupon payment per period. Period 3 pays principal plus coupon of $101.75. The first payment computation is as follows:

N = 0.5

I = 2.2%

FV= 1.75

Solve for PV→ 1.73

Maturity(years)	Spot rate（%）	PV
0.5	2.20%	1.73
1.0	2.25%	1.71
1.5	2.30%	1.69

2.0	2.35%	1.67
2.5	2.40%	1.65
3.0	2.45%	94.62
Bond price		**103.07**

(See Book 3, Topic 23)

6. Answer: D

A strap is betting on volatility in a bullish market since it pays off more on the upside.

7. Answer: B

The cost of equity for STT is equal to: risk-free rate + (beta x equity risk premium) cost of equity = 3% + [1.6 x (5% + 2%)) = 14.2%

The cost of debt for STT is equal to: cost of borrowing x (1 — marginal tax rate)

Cost of debt = 10% x (1 —0.35) = 6.5%

Note that the cost of borrowing could also be computed as: risk-free rate + default spread = 3% + 7% = 10%.

Given STT's capital structure mix of 55% equity and 45% debt, its weighted average cost of capital is computed as:

WACC = (55% x 14.2%) + (45% x 6.5%) = 10.735%

(See Book 1, Topic 1)

8. Answer: D

$\text{Standard deviation} = \sqrt{160,000} = 400;\ 400/\sqrt{100} = 40$ The researcher is correct that a possible consequence of increasing the sample size is sampling more than one population. In addition, increasing sample size will increase its costs. The need for additional precision must be balanced with cost and the risk of sampling more than one population.

9. Answer: D

Solve for the face value (F) using the following formula:

$$\frac{0.81}{100}F = \$4.04$$

F=$499

Thus the correct response is d. The other answers are incorrect because they utilize the effective duration, which is not needed in this problem. (See Book 4, Topic 44)

10. Answer: C

The delta of a call option with a continuous dividend yield is given by the following formula:

Delta = $N(d_1) \times e^{-qT}$

where:

q = continuous dividend yield

T = time to maturity

So, Delta = $0.7 \times e^{-0.02 \times 3} = 0.66$.

11. Answer: D

Since Deininger is long equities, a short hedge is appropriate. Deininger should sell S&P futures contracts by the following amount:

$$1.07 \times \frac{400,000,000}{1,368 \times 250} = 1,251 \text{ contracts}$$

(See Book 3, Topic 22)

12. Answer: C

Since you are long the portfolio, the appropriate strategy is to short the futures.

N = - (75,000,000×9) / (104,406.25×8) = - 808.14. Rounding up to the nearest whole number means that you should short 809 futures contracts.

13. Answer: D

The expected value of the portfolio after two years is: (10)(1 - 0.03)(1 - 0.03) ($1,000,000) = $9,409,000. Therefore, the expected cumulative loss is: $10,000,000 - $9,409,000 = $591,000.

14. Answer: D

We are looking to find P(G/U), the probability the economy grows given that ABC stock is up.

P(G) probability the economy grows = 0.50

P(R) = probability of a recession 0.50

P(U/G) = probability the stock is up given the economy grows = 0.60

P(U/R) = probability the stock is up given the economy goes into a recession = 0.15

Using Bayes' formula:

P(GIU) = P(G)* P(UIC) I [P(C) P(UIG) ÷ P(R) P(U/R)j

P(CIU) = (0.50) * (0.60)/ [(0.50)(0.60) + (0.50)(0.15)J

P(G/U) = 0.3 I 0.375 =0.8 = 80.0%

(See Book 2, Topic 10)

15. Answer: D

The minimum value for a European-style call option, cT, is given by:

$$\max[0, S_T - X / (1 + R_F)^T] = \max[0, 86 - 80 / (1.03)^{3/12}] = \$6.59$$

An American-style call option must be worth as least as much as an otherwise identical European-style call option and has the same minimum value. Note that this fact alone limits the possible correct responses to Choices a and d. Since the American-style cat! is in-the-money and therefore must be worth more than the $6 difference between the strike price and the exercise price, you can eliminate Choice a and select Choice d without calculating the exact minimum value. (See Book 3, Topic 27)

16. Answer: C

Fields violated the Professional Integrity and Ethical Conduct section of the Code of Conduct by misrepresenting the bonds as being safe and secure when in fact they were investing in risky projects and backed only by the revenue generated from those projects. According to the Code,

GARP Members shall not knowingly misrepresent details relating to analysis, recommendations, actions, or other professional activities.

17. Answer: A

The daily delta-normal VAR is calculated as [Rp - (z)(σ)](value of portfolio). where Rp is the expected return on the portfolio, z is the z-value corresponding to the desired level of significance, and σ is the standard deviation. Annual VaR = [0.1 - (2.33 × 0.15)] ×10,000,000 = -€2,495,000. In order to convert annual VaR to daily VaR, we need to scale the standard deviation by the square root of time and the mean by 250 trading days. VaR = {0.1 / 250 - [(2.33 × 0.15) / $250^{(1/2)}$}} × 10,000,000 = -€217,043.

18. Answer: D

Assuming no default risk, the domestic return is 6.25%. The return on the UK investments, however, is equal to the amount invested today (USD25,000,000) / (USD1.642/GBP) = GBP15,225,335, which turns into GBP15,225,335×1.07 = GBP16,291,108 one year from now. Since the forward contract guarantees the exchange rate in the future, that amount of GBP translates into GBP16,291,108×USD1.5800/GBP = USD25,739,951. This is a dollar return to the bank of USD25,739,951/USD25,000,000 - 1 = 2.96%. Hence, the weighted average return to the bank's investments is (0.5)(6.25%) + (0.5)(2.96%) = 4.61%.

19. Answer: D

The classical linear regression model assumes homoskedasticity, which means that the variance does not vary across the sample and would not depend on the value of the independent variable.

20. Answer: B

Defining F^R and F^N as the face amounts of the real and nominal bonds, respectively, and their corresponding DV01s as $DV01^R$ and $DV01^N$, a DV01 hedge is adjusted by the hedge adjustment factor, or beta, as follows:

$$F^R = F^N \times \left(\frac{DV01^N}{DV01^R}\right) \times \beta$$

$$F^R = 100{,}000 \times \left(\frac{0.072}{0.051}\right) \times 1.2 = 169{,}412$$

(See Book 4, Topic 45)

21. Answer: A

N = 2×22; PMT = 40/2; FV = 1,000; I/Y = 5/2; CPT→PV = 867.481 = V_0

N = 2×22; PMT = 40/2; FV = 1,000; I/Y = 5.05/2; CPT→PV = 861.484 = V_+

N = 2×22; PMT = 40/2; FV = 1,000; I/Y = 4.95/2; CPT→PV = 873.534 = V_-

$$\text{Convexity} = \frac{V_- + V_+ - 2V_0}{V_0(\Delta y)^2} = \frac{873.534 + 861.484 - 2(867.481)}{(867.481)(0.0005)^2} = 258.22$$

22. Answer: C

All of the statements are correct except for the one relating to SIMEX. Nick Leeson was eligible to trade on the SIMEX.

23. Answer: A

The current value of the contract per ton by the formula:

$$V_t = S_t - Ke^{-rt}$$

$$V_t = \$110 - (\$105)e^{-0.04\times(5/12)} = \$6.735$$

For a 100-ton contract, the value would be $673.55

24. Answer: B

The z-statistic equals:

$(x - \mu)/ \sigma$

where x is the value for a randomly selected observation from the population, μ is the mean value for the population, and σ is the standard deviation of the population. Therefore, as indicated by the formula, the z-statistic is the number of standard deviations x is from the mean (Ecko is correct).

According to the normal distribution, 95% of the observations lie within 1.96 standard deviations of the mean, which implies that 95% of the z-statistics lie within plus and minus 1.96. Therefore, 5% of the z-statistics lie above plus 1.96 and below minus 1.96 and since the normal distribution is symmetrical, then 2.5% of the z-statistics lie below minus 1.96. As a result, 97.5% (not 95%) of the z-statistics lie above minus 1.96. (Charles is not correct).

25. Answer: A

Metallgesellschaft implemented a stack-and-roll hedging strategy, which uses short-term futures contracts to hedge long-term risk exposure. The stack-and-roll hedge strategy proved ineffective due to interim funding cash outflows created by margin calls and other factors. No offsetting interim cash inflows were available on their long-term customer contracts, creating a liquidity crisis that was exacerbated by their size of their futures positions in relation to the liquidity of the market. However, many economists believe that such a hedging strategy is fundamentally sound. Gains and losses on its customer contracts were realized if and when the customers took delivery, which would occur over a 5- to 10-year period.

26. Answer: A

Income bonds pay at most the specified interest, but they may pay less if the company's income is not sufficient. Participating bonds pay at least the specified interest rate but may pay more if the company's profits increase. Zero-coupon bonds pay the face value/principal at maturity but is not a cash payment. It is an implied rate of return earned by the bondholder by purchasing the bond at a discount to face value and receiving the full face value at maturity. The interest paid on floating-rate bonds is generally linked to some widely used reference rate such as LIBOR. Although the amount of interest may decrease with LIBOR, the payment is still technically at the specified interest.

27. Answer: A

$1,015e^{(0.041-0.02)(0.25)} = 1,020.34$

28. Answer: B

At the end of every 12 month period, Bell-Con will pay EUR 7 million to Bro-Con(3.5% x EUR 200 million), Bro-Con will pay USD 7.5 million to Bell-Con (3% x USD 250 million). At the swap's conclusion, the principal amounts are re-exchanged.
(See Book 3, Topic 26)

29. Answer: B

The institution is paying USD and receiving JPY so the value of this swap will equal the current exchange rate times the value of the JPY portion minus the value of the USD portion.

$$\text{The JPY portion of this swap}=70e^{-0.005}+3,570e^{-0.005\times 2}=\text{JPY}3,604,130,000$$

$$\text{The USD portion of this swap}=5.4e^{-0.03}+125.4e^{-0.03\times 2}=\text{USD}123,340,000$$

The value to the institution = [JPY3604.13 million / (JPY120/USD)] - USD123.34 million = -USD93.3 million.

30. Answer: D

The lower pricing bound of an American put on a non-dividend-paying stock is P $\geqslant$max(X –S0,0). In this case, the lower bound is P $\geqslant$ ($110 — $106) = $4.00.
(Sec Book 3. Topic 27)

31. Answer: C

Large institutions can potentially profit from STRIP mispricings relative to the underlying bonds. They can do this by either buying Treasuries and stripping them or reconstituting STRIPS. Because of the cost involved with stripping/reconstituting, investors generally pay a premium for zero-coupon bond

32. Answer: B

Vega is an option's sensitivity to changes in volatility of the underlying stock. Vega is close to zero for deep in- or deep out-of-the-money puts and calls. Rho is an option's sensitivity to changes in interest rates and tends to be the highest for in-the-money calls and puts. Increases in rates will cause larger increases for in-the-money calls, but larger decreases for in-the-money puts. Given this info, choice b will work because it is a deep in-the-money call, and choice c will not work because it is a short position in an at-the-money put. Choice a will not work because it is an at-the-money call (which would be highly sensitive to vega). and choice d will not work because rising rates will have little impact on the position since it is an out-of-the-money put.

33. Answer: D

Shorting the ABC call with the $55 strike price will be out-of-the-money, thus, the profit will be the option premium ($1.10). Going long the)XYZ put option with the $10 strike price will be

in-the-money, and the profit will be: 10— 8.13 — 0.75 = 1.12.
(See Book 3, Topic 20)

34. Answer: B

{[p×98.45] + [(1 - p)×96.00]} / [1 + (0.025 /2)] = 97.00
p = 0.9 and (1 - p) = 0.1

35. Answer: A

Based on the CAPM, the portfolio should earn: E(R) = 0.05 + 0.7(0.10) = 12%. On a risk-adjusted basis, this portfolio lies on the security market line (SML) and thus is earning the proper risk-adjusted rate of return.

36. Answer: C

The daily delta-normal VAR is calculated as [Rp - (z) (σ)]× (Value of Portfolio), where Rp is the expected 1-day return on the portfolio, z is the z-value corresponding to the desired level of significance, and σ is the standard deviation of 1-day.
-1,907,500 = [0.0004 - (2.05)(0.0095)] 100,000,000
The historical simulation VAR for 2% is the 5th lowest return, which is -2.59%; therefore, the correct VAR is:
-2,590,000 = (-0.0259)(l00,000,000)

37. Answer: C

The bank lent USD5,000,000×1.12 = EUR5,600,000 to its German client. At the end of the year, the client repaid, with interest, 5,600,000×1.06 = EUR5,936,000, which was then worth USD5,936,000/0.84 = USD7,066,667. The bank repaid USD5,000,000×1.045 = USD5,225,000, including interest on its borrowed money, which generated a return of (7,066,667 - 5,225,000)/ 5,000,000 = 36.8% on the loan. Alternate method: (1.12/0.84)(1.06) - 1.045 = 0.368.

38. Answer: B

To find the correct price of the futures contract, we use the formula:
$F_{0,T} \geqslant S_0 e^{rT} + \lambda(0,T)$
$F_{0,T} = 0.325e^{0.03\times 3/12} + [0.002 + 0.002(1.0025) + 0.002(1.0025)^2] = 0.3335$
Since the actual futures price of 0.3368 is higher than the correct price, there is an arbitrage opportunity that can be exploited by selling the overpriced contract. The investor would want to sell the futures contract, borrow at the risk-free rate, and buy the spot asset. The investor would pay off the loan in three months with the proceeds from delivering the cotton against the futures and would have a risk-free profit.

39. Answer: C

The delta of a call option that is deep in-the-money is close to 1. The addition of the 2,500 long options to bring about gamma neutrality disturbed the original delta neutral position of the portfolio. Since 2,500 options have been added, (2,500)(l.0) = 2,500 shares of the underlying must be sold to restore delta neutrality to the portfolio. Note that answer A could be correct only if the options were at-the-money where delta is 0.5.

40. Answer: D

Note that the recovery rate is given as 40% which implies the LGD is 60%. We can calculate adjusted exposure as follows.

Adjusted exposure = OS + (COM_U - OS) UGD

= \$2,000,000 + (\$8,000,000)×(0.60)

= \$6,800,000

$$UL = AE \times \sqrt{EDF \times \sigma_{LGD}^2 + LGD^2 \times \sigma_{EDF}^2}$$

$$UL = 6,800,000 \times \sqrt{0.02 \times 0.3^2 + 0.6^2 \times 0.05^2} = \$353,338$$

41. Answer: D

The implementation of a regime switching model is appropriate in cases such as this example where there appears to be fat-tails and deviations from normality caused by shifts in volatility to high and low levels. The regime-shifting model may resolve the fat-tail issues, and the return distributions will be conditionally normally distributed assuming time-varying volatility of interest rates.

42. Answer: B

Yasuo Hamanaka, the lead copper trader for Sumitomo, established a dominant long position in futures contracts and simultaneously purchased large quantities of physical copper. As the future contracts approached delivery, the party with the short position would find little physical copper available for delivery and would be forced to either pay a large premium for physical copper or unwind their short position at unfavorable prices by taking an offsetting long futures position. Either way, the price of copper and/or copper futures would rise and create handsome profits.

43. Answer: C

European options can only be exercised at maturity American call options are more likely to be exercised when dividends are large and expiration is close. American put options are less likely to be exercised when dividends are large.

44. Answer: D

This is an out-of-the-money covered call. The stock can go up \$2 to the strike price, and then the writer will get \$3 for the premium. Thus, the maximum profit is \$5..

45. Answer: A

The change in asset value would be a decrease of [(\$500,000,000)(7)(0.005)] = \$17,500,000, whereas the change in liability value would be a decrease of [(\$400,000,000)(5)(0.005)] = \$10,000,000. The net effect would be a decline in equity value of \$7.5 million.

46. Answer: B

With the business process view, for each business process, the scorecard has complex metrics that quantify the impact of each data quality problem. This allows for the ability to determine exactly where in the business process the data problem is originating. (See Book 1, Topic 6)

47. Answer: D

Calculate the price of the February (6-month) and May (9-month) forward prices using the following pricing formula which accounts for storage costs:

$$\text{storage costs}(\lambda)=0.45/5.05=8.91\%$$

$$\text{forward prices}(F_{0,T})=S_0e^{(R_F+\lambda)T}$$

$$F_{0,0.50}=5.05e^{(0.08+0.0891)(0.50)}=\$5.50$$

$$F_{0,0.75}=5.05e^{(0.08+0.0891)(0.75)}=\$5.73$$

The soybean farmer would only be willing to store half the crop until February if the February futures contract price is at Least $5.50/bushel. Similarly, the soybean farmer would only be willing to store the other half of the crop until May if the May futures contract price is at least $5.73/bushel.

48. Answer: B

$$\$10,000[1-(0.068)(\frac{91}{360})]=\$9,828.11$$

49. Answer: C

People risk relates to the risk associated with fraud perpetrated by internal employees and/or external individuals. It does not relate to incompetnce and lack of suitable training. Presettlement risk is lower than settlement risk because the former allows for offsetting of payments while the latter requires settlement of the full value of payments. Non-directional risks have non-linear exposures to changes in economic or financial variables which is clearly the case with options. Asset-liquidity risk (not funding liquidity risk) results from a large position size forcing transactions to influence the price of securities.

50. Answer: A

The firm owns its own production resources and sells wholesale with long-term contracts at fixed prices, so it does not face commodity price risk in acquiring crude oil. Hence, a commodity swap based on oil will not reduce earnings volatility. The firm has issued floating rate notes, however, so its earnings will be sensitive to changes in interest rates. Entering into the pay-fixed side of an interest-rate swap would reduce this source of earnings volatility.

51. Answer: C

$$\text{Sharp ratio(SR)}=\frac{\text{average return on portfolio - risk-free rate}}{\text{standard deviation}}$$

$$\text{(SR)}=\frac{13.75\text{-}5.35}{16.9}=0.497$$

$$\text{Sortino ratio(SOR)}=\frac{\text{average return on portfolio - risk threshold}}{\text{semi-standard deviation}}$$

$$\text{(SOR)}=\frac{13.75\text{-}5.35}{13.72}=0.612$$

$$\text{information ratio(IR)}=\frac{\text{average return on portfolio - average return on benchmark}}{\text{tracking error}}$$

$$\text{(IR)}=\frac{13.75\text{-}12.36}{7.21}=0.192$$

52. Answer: B

LTCM required their investors to invest for three years, thereby decreasing (not increasing) funding risk.. Although the risk of their positions was quite small in theory, the size of their positions resulted in them selling at large discounts. They borrowed at favorable terms in their repurchase agreements, but the firm had high leverage which magnified the degree of their losses.

53. Answer: B

GARP Members shall make full and fair disclosure of all matters that could reasonably be expected to impair independence and objectivity or interfere with respective duties to their employer, clients, and prospective clients.

54. Answer: C

Because the options dealer has sold options, the dealer will have a negative gamma and negative vega exposure. When sold, the options are at-the-money, but over time the options will move in- or out-of-the-money. Gamma and vega decline as the options move away from an at-the-money position, so gamma and vega will have less of an impact on the value of the option over time. Hence the correct answer is both I and II.

55. Answer: A

Correlation of risk factors is included and is therefore not a problem.

56. Answer: D

The first step is to estimate the number of expected defects in 1,000 runs as follows:
(1,000) (0.005) = 5. Next the mathematical formula for the Poisson distribution for estimating 7 defects given that 5 are expected is:

$$P(X=7)=\frac{5^7 e^{-5}}{7!}=\frac{78125\times 0.006738}{7\times 6\times 5\times 4\times 3\times 2\times 1}=0.104$$

57. Answer: B

1. Jensen's alpha = actual return - expected return using CAPM
2. CAPM E(R) = risk-free rate + beta × (return on the market - risk-free rate)*
*Return on the market - risk-free rate = equity risk premium.
Use Jensen's alpha of 4.75% and the actual return of 14.2%. The expected return from CAPM must be 14.2% - 4.75% = 9.45%.
Use this value in the CAPM to find the beta of the portfolio.
expected return = risk-free rate + beta × equity risk premium
9.45% = 4.25% + β × 6%, therefore β = approximately 0.87

58. Answer: C
The GARCH(1,1) estimate of volatility (standard deviation) will be:
variance = $0.000008 + (0.16)(0.034)^2 + (0.78)(0.026)^2$
variance = 0.000008 + 0.00018496 + 0.00052728
variance = 0.00072024

$$\text{volatility (standard deviation)} = \sqrt{\text{variance}}$$

$$\text{volatility} = \sqrt{0.00072024} = 2.68\%$$

59. Answer: A
Cost of delivery:
Bond 1: 98 - (91.50 × 1.02) = $4.67
Bond 2: 122 - (91.50 × 1.27) = $5.80
Bond 3: 105 - (91.50 × 1.08) = $6.18
Bond 4 112 - (91.50 × 1.15) = $6.78
Therefore, Bond 1 is the cheapest to deliver.

60. Answer: A
A stack hedge is less effective than a strip hedge if the yield curve undergoes any other move than a parallel shift.

61. Answer: C
The basic formula is $V_{swap}(USD) = B_{USD} - (S_0 \times B_{EUR})$
$B_{USD} = 3.64e^{-0.02\times1} + 133.64e^{-0.0225\times2} = 3.57 + 127.76 = \$131.33$
$B_{EUR} = 3.50e^{-0.04\times1} + 103.5e^{-0.045\times2} = 3.36 + 94.59 = 97.95$
$V_{swap}(USD) = B_{USD} - (S_0 \times B_{EUR}) = \$131.33 - (1.33 \times 97.95) = \$131.33 - \$130.27 = \$1.06$ million

62. Answer: C
Starr's supervisor states that "the mean 1-year Treasury bill rate should equal four percent." Therefore, the null hypothesis is: H_0: mean Treasury bill rate equals 4%; and the alternative hypothesis is H_A: mean Treasury bill rate does not equal 4%, which is a two-tailed test. Starr's supervisor also states that "the mean market risk premium should be positive." Therefore, the null hypothesis is: H_0: mean market risk premium is less than or equal to zero; and the alternative hypothesis is H_A: mean market risk premium is greater than zero, which is a one-tailed test.

63. Answer: A

The following formula is used to calculate the VAR for a linear derivative:

$VAR_p = \Delta VAR_f$

The delta in the formula is a sensitivity factor that reflects the change in value of the derivatives contract for a given change in the value of the underlying. The delta adjustment to the VAR of the underlying asset accounts for the fact that the relative changes in value between the underlying and the derivatives may not be one for one but nevertheless are linear in nature. Note that options are non-linear.

64. Answer: D

At the 5% level of significance the critical z-statistic for a two-tailed test is 1.96 (assuming a large sample size).

The null hypothesis is H_0: x = 10%. The alternative hypothesis is H_A: x≠10%. Because the computed z-statistic is greater than the critical z-statistic (2.3 > 1.96), we reject the null hypothesis and we conclude that small cap returns are significantly different than 10%.

65. Answer: A

To identify if there is mispricing in the 2-year zero-coupon bond, back out its yield using your financial calculator. Using annual compounding FV = 100; PV = -82.6446, N = 2; CPT I/Y = 10.00%.

Because its yield is too low (compared to the spot rate of 10.263%), this implies that its price is too high. So we will short this zero-coupon and buy the 2-year coupon bond. We would also short the 1-year zero-coupon bond because its principal repayment can be covered with the first year coupon on the coupon bond.

The following calculations provide the arbitrage profit, assuming $1,000,000 of the coupon bond is bought.

The 1-year zero-coupon bond will be shorted in an amount corresponding to the first year coupon on the coupon bond, which is 10%×$1,000,000 = $100,000. We will short the PV of this amount, which using the discount factor of 0.952381 (from the zero-coupon bond's price) is $95,238.10.

The 2-year zero-coupon bond will be shorted in an amount corresponding to the second year coupon and principal on the coupon bond, which is $1,100,000. We will short the PV of this amount, which using the discount factor of 0.826446 (from the zero-coupon bond's price) is $909,090.60.

The total receipt from the short sale is $95,238.10 + $909,090.60 = $1,004,328.70.

After buying $1,000,000 of the coupon bond, the arbitrage profit is $4,328.70.

You can verify that if the yield on the 2-year zero-coupon bond were 10.263%, its price would fall to 82.2508, eliminating the arbitrage profit.

66. Answer: C

The usual approach is to specify a hypothesis that the researcher wishes to disprove.

67. Answer: C

$$c = \$25(0.9737) - \$20(e^{-0.045\times0.25})(0.9652) = \$5.25$$

68. Answer: B

Decreased correlations in market downturns would not be a concern. Typically, correlations increase during a market downturn, which reduces the diversification of a portfolio or group of investments. In this example, Capital is subject to counterparty risk, the risk of expanding in areas where risk is not accounted for, and the failure to discover all risks. (See Book I, Topic 8)

69. Answer: D

Bull and bear spreads are both constructed with either two calls or two puts with a lower and higher strike price.

Bull spread: buy the option with lower strike price, sell the option with higher strike price.

Bear spread: buy the option with higher strike price, sell the option with lower strike price.

This investor is selling an option with low strike price and buying an option with high strike price so it is a bear spread.

The maximum profit is found at a price of 50. The profit consists of:

- Profit on the long 65 put is $15.
- Loss on the net premium is $2 (i.e., paid - 5, earned +3).
- Overall profit = +$13.

70. Answer: B

Since the median is higher than the mean, the distribution is negatively skewed. If the mean were higher than the median the distribution would be positively skewed. Since the excess kurtosis is negative, the distribution is platykurtic or less peaked/flatter than normal distribution. Leptokurtic is defined as a distribution which is more peaked than a normal distribution and would have a positive excess kurtosis.

71. Answer: B

Invoice price is: clean price + accrued interest.

$100,000 × 0.7 × 1.3 + $1,500 = $92,500

72. Answer: A

Corn is an example of a commodity with seasonal production and a constant demand. Corn is produced in the fall of every year, but it is consumed throughout the year. Natural gas is an example of a commodity with constant production but seasonal demand. Natural gas is expensive to store, and demand in the United States peaks during high periods of use in the winter months. In addition the price of natural gas is different for various regions due to high international transportation costs. The demand and production of oil is more constant relative to natural gas due to the ability to transport and store oil more cheaply than natural gas. Therefore, the worldwide demand and production is relatively more constant even though it is subject to supply and demand stocks.

Commodities	Oil	Corn	Natural Gas
Production	Constant	Seasonal	Constant
Demand	Relatively constant	Constant	Seasonal
Storage Costs	Relatively moderate	Moderate	Expensive

73. Answer: A

The optimal hedge ratio is $\rho_{1,2}\frac{\sigma_1}{\sigma_2} = 0.5(\frac{1}{2}) = 0.25$

74. Answer: B

At the end of year 1, there is a 5% chance of default and an 80% chance that the firm will maintain a Baa rating. In year 2, there is a 5% chance of default if the firm was rated Baa after 1 year (80% $\times$ 5% = 4%). There is a 0% chance of default if the firm was rated Aaa after 1 year (10% $\times$ 0% = 0%). Also, there is a 15% chance of default if the firm was rated Caa after 1 year (5% $\times$ 15% = 0.75%). The probability of default is 5% from year 1 plus 4.75% chance of default from year 2 (i.e., 4% + 0% + 0.75%) for a total probability of default over a 2-year period of 9.75%.

75. Answer: A

Expected loss is calculated as follows: EL = AE $\times$ LGD $\times$ EDF. Therefore, increasing LGD directly increases expected loss.

Usage given default (UGD) is calculated as the percentage of draw down. Therefore, increasing draw down will increase UGD and hence increase AE from the increased draw down in default. It follows that the expected loss will increase as well.

76. Answer: A

The payoff from exercising the option is the exercise price minus the current stock price:
\$40 —\$36 = \$4. The discounted value of the expected future payoff is:

$$\frac{(\$0.00\times 0.75)+(\$10.00\times 0.25)}{e^{0.05\times 1}} = \$2.38$$

It is optimal to exercise the option early because it is worth more exercised (\$4.00) than if not exercised (\$2.38).

77. Answer: D

The dollar amount translates to:
\$10,000[100 - 0.25(100 - quoted price)] = \$10,000[100 - 0.25(100 - 96.89)] = \$992,225

78. Answer: C

A negative net exposure position means that we are net short in a currency. On-balance-sheet hedging is achieved when a financial institution has a matched maturity and currency foreign asset-liability book. Both of the statements are correct.

79. Answer: B

Having a single, quantifiable metric is generally required as a guideline to indicate when risk should be increased or decreased. There are many possible shortcomings, however, such as the measure not incorporating the human element of the market. Scenario analysis can improve the process by attempting to account for human activity such as predatory trading and including the possibility and consequences of extreme events.

80. Answer: B

Calculate the standardized variable corresponding to the outcomes:

Z1 = (91.13 - 50)/25 = 1.645, and Z2 = (108.25 - 50)/25 = 2.33

The cumulative normal distribution gives cumulative probabilities of:

F (1.645) = 0.95 and F (2.33) = 0.99

The probability that the outcome will lie between Z1 and Z2 is the difference:

0.99 - 0.95 = 0.04

81. Answer: C

Statements II, III, and IV are correct. Statement I is incorrect because supervisors should make stress testing assessments more frequently than annually. (See Book 4, Topic 52)

82. Answer: D

Stock A = 8% + 1.5(7%) = 18.5%. Because the estimated return of 15.0% is less than the required return of 18.5%, Stock A is overvalued.

Stock C = 8% + 0.6(7%) = 12.2%. Because the estimated return of 14.2% is greater than the required return of 12.2%, Stock C is undervalued.

83. Answer: C

Since there are a total of 40 observations, the sample is large enough to qualify to use the z-test. The calculated z-statistic for the industry index = (2.2 - 0)/0.58 = 3.79. That is greater than the critical value of 2.58 so the industry index is significant at the 99% level. The calculated z-statistic for the intercept = (3.8 - 0)/2.25 = 1.68. That is less than the critical value of 1.96 so the intercept is not significant at the 95% level.

TSS = ESS + SSR; 1,264.72 = ESS + 272.49, therefore, ESS = 992.23. R^2 = coefficient of determination = ESS/TSS = 992.23/1,264.72= 0.7845. Correlation coefficient is the square root of R^2 and therefore, it is 0.8857.

84. Answer: D

Step 1: compute the 2-year spot rate:

N = 4

PV = -93.2775

PMT =0

FV =100

CPT I/Y = 1.755% (semi-annual) therefore × 2 = 3.51% annual yield

Step 2: compute the forward rate:

$$(1+\text{semi-annual spot}_{1.5})^3 \times (1+\text{forward rate}_{1.5F2}) = (1+\text{semi-annual spot}_2)^4$$

Forward rate = 1.072069/1.049701 - 1 = 2.13% per half year

annual forward rate = 2.13% × 2 = 4.26%

85. Answer: A

NPV = PV(cash inflows) — CFO = ($1.8 million /0.105) —$15 million = $2,142,857

(See Book 1, Topic 1)

86. Answer: A

$1,025e^{(0.0275-0.012)(0.25)} = 1,028.98$ The market rate of interest is irrelevant here.

87. Answer: B

An unbiased estimator has an expected value equal to the true value of the population parameter. A consistent estimator is more accurate the greater the sample size. An efficient estimator has the sampling distribution that is less than that of any other unbiased estimator.

88. Answer: A

A delta hedge will be required as it is extremely likely that the exchange rate will change. When the exchange rate changes, so does the delta. When the delta changes, the portfolio will no longer be hedged and so a dynamic hedging strategy is required. This involves rebalancing (i.e., either purchasing or selling the underlying asset) on a continual basis to maintain the delta-neutral hedged position.

89. Answer: C

With YTM = 10.45% (I/Y = 5.225), PMT = 40, N = 24, FV = 1,000, PV = $834.61.
With YTM = 10.07% (I/Y = 5.035), PV = $857.67, an increase of $23.06.

90. Answer: D

59.2. D. Yes and S2 = S1
The ability to borrowing or lend morphs the concave/convex efficient frontier into the linear CML; i.e., the leveraged portfolio is efficient with higher risk and higher return.
All portfolios on the CML have the same Sharpe ratio: the slope of the CML.

91. Answer:A

58.1. A. Increase by ~3.14%
Since variance(portfolio) = X(A)^2*variance(A) + X(B)^2*variance(B) + 2*X(A)*X(B)*covariance(A,B), where X(A) is fraction of portfolio held in A, per Elton & Gruber, we know that 11.18%^2 = X(A)^2*variance(A) + X(B)^2*variance(B) + 0, when covariance/correlation is zero.
The revised variance = X(A)^2*variance(A) + X(B)^2*variance(B) + 2*50%*50%*0.0160, such that: the variance increases from 11.18%^2 to 11.18%^2 + 2*50%*50%*0.0160, which equals 0.02050, and the revised portfolio volatility = SQRT(0.02050) = 14.32%.
In this way the increase in portfolio volatility = 14.32% - 11.18% = 3.137%.
In brief, the portfolio variance must increase by 0.0080 (=2*0.5*0.5*0.0160) such that the increase in portfolio volatility = SQRT(11.18%^2 + 0.80%) - 11.18% = 3.137%

92. Answer:A

$$\sigma_t = \sqrt{\lambda\sigma_{t-1}^2 + (1-\lambda)\mu_{t-1}^2} = \sqrt{0.94 \times 1.5\%^2 + 0.06 \times \left[\ln(30.5/30)\right]^2}$$
$$= 0.015096$$

93. Answer: A

As yields in the market declines, the probability that the call option will get exercised increases. This causes the price to reduce relative to an otherwise comparable option free bond, which is also known as a negative convexity.

94. Answer: C

204.2. C. Buy short-term options + sell long-term options

For ATM options, vega and theta are increasing functions with maturity; and gamma is a decreasing function with maturity.
To buy short-term options + sell long-term options --> negative position theta, negative position vega, and positive position gamma.

In regard to (A), sell short-term + sell long-term --> positive theta; negative vega; negative gamma
In regard to (B), sell short-term + buy long-term --> positive theta; positive vega; and negative gamma.
In regard to (D), buy short-term + buy long-term --> negative theta; positive vega; and positive gamma

Note: the above are approximately actual numbers for 100 option contracts (100 options each = 10,000 options) with the following properties: Strike = Stock = $100; volatility = 15.0%, risk-free rate = 4.0%; term = 1.0 year. Under these assumptions

- 1-year term: percentage theta ~= -5.0, vega ~= +37, gamma ~= +0.025
- 10-year term: percentage theta ~= - 2.5, vega ~= +70, gamma ~= +0.005

95. Answer: C

136.1 C. The payoff of short futures contract = K - S(t).

Payoff of long put = MAX[0, K - S(t)] and payoff of short call = -MAX[0, S(t) - K] = MIN[K-S(t)], such that the combination payoff = K-S(t)
In regard to (D), please note:
profit = the payoff - initial investment [net premium]
... sometime also profit = payoff - FV (initial investment)

96. Answer: A

144.1. A. $35 drop

The maintenance margin = 75% * $14,000 = $10,500 per contract; the margin call occurs when the loss is $3,500 per contract or $35 per ounce.
That is, if gold drops from $1,400 to $1,365 then value of margin account, per contract, drops $3,500 ($35 * 100) which is 25% of the initial margin.

97. Answer: B

147.3 B. The roll return (roll yield) is profitable during an inverted (backwardation) futures market; i.e., the futures are rolled into higher prices as the futures price increases while maturity shortens.

- In regard to (A), this is FALSE: commodities are often in alternating contango/backwardation; e.g., natural gas, corn due to seasonality in demand/production.
- In regard to (C), this is tempting but FALSE: in the Metallgesellschaft, a backwardation experienced falling futures price yet went into contango because the SPOT price dropped more!
- In regard to (D), this is FALSE for two reasons: 1. It omits the lease rate and convenience yield; 2. It omits technical factors; supply/demand could conceivably create backwardation

98. Answer: D

$SE = 1.5\%/\sqrt{400} = 0.075\%$

99. Answer: D

The number of questions correct follows a binomial distribution where the probability of success is (1/4) and the number of trials is 6. Therefore, the probability of getting zero correct, p(0),and the probability of getting one correct, p(1), are:

$p(0) = (3/4)^6 = 17.80\%$

$P(1) = 6 \times (1/4) \times (3/4)^5 = 35.59\%$

And so, the probability of getting less than two questions correct is

$p(0) + p(1) = 53.39\%$

100. Answer: A

The following table shows the test statistics for each of the four variables, calculated by dividing the variable coefficient by the standard error. The variable is significant if the absolute value of the t-test is greater than the critical value from the student's t-distribution for 456 degrees of freedom (which is very close to the z-statistic since the number of observations is so high), i.e. 1.96.

Predictor	T-stat	Significant
Intercept	-4.21	Yes
All share index	1.45	No
Industrial index	7.33	Yes
Financial index	0.85	No

$R^2 = SSR/SST = 12{,}466.47/13{,}479.69 = 0.924834$