Solutions

4. Valuation and Risk Models

Q-1. Solution: A

With an upward sloping curve, the coupon curve is the lowest, the zero-coupon curve is above the coupon curve and the forward curve is above the zero-coupon curve. The order is reversed if the curve is downward sloping.

Q-2. Solution: D

The forward rate can be inferred from $(1 + R_4)^4 = (1 + R_3)^3(1 + F_{3,4})$. Solving, this gives $F_{3,4} = (85.16/79.81) - 1 = 0.067$.

Q-3. Solution: D

The forward curve will be above the spot curve when the spot curve is rising. The forward curve will also cross the spot curve when the spot curve reaches its maximum (or extreme) value. The forward curve will be below the spot curve when the spot curve is declining. The only chart that reflects these three conditions is choice D.

Q-4. Solution: C

C is correct. The current annual yield on both the coupon and zero-coupon bonds are the same at 6% If rates are higher than 6% then the coupon bond would be preferred due to higher reinvestment income.

A is incorrect. If the interest rate are expected to rise, coupon bonds would be more attractive because investors can reinvest the coupon at higher interest rates.

B is incorrect. If the interest rate are expected to rise, coupon bonds would be more attractive because investors can reinvest the coupon at higher interest rates.

D is incorrect. Falling interest rates below the yield to maturity would mean lower reinvestment income for the coupon bond, which makes the coupon bond less attractive.

Q-5. Solution: B

The future value of $1 invested for time t is 1/d(t).

$$d(0.5) = \frac{100.62600}{(100 + 2.875/2)} = 0.992$$

$$d(1) = \frac{(99.45250 - 1.25d(0.5))}{101.25} = 0.9700$$

$$d(1.5) = \frac{(100.3800 - 2.375d(0.5) - 2.375d(1))}{102.375} = 0.9350$$

Q-6. Solution: D

The duration of the bond must be the market weighted duration of the floater and inverse floater components, modified duration of the portfolio = $W_F D_F + W_{IF} D_{IF} = 8.0$. Since $D_F = 0$, $D_{IF} = 8/W_{IF} = 8/0.2 = 40$.

Q-7. Solution: D

Assuming parallel movements to the yield curve, the expected price change is:

$\Delta P = -P\Delta y \times D$ where P is the current price or net present value Δy is the yield change D is duration All else equal, a negative impact of yield curve move is stronger in absolute terms at the bond which is currently priced higher. Upward parallel curve movements makes bonds cheaper.

Q-8. Solution: C

In order to change her interest rate exposure by acquiring securities with negative duration, the manager will need to invest in securities that decrease in value as interest rates fall (and increase in value as interest rates rise). Zero coupon bonds with long maturity will increase in value as interest rates fall, so calls on these bonds will increase in value as rates fall but puts on these bonds will decrease in value and this makes C the correct choice. Interest-only strips from long maturity conforming mortgages will decrease in value as interest rates fall, so puts on them will increase in value, while principal strips on these same mortgages will increase in value, so calls on them will also increase in value.

Q-9. Solution: A

DV01 may not be a reliable measure when interest rates changes are not small. Also, when applying DV01 we assume that the yield curve shifts are parallel.

Q-10. Solution: B

(A)	(B)	(C)	(D)	(E)
Bond	**Value (USD)**	**Modified Duration**	**(B × C)**	**(D/B)**
1	4,000,000	7.5	30,000,000	
2	2,000,000	1.6	3,200,000	
3	3,000,000	6	18,000,000	
4	1,000,000	1.3	1,300,000	
SUM	10,000,000		52,500,000	5.25

The portfolio modified duration is 5.25. This is obtained by multiplying the value of each bond by the modified duration(s), then taking the sum of these products, and dividing it by the value of the total bond portfolio.

The change in the value of the portfolio will be -10,000,000 × 5.25 × 0.1% = -52,500

Q-11. Solution: D

The call option reduces the bond price, therefore the bond with no embedded options will be the sum of the callable bond price and the call option price.

Therefore the price of the bond with no embedded options at a rate of 4.98% would be 104.1657 and the price at a rate of 5.02% would be 102.9351.

DV01 is a measure of price sensitivity of a bond. To calculate the DV01, the following equation is used:

$$\mathrm{DV01} = -\frac{\Delta P}{10{,}000 \times \Delta y}$$

Where ΔP is the change in price and Δy is the change in yield. Therefore

$$\mathrm{DV01} = -\frac{102.9351 - 104.1657}{10{,}000 \times (5.02\% - 4.98\%)} = 0.3077$$

Q-12. Solution: B

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:

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

where Δr is the change in the rate in one step; in this case, 0.02%.

Therefore, the best estimate of convexity is:

$$C = \frac{1}{101.61158} \times \frac{(100.92189 - 2 \times 101.61158 + 102.07848)}{(0.02\%)^2} = -54{,}814$$

Q-13. Solution: B

D = ($P_- - P_+$)/($2P_0 \triangle Y$) = (96.35 – 92.75)/ (2 × 94.65 × 0.003) = 6.34

Q-14. Solution: A

$$D = \frac{V_- - V_+}{2 \times V_0 \times \Delta y} = \frac{127.723 - 122.164}{2 \times 125.482 \times 0.003} = 7.38$$

Q-15. Solution: C

To construct a barbell portfolio with the same cost and same duration as the bullet:

Cost of bullet = (106.443/100)*USD 60,000,000 = USD 63,865,800

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

V_2 + V_{15} = USD 63,865,800 (1)

Therefore, to match duration:

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

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

From Equation (1), V_2 = 63,865,800 – V_{15}. Then, Equation (2) becomes:

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

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

276,794,377.2 = 9.749V_{15}

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

And so, V_2 = 63,865,800 – V_{15} = 63,865,800 – 28,392,078.90 = USD 35,473,721.10

Giving weight of 2-Year Treasury = 35,473,721.10/63,865,800 = 55.54%

And weight of 15-year Treasury = 28,392,078.90/63,865,800 = 44.46%

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

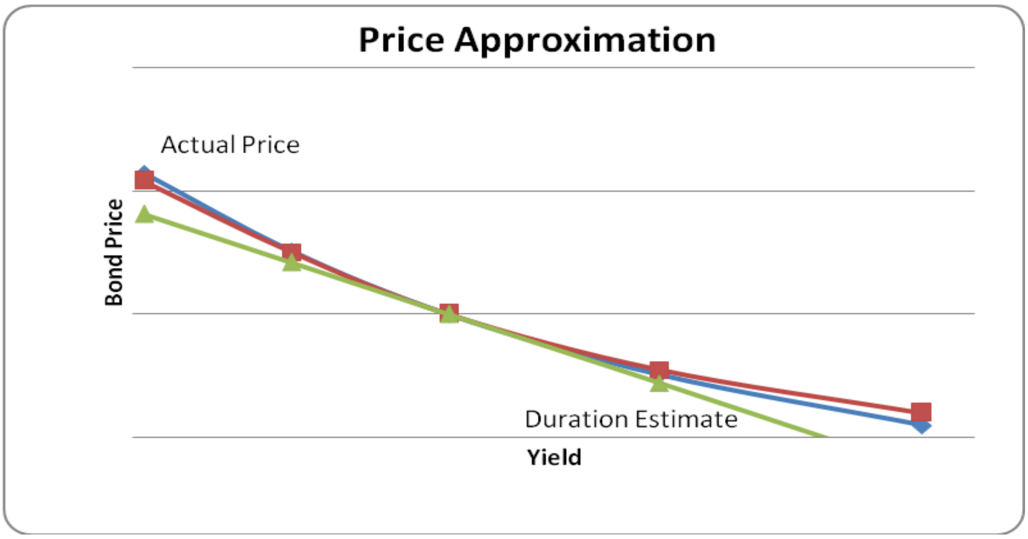
B is incorrect. It switches the weights derived in C above.

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

Q-16. Solution: A

Option-free bonds have positive convexity and the effect of (positive) convexity is to increase the magnitude of the price increase when yield fall and to decrease the magnitude of the price decrease when yields rise.

Q-17. Solution: A



Q-18. Solution: D

The solution is to replicate the 1 year 8% bond using the other two treasury bonds. In order to replicate the cash flows of the 8% bond, you could solve a system of equations to determine the weight factors, F_l and F_2, which correspond to the proportion of the zero and the 10% bond to be held, respectively.

The two equations are as follows:

$(100 \times F_1) + (105 \times F_2) = 104$ (replicating the cash flow including principal and interest payments at the end of 1 year), and $(5 \times F_2) = 4$ (replicating the cash flow from the coupon payment in 6 months.)

Solving the two equations gives us $F_l = 0.2$ and $F_2 = 0.8$. Thus the price of the 8% bond should be 0.2 (96.12) + 0.8 (106.2) = 104.18.

Q-19. Solution: C

$$\left(2\frac{7}{8}+100\right)X_1+\left(6\frac{1}{4}+100\right)(1-X_2)=\left(4\frac{1}{2}+100\right)$$

$$X_1=0.52$$

$$\text{Price}=0.52\times 94.40+(1-0.52)\times 101.30=97.71$$

Q-20. Solution: C

Single-factor models assume that any change in any rate across the maturity spectrum can indicate changes across the maturity spectrum can indicate changes across any other portion of the curve.

Q-21. Solution: C

The 10 basis point shock to the 10-year yield is supposed to decline linearly to zero for the 20-year yield. Thus, the stock decrease by 1 basis point per year and will result in an increase of 6 basis points for the 14-year yield.

Q-22. Solution: D

Key rate exposures assume that key rates chosen adjacent to the rate of interest are affected, not across other key rates.

Q-23. Solution: C

Key rate'01 with respect to the 30-year shift is calculated as follows:

-1/10,000 (25.01254 − 25.11584) / (0.01%) = 0.103 or 25.01254-25.11584=0.103

This implies that the C-strip decreases in price by 0.103 per 100 face amount for a positive one basis point 30-year shift.

Q-24. Solution: D

Key rate duration for the 30-year shift is calculated as follows:

-1/25.11584 (25.01254 − 25.11584) / (0.01%) = 41.13

Q-25. Solution: D

A callable bond includes an embedded option for the issuer to call the bond at a stated redemption or call price. If the issuer is long the call option, then the holder of a callable bond is short the call option.

Q-26. Solution: B

Callable bond can be decomposed into a long position in a straight bond minus a call option on the bond price. Putable bond can be decomposed into a long position in a straight bond plus a put option on bond price.

Q-27. Solution: 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.

Q-28. Solution: C

All else equal, convexity increase for longer maturities, lower coupons, and lower yields.

Bonds with embedded options (e.g., callable bonds) exhibit negative convexity over certain ranges of yields while straight bonds with no embedded options exhibit positive convexity over the entire range of yields.

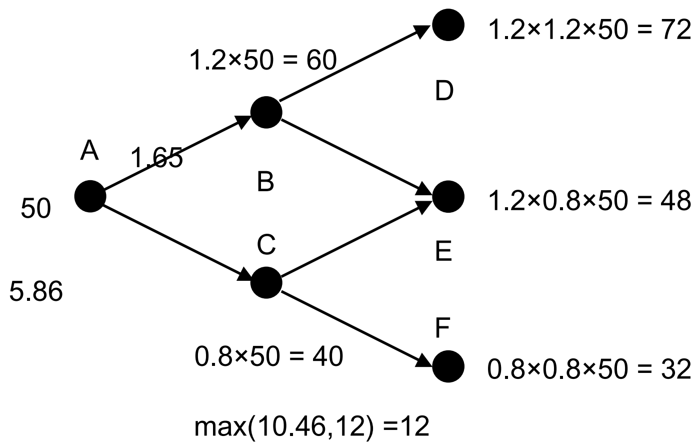
Q-29. Solution: B

Calculation follows:

$$P_{up} = \frac{e^{r\Delta t} - d}{u - d} = \frac{e^{0.12\times 3/12} - 0.8}{1.2 - 0.8} = 57.61\%$$

Q-30. Solution: D

The risk neutral probability of an up move is 57.61% (calculated in the previous question).



The figure shows the stock price and the respective option value at each node. At the final nodes the value is calculated as max (0, K – S).

Node B: (0.5761 × 0 + 0.4239 × 4) × exp(-0.12 × 3/12) = 1.65, which is greater than the intrinsic value of the option at this node equal to max(0, 52 – 60) = 0, so the option should not be exercised early at this node.

Node C: (0.576l × 4 + 0.4239 × 20) × exp(-0.12 × 3/12) = 10.46, which is lower than the intrinsic value of the option at this node equal to max(0, 52 – 40) = 12, so the option should be exercised early at node C, and the value of the option at node C is 12.

Node A: (0.576l × l.65 + 0.4239 × 12) × exp(-0.12 × 3/12) = 5.86, which is greater than the intrinsic value of the option at this node equal to max(0, 52 – 50) = 2, so the option should not be exercised early at this node.

Q-31. Solution: C

Q-32. Solution: B

It is never optimal to exercise an American call option on a non-dividend-paying stock before the expiration date, but at any given time during its life, a put option should always be exercised early if it is sufficiently deep in the money. Thus, it can be optimal to exercise an American put option on a non-dividend-paying stock early.

Q-33. Solution: A

In this case S_{0} = 50, K = 50, r = 0.1, σ = 0.3, T = 0.25, and

$$d_1 = \frac{\ln(50/50) + (0.1 + 0.09/2)0.25}{0.3\sqrt{0.25}} = 0.2417$$

$$d_2 = d_1 - 0.3\sqrt{0.25} = 0.0917$$

The European put price is:

$$50N(-0.0917)e^{-0.1\times0.25} - 50N(-0.2417)$$
$$= 50\times0.4634e^{-0.1\times0.25} - 50\times0.4045 = 2.37$$
$$\text{or } \$2.37$$

Q-34. Solution: C

The value of a European call is equal to $SN(d_1) - Ke^{-rT}N(d_2)$, where S is the current price of the stock. In the case that dividends are introduced, S in the formula is reduced by the present value of the dividends. Furthermore, the announcement would affect the values of S, d_1 and d_2. However, since we are given the new values, and d_2 is the same, the change in the price of the call is only dependent on the term S × N(d_1).

Previous S × N(d_1) = 40 × 0.29123 = 11.6492

New S × N(d_1) = (40 – (0.5 × exp(-3%/12)) × 0.29928 = 11.8219

Change = 11.8219 – 11.6492 = 0.1727

So the new BSM call price would increase in value by 0.1727, which when added to the previous price of 1.78 equals 1.9527.

Q-35. Solution: B

$$\frac{N}{N+M}\cdot c=\frac{60{,}000{,}000}{60{,}000{,}000+3{,}000{,}000}\times 4.39=4.1809$$

Q-36. Solution: C

For a short call, Delta Vega, Gamma, and Rho contribute to the risk of the position. Theta is not a risk factor.

Q-37. Solution: B

The short index futures makes the portfolio delta neutral. It does not help with large moves.

Q-38. Solution: C

For ATM options, vega and theta are increasing funtions with maturity;and ganma is a decreasing function with matutity.

To buy short-term options + sell long-term options ≥ negative position thera, negative position vega,and positive position gamma.

In regard to (A), sell short-term + sell long-term options ≥ positive thera,negative vega; negative gamma.

In regard to (B), sell short-term + buy long-term options ≥ positive thera,positive vega; and negative gamma.

In regard to (D), buy short-term + buy long-term ≥ negative thera,positive vega; and positive gamma.

Note: the above are approximately actual numbera 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:

a) 1-year term: percentage theta = -5.0, vega = +37, gamma = +0.025

b) 10-year term:percentage theta = -2.5, vega = +70, gamma = +0.005

Q-39. Solution: D

Statement I is false – rho of a call and a put will change, with expiration of time and it tends to approach zero as expiration approaches.

Statement II is false-theta is positive for long ITM European put.

Q-40. Solution: C

Theta is negative for long positions in ATM options, so A is incorrect. Gamma is small for ITM options, so B is incorrect. Delta of ITM puts tens to -1, so D is incorrect.

Q-41. Solution: C

A riskier position is one that is expected to move around a lot in value. A delta neutral position should not change in value as the value of the underlying asset changes. This eliminates Choice A and Choice D Choice C is correct because a gamma-negative position means that delta and the change in the underlying asset move inversely with each other.

Q-42. Solution: D

To reduce positive gamma, one needs to sell options. When call options are sold, the delta becomes negative and one needs to buy stock to keep delta neutrality. When put options are sold, the delta becomes positive, and one needs to sell stock to keep delta neutrality.

Q-43. Solution: D

In order to hedge a short call option position, a manager would have to buy enough of the underlying to equal the delta times the number of options sold. In this case, delta = 0.5, so for every two options sold, the manager would have to buy a share of the underlying security. (Stop-loss strategies with call options are designed to limit the losses associated with short option positions. The strategy requires purchasing the underlying asset for a naked call position when the asset rises above the option's strike price.)

Q-44. Solution: D

Q-45. Solution: A

The call option is deep in-the-money and must have a delta close to one. The put option is deep out-of-the-money and will have a delta close to zero. Therefore, the value of the in-the-money call will decrease by close to USD 1, and the value of the out-of-the-money put will increase by a much smaller amount close to 0. The choice that is closest to satisfying both conditions is A.

Q-46. Solution: C

In the Black-Scholes framework, an in-the-money option is expected to change its value the most and out-of-money the least as a result of dividend payments. For the purpose of illustration, the impact of dividend payment on the option is characterized by:

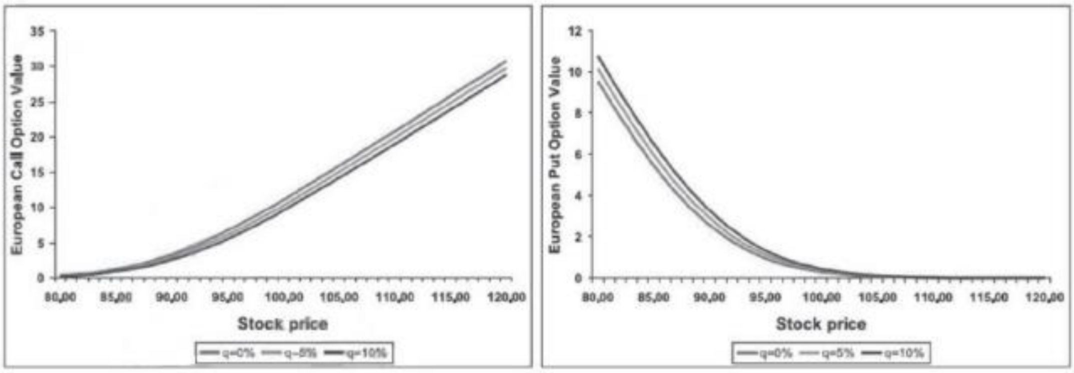
S = 93

K = 90

T = 60 days

r = 5%

sigma = 20%



Q-47. Solution: B

The deeper into-the-money the options are, the larger their deltas and therefore the more expensive to delta hedge.

Q-48. Solution: C

Gamma is defined as the rate of change of an option's delta with respect to the price of the underlying asset, or the second derivative of the option price with respect to the asset price. Therefore the highest gamma is observed in shorter maturity and at-the-money options, since options with these characteristics are much more sensitive to changes in the underlying asset price. The correct choice is a call option both at-the-money and with the shorter maturity.

Q-49. Solution: A

Delta hedging the short call option position requires buying shares in an amount equal to the hedge ratio times the 100,000 shares underlying the call position. We can calculate the hedge ratio as N(d$_l$) from the Black Scholes option pricing model. First we need to compute N(d$_l$).

$$d_1 = \frac{\ln\left(\frac{50}{49}\right) + (0.05 + \frac{0.20^2}{2}) \times 0.25}{0.20 \times \sqrt{0.25}} = 0.3770$$

We know that N(0.3770) has to be between 0.5 and 1.0, which means we need to buy somewhere between 50,000 and 100,000 shares. The only answer that fits is A, buy 65,000 shares. If you did have access to a probability table, you could determine that N(0.3770) = 0.6469, which means we need to buy exactly 64,690 shares to delta hedge the position.

Q-50. Solution: D

Changes of Stock number = (0.7040 – 0.5739) × 200 × 100 = 2602

Q-51. Solution: A

Such a portfolio is short vega (volatility) and short theta (time). We need to implement a hedge that is delta-neutral and involves buying and selling options with different maturities. Long positions in short-dated options have high negative theta and low positive vega. Hedging can be achieved by selling short-term options and buying long-term options.

Q-52. Solution: D

One important drawback of VaR is that it is not sub-additive.

Q-53. Solution: C

$$\text{VaR}_{10-\text{day}} = \text{VaR}_{2-\text{day}} \times \frac{\sqrt{10}}{\sqrt{2}} = 5.59$$

Q-54. Solution: B

The computation follows: VaR^2 (portfolio) = VaR^2 (stocks) + VaR^2 (fixed income), assuming the correlation is 0. $(1,367,000)^2 = (1,153,000)^2$ + VaR^2 (fixed income), VaR (fixed income) = 734,357. Next convert the annual VaR to daily VaR: $734,357/(250)^{(1/2)}$ = 46,445

Q-55. Solution: A

$$\text{VaR} = |\Delta| \times 1.645 \times \sigma \times S = 0.5 \times 1.645 \times 0.015 \times \$23 = \$0.28$$

The Δ of an at-the-money put is -0.5 and the absolute value of the Δ is 0.5.

Q-56. Solution: B

Q-57. Solution: D

A. is incorrect. This is the minimum.

B. is incorrect. This is the maximum.

C. is incorrect. This is the median.

D. is correct. Conditional VaR is the "mean" of the losses beyond the VaR level.

Q-58. Solution: C

18% – 2 × L = 3 × 6% – 2 × L

(18% – 2 × L) + (2 × L) = 3 × 6%

D_{IF} = 3 × $D_{6\%}$ = 3 × 4.5 = 13.5

VAR_{IF} = D × P (worst change in yields) = 13.5 × 100million × 0.66% = 8.91million

Q-59. Solution: C

$$\text{VaR} = \Delta(\text{dS}) - \frac{1}{2}\Gamma(\text{dS})^2 = 100000 \times 2 - \frac{1}{2} \times (-50000) \times 2^2 = \$300000$$

Q-60. Solution: C

The hybrid approach combines the two simplest approaches, HS and Risk Metrics, by estimating the percentiles of the return directly (similar to HS), and using exponentially declining weights on past data (similar to Risk Metrics)

Q-61. Solution: A

The Risk Metrics approach is a delta-normal model that requires the returns to be approximately normally distributed, while the historical simulation model requires much less stringent assumptions. The returns on a portfolio with small number of securities is less likely to be normally distributed than a larger portfolio and an emerging markets index is less likely to be normally distributed than a broad market index. Therefore the historical simulation approach will most likely provide a better VaR estimate than Risk Metrics for a portfolio with a small number of emerging market securities.

Q-62. Solution: B

The historical method requires that the future be determined by past asset price movements.

Q-63. Solution: B

The hybrid approach combines two approaches to estimating VaR, the historical simulation and the exponential smoothing approach (i.e. an EWMA approach). Similar to a historical simulation approach, the hybrid approach estimates the percentiles of the return directly, but it also uses exponentially declining weights on past data similar to the exponentially weighted moving average approach.

Q-64. Solution: D

Since the option is at-the-money, the delta is close to 0.5. Therefore a 1 point change in the index would translate to approximately 0.5 × EUR 10 = EUR 5 change in the call value. Therefore, the percent delta, also known as the local delta, defined as %D = (5/350) / (1/2200) = 31.4.

So the 99% VaR of the call option = %D × VaR(99% of index) = %D × call price × alpha (99%) × 1-day volatility = 31.4 × EUR 350 × 2.33 × 2.05% = EUR 525. The term alpha (99%) denotes the 99th percentile of a standard normal distribution, which equals 2.33.

There is a second way to compute the VaR. If we just use a conversion factor of EUR 10 on the index, then we can use the standard delta, instead of the percent delta:

VaR(99% of Call) = D × index price × conversion × alpha (99%) × 1-day volatility = 0.5 × 2200 × 10 × 2.33 × 2.05% = EUR 525, with some slight difference in rounding.

Both methods yield the same result.

Q-65. Solution: C

Annual VaR = 6,247,000 × (250^0.5) × (0.0002^0.5) × 1.645 = 2,297,854

Q-66. Solution: B

The delta of the option is 0.6. The VaR of the underlying is:

1.89% * 1.65 * 104 = 3.24

Therefore, the VaR of one option is:

0.6*3.24=1.946, and multiplying by 1,000 provides the VaR of the entire position: 1,946.

Q-67. Solution: A

The VaR will always be higher under the linear approximation method than a full revaluation conducted by Monte Carlo simulation analysis.

Q-68. Solution: A

The calculations follow. Calculate VaR(1-day) from each choice:

$$\begin{aligned}
\text{VaR}(10-\text{day}) &= 316 \rightarrow \text{VaR}(1-\text{day}) = 316/\sqrt{10} = 100 \\
\text{VaR}(15-\text{day}) &= 465 \rightarrow \text{VaR}(1-\text{day}) = 465/\sqrt{15} = 120 \\
\text{VaR}(20-\text{day}) &= 537 \rightarrow \text{VaR}(1-\text{day}) = 537/\sqrt{20} = 120 \\
\text{VaR}(25-\text{day}) &= 600 \rightarrow \text{VaR}(1-\text{day}) = 600/\sqrt{25} = 120
\end{aligned}$$

VaR(1-day) from A is different from those from other answers.

Q-69. Solution: A.

The 10% loss tail includes 5% of no loss (i.e., the 90% to 95% CDF) and 5% of the loss event.

The average of this 10% tail is therefore given by:

50% × 0 + 50% × [E (loss | loss event)] = 50% × [20% × 10 + 50% × 18 + 30% × 25] = $9.25 million

Q-70. Solution: C

Q-71. Solution: D

The approaches are not compatible or directly comparable, and using the two approaches for different firms can yield highly inconsistent and misleading results.

Q-72. Solution: C

The interpretation given by the above statement refers to a rating of BBB/Baa, which is a lower investment grade rating. A rating of BB/Ba is not investment grade, an AA/Aa rating is a very high investment grade rating and an A/A rating still reflects a strong capacity to make payments.

Q-73. Solution: B

The interpretation the statement refers to is a rating of A. The interpretations for each of the ratings are:

AAA — Extremely strong capacity to meet financial commitments

A — Strong capacity to meet financial commitments

B — Very speculative with significant credit risk

C — In bankruptcy or default

Q-74. Solution: C

A is incorrect. The chance of BBB loans being upgraded over 1 year is 4.08% (0.02 + 0.21 + 3.85).

B is incorrect. The chance of BB loans staying at the same rate over 1 year is 75.73%.

C is correct. 88.21% represents the chance of BBB loans staying at BBB or being upgraded over 1 year.

D is incorrect. The chance of BB loans being downgraded over 1 year is 5.72% (0.04 + 0.08 + 0.33 + 5.27).

Q-75. Solution: D

The first period probability of default for a B-rated bond is 2%. In second period the probability of default is the probability of surviving year 1 and defaulting in year 2. The year 2 probability of default = (0.03 × 0.00) + (0.90 × 0.02) + (0.05 × 0.14) = 2.5%. Therefore, the two-period cumulative probability of default = 2% + 2.5% = 4.5%.

Q-76. Solution: C

EL_P = 40 × 3% × (1 – 70%) + 60 × 5% × (1 – 45%) million = 2,010,000

Q-77. Solution: C

Unexpected loss (%) = SQRT [EDF × variance (LGD) + LGD^2 × variance (EDF)] =

SQRT [4% × 25%^2 + 50%^2 × 4% × 96%] = 11.00%

Expected loss (%) = EDF × LGD = 4% × 50% = 2.0%

Ratio of UL/EL = 11.0%/2.0% = 5.50

Q-78. Solution: B

$$\begin{aligned}&\text{adjust exposure} = \text{OS} + (\text{COM} - \text{OS}) \times \text{UGD}\\&= 2{,}000{,}000 + (3{,}000{,}000 - 2{,}000{,}000) \times 0.65\\&= 2{,}650{,}000\end{aligned}$$

Q-79. Solution: C

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

Q-80. Solution: A

Unexpected devaluation of the yen would result in a gain to the trader.

Q-81. Solution: D

In addition to contagion, there are other reasons why country risk assessment is prone to error. First of all, the interrelationship among the relevant variables is complex and hard to model. Also, many sovereign and foreign borrowers provide incomplete and/or inaccurate information.

Q-82. Solution: D

Despite large and often comprehensive amounts of data used in analysis, actual ratings may be based on subjective interpretations of the data. Also, ratings are often delayed relative to the dynamic business and political environments. Ratings may be influenced by politics. Also, ratings may not be considered useful in assessing a country's ability and willingness to pay 5 to 10 years in the future. Rating agencies are not required to use government data for quantitative assessments of the likelihood of repayment although, like other analyses, government data is often heavily relied upon for conclusions regarding default risk.

Q-83. Solution: D

The Gini coefficient is commonly used to measure income inequality on a scale of zero to one, with zero being total equality and one being total inequality. Therefore, nations with lower Gini coefficients have a more even distribution of income, while higher Gini coefficients indicate a wider disparity between higher and lower income households.

Q-84. Solution: D

Numerous services attempt to evaluate country risk in its entirety. They include Political Risk Services (PRS), The Economsit, Euromoney, and the World Bank. Euromoney surveys 400 economists who assess country risk factors and rank countries from 0 to 100, with higher numbers indicating lower risk.

Q-85. Solution: D

Historically, countries have been more likely to default on foreign bank debt than on sovereign bonds. Latin America is responsible for the greatest number of foreign currency defaults over the last five decades with more than 60% of defaults in each decade with the exception of the 1990s. Over the last 200 years there are many instances of default. The defaults primarily occur in seven distinct time periods: 1824-1834, 1867-1882, 1890-1900, 1911-1921, 1931-1940, 1976-1989, and 1998-2003. Thus, countries did borrow and default in the 19th century.

Q-86. Solution: C

Q-87. Solution: B

Q-88. Solution: D

Q-89. Solution: D

In the standardized approach to calculating operational risk, a bank's activities are divided up into several different business lines, and a beta factor is calculated for each line of business Economic capital covers the difference between the worst-case loss and the expected loss. Loss severity tends to be modeled with a lognormal distribution, but loss frequency is typically modeled using a Poisson distribution. Operational loss data available from data vendors tends to be biased towards large losses.

Q-90. Solution: D

D is correct. Using external data obtained from other banks is one good way to increase the data set of historical operational losses. Data from other banks needs to be adjusted for size before being merged with the bank's internal data.

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

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

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

Q-91. Solution: B

The main purpose of value-at-risk (VaR) measures is to quantify potential losses under "normal" market conditions, where normal is defined by the confidence level, typically 99 percent. In principle, increasing the confidence level could uncover progressively larger but less likely losses. In practice, VaR measures based on recent historical data can fail to identify extreme unusual situations that could cause severe losses. This is why VaR methods should be supplemented by a regular program of stress testing. Stress testing is a non-statistical risk measure because it is not associated with a probability statement like VaR.

One other reason to stress test is that VaR measures typically use recent historical data. Stress testing, in contrast, considers situations that are absent from historical data or not well represented but nonetheless likely. Alternatively, stress tests are useful to identify states of the world where historical relationships break down, either temporarily or permanently.

A is incorrect. VaR utilizes a great number of scenarios while stress testing focuses on just a few.

C is incorrect. This is a description of VaR. D is incorrect. Stress testing may employ scenarios that are not generated by distributions and probabilities in general do not play a prominent role.

Q-92. Solution: C

The purchase of insurance protection can transform market risk into counterparty credit risk.

Q-93. Solution: B

Stress testing can serve as an early warning sign of upcoming pressures and risks. The board of directors can take actions that include adjusting capital levels, increasing liquidity, adjusting risks, or engaging in or withdrawing from certain activities.

The board of directors has ultimate oversight responsibility and accountability for an entire institution. Senior management is responsible for implementing authorized stress testing activities. Senior management should use stress testing, complemented with scenario analysis, to evaluate an institutions risk decisions.

Q-94. Solution: A

An internal audit should review the manner in which stress testing efficiencies are identified, tracked, and remedied.

An internal audit should assess not only the stress testing activities, but also the staff involved in stress testing activities. An internal audit does not need to independently assess each stress test used. The internal audit function needs to be independent and objective.

Q-95. Solution: A

Institutions use reverse stress tests “break the bank” in order to assess the events that are outside of normal business expectations and could threaten the institutions viability.

Q-96. Answer: D

Stress tests tend to use ordinal rank arrangements, while EC methods use cardinal probabilities. Stress tests tend to focus on longer periods of time (e.g., several years) compared to EC methods (e.g., point in time). Stress tests tend to focus on conditional scenarios, while EC methods tend to focus on unconditional scenarios. Stress tests tend to compute losses from an accounting perspective which EC methods tend to compute them from a market perspective.

Q-97. Solution: A

The same percentile loss on the VaR loss distribution would be taken in the EC model as a proxy for the stressed loss resulting from market risk. Assigning probabilities to outcomes often allows the results of stress tests to be generated. The use of stress inputs has been especially notable in the area of market risk. Financial institutions usually use a Merton model, not a binomial model, to simulate defaults and credit quality.

Q-98. Solution: C

A key advantage of using stressed risk metrics is chat they are conservative. In examining capital adequacy for unexpected losses and considering stressed metrics, the amount of capital is likely to be more than sufficient. In other words, a risk metric that is stressed is likely to be more conservative. A more conservative risk metric does not necessarily mean it is more realistic. One of the disadvantages of using stressed inputs is that the risk metric becomes unresponsive to current market conditions and is more dependent on the investments within the portfolio.

Q-99. Solution: B

Recent turmoil revealed numerous weaknesses in banks, stress caking practices, such lack of proper recognition of extreme shocks and presence of significant system-wide correlations (feedback and spillover effects) between different markets, risks, and portfolio positions. Shorter test durations and historical or hypothetical scenario-based testing were key weaknesses in stress testing practices. Actual events showed longer duration of stress conditions and breakdown of historical statistical relationships.

Q-100. Solution: C

Basel II does not impose monthly requirements for stress testing.