2020 FRM Part I

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期权与风险模型

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4. Options and Risk Models

4.1. Basic Characteristics of Option

4.1.1. 重要知识点

4.1.1.1. Option Factors & Pricing Bounds

Factor	European Call	European Put	American Call	American Put
S	+	-	+	-
X	-	+	-	+
T	?	?	+	+
σ	+	+	+	+
r	+	-	+	-
D	-	+	-	+

Option	Proxy	Min Value	Max value
European call	c	$\max(0, S_0 - Xe^{-rT})$	S_0
American call	C	$\max(0, S_0 - Xe^{-rT})$	S_0
European put	p	$\max(0, Xe^{-rT} - S_0)$	Xe^{-rT}
American put	P	$\max(0, X - S_0)$	X

4.1.1.2. Put-call Parity

European option: $p + S = c + Xe^{-rT}$

American option: no exact price relationship

4.1.2. 基础题

Q-1. The current stock price of a share is USD 100 and the continuously compounding risk-free rate is 12% per year. The maximum possible prices for a 3-month European call option, American call option, European put option, and American put option, all with strike price USD 90, are:

A. 100,100,87.34, 90

B. 100,100,90, 90

C. 97.04,100, 90, 90

D. 97.04, 97.04, 87.34, 87.34

Q-2. Consider an American call option and an American put option, each with 3 months to maturity, written on a non-dividend-paying stock currently priced at USD 40. The strike price for both options is USD 35 and the risk-free rate is 1.5%. What are the lower and upper bounds on the difference between the prices of the call and put options?

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

A. Scenario A

B. Scenario B

C. Scenario C

D. Scenario D

Q-3. Jeff is an arbitrage trader, and he wants to calculate the implied dividend yield on a stock while looking at the over-the-counter price of a 5-year put and call (both European-style) on that same stock. He has the following data:

- Initial stock price = USD 85
- Strike price = USD 90
- Continuous risk-free rate = 5%
- Underlying stock volatility = unknown
- Call price = USD 10
- Put price = USD 15

What is the continuous implied dividend yield of that stock?

A. 2.48%

B. 4.69%

C. 5.34%

D. 7.71%

Q-4. The price of a six-month, USD 25 strike price, European call option on a stock is USD 3. The stock price is USD 24. A dividend of USD 1 is expected in three months. The continuously compounded risk-free rate for all maturities is 5% per year. Which of the following is closest to the value of a put option on the same underlying stock with a strike price of USD 25 and a time to maturity of six months?

A. USD 3.60

B. USD 2.40

C. USD 4.37

D. USD 1.63

4.2. Trading Strategies Involving Options

4.2.1. 重要知识点

4.2.1.1. Simple Strategies

- Covered Call and Protective Put
- Principal Protected Notes(PPN)

4.1.1.1. Spread Strategies

- Bull and Bear Spread
- Box Spread
- Butterfly Spread

4.1.1.1. Combination Strategies

- Straddle and Strangle

4.1.1. 基础题

Q-5. Consider the following bearish option strategy of buying one at-the-money put with a strike price of $43 for $6, selling two puts with a strike price of $37 for $4 each and buying one put with a strike price of $32 for $1. If the stock price plummets to $19 at expiration, calculate the net profit/loss per share of the strategy.

A. -2.00 per share

B. Zero – no profit or loss

C. 1.00 per share

D. 2.00 per share

Q-6. Which option combination most closely simulates the economics of a short position in a futures contract?

A. Payoff of a long call plus a short put

B. Profit of a long call plus a short put

C. Payoff of a long put plus short call

D. Profit of long put plus short call

Q-7. A butterfly spread involves positions in options with three different strike prices. It can be created by buying a call option with a low strike of X1; buying a call option with a high strike X3; and selling two call options with a strike X2 halfway between X1 and X3. What can be said about the upside and downside of the strategy?

A. Both the upside and downside is unlimited.

B. Both the upside and downside is limited.

C. The upside is unlimited but the downside is limited.

D. The upside is limited but the downside is unlimited.

Q-8. The payoff on a calendar spread is most similar to which of the following option strategies?

A. Bull spread

B. Bear spread

C. Long straddle

D. Butterfly spread

Q-9. An investor sells a January 2014 call on the stock of XYZ Limited with a strike price of USD 50 for USD 10, and buys a January 2014 call on the same underlying stock with a strike price of USD 60 for USD 2. What is the name of this strategy, and what is the maximum profit and loss the investor could incur at expiration?

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

4.2. Exotic Options

4.2.1. 重要知识点

4.2.1.1. Compound option: option on another option.

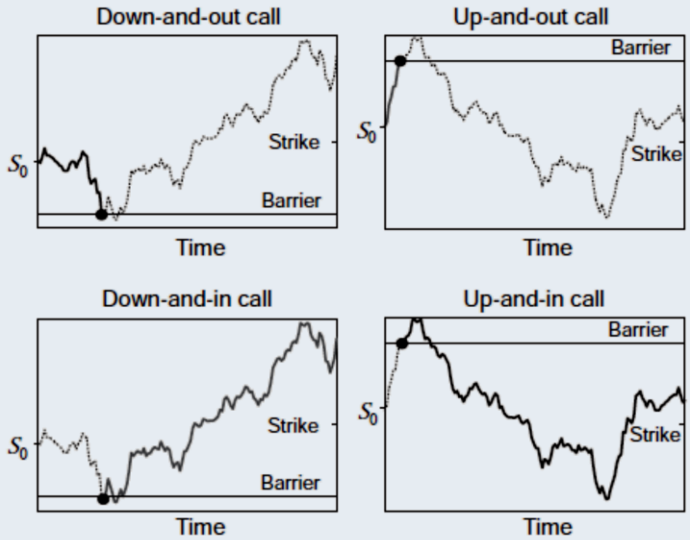
- Call on a call: right to buy a call option at a set price for a set period of time.
- Call on a put: right to buy a put option at a set price for a set period of time.
- Put on a call: right to sell a call option at a set price for a set period of time.
- Put on a put: right to sell a put option at a set price for a set period of time.

4.2.1.2. Chooser option

- Owner chooses whether option is call or put after initiation.

4.2.1.3. Barrier option

- Payoff and existence depend on price reaching a certain barrier level.
- Down-and-out call (put): ceases to exist if the underlying asset price hits the barrier level, which is set below the current stock value.
- Down-and-in call (put): only comes into existence if the underlying asset price hits the barrier level, which is set below the current stock value.
- Up-and-out call (put): ceases to exist if the underlying asset price hits a barrier level, which is set above the current stock value.
- Up-and-in call (put): only comes into existence if the underlying asset price hits the above current stock price barrier level.



Paths for Knock-Out and Knock-In Call Options

4.2.1.4. Binary option

- Pay either nothing or a fixed amount.
- Cash-or-nothing call: a fixed amount, Q, is paid if the asset ends up above the strike price.
- Asset-or-nothing call: pays the value of the stock when the contract is initiated if the stock price ends up above the strike price at expiration.

4.2.1.5. Lookback option

- Payoff depends on the maximum (call) or minimum (put) value of the underlying asset over the life of the option. Can be fixed or floating depending on the specification of a strike price.

4.2.1.6. Asian option

- Payoff depends on average of the underlying asset price over the life of the option; less volatile than standard option.

4.2.2. 基础题

Q-10. A trader writes the following 1-year European-style barrier options as protection against large movements in a non-dividend paying stock that is currently trading at EUR 40.96.

Option	Price (EUR)
Up-and-in barrier call, with barrier at EUR 45	3.52
Up-and-out barrier call, with barrier at EUR 45	1.24
Down-and-in barrier put, with barrier at EUR 35	2.00
Down-and-out barrier put, with barrier at EUR 35	1.01

All of the options have the same strike price. Assuming the risk-free rate is 2% per annum, what is the common strike price of these options?

A. EUR 39.00

B. EUR 40.00

C. EUR 41.00

D. EUR 42.00

Q-11. A 1-year forward contract on a stock with a forward price of USD 100 is available for USD 1.50. The table below lists the prices of some barrier options on the same stock with a maturity of 1 year and strike of USD 100. Assuming a continuously compounded risk-free rate of 5% per year. What is the price of a European put option on the stock with a strike of USD 100.

Option	Price
Up-and-in barrier call, barrier USD 95	USD 5.21
Up-and-out barrier call, barrier USD 95	USD 1.40
Down-and-in barrier put, barrier USD 80	USD 3.5

A. USD 2.00

B. USD 4.90

C. USD 5.11

D. USD 6.61

Q-12. Looking at a risk report. Mr. Woo finds that the options book of Ms. Yu has only long positions and yet has a negative delta. He asks you to explain how that is possible. What is a possible explanation?

A. The book has a long position in up-and-in call options.

B. The book has a long position in binary options.

C. The book has a long position in up-and-out call options.

D. The book has a long position in down-and-out call options.

Q-13. Of the following options, which one does not benefit from an increase in the stock price when the current stock price is $100 and the barrier has not yet been crossed:

A. A down-and-out call with barrier at $90 and strike at $110

B. A down-and-in call with barrier at $90 and strike at $110

C. An up-and-in put with barrier at $110 and strike at $100

D. An up-and-in call with barrier at $110 and strike at $100

Q-14. Trader A purchased a 3-month floating lookback call option on ABA stock three months ago. Trader B purchased a 3-month fixed lookback call option on the same stock during the same time period as Trader A. ABA stock finished at $50 at the end of the three-month option term, and the initial strike price was equal to $40. The minimum stock price over the investment horizon was $35 , and the maximum stock price over the investment horizon was $53.The payoff difference between the floating lookback call and the fixed lookback call is closest to:

A. $2.

B. $3.

C. $8.

D. $10.

4.3. Value Option Using a Binomial Tree

4.3.1. 重要知识点

4.3.1.1. $f = e^{-rt}[pf_u + (1-p)f_d]$

4.3.1.2. $p = \frac{e^{r\Delta t}-d}{u-d}$ $u = e^{\sigma\sqrt{\Delta t}}$ $d = \frac{1}{u}$

4.3.1.3. **Stocks with dividends and stock indices:** replace $e^{r\Delta t}$ with $e^{(r-q)\Delta t}$ where q is the dividend yield of a stock or stock index.

4.3.2. 基础题

Common text for following two questions:

A risk manager for Bank XYZ, Mark is considering writing a 6 month American put option on a non-dividend paying stock ABC. The current stock price is USD 50 and the strike price of the option is USD 52. In order to find the no-arbitrage price of the option. Mark uses a two-step binomial tree model. The stock price can go up or down by 20% each period. Mark's view is that the stock price has an 80% probability of going up each period and a 20% probability of going down. The annual risk-free rate is 12% with continuous compounding.

Q-15. What is the risk-neutral probability of the stock price going up in a single step?

A. 34.5%

B. 57.6%

C. 65.5%

D. 80.0%

Q-16. The no-arbitrage price of the option is closest to:

A. USD 2.00

B. USD 2.93

C. USD 5.22

D. USD 5.86

Q-17. Martha used a three-step binomial model to value a (long-term) put option with three years to maturity; i.e., each time step is one year. While the risk-free rate is 4.0%, the underlying asset's volatility is 28.480%. Using these assumptions, she was pleasantly surprised to see that the risk-neutral probability of up movement in her model as 50.0%; i.e., p = d = 0.50. However, she forgot to include the assumption that the asset will pay a continuous dividend of 2.0% per annum. By how much will this assumption change her model's risk-neutral probability of a down (d) movement?

A. Decrease probability of down movement, (d), by about 10.79% percentage points

B. Decrease probability of down movement, (d), by about 3.57% percentage points

C. Increase probability of down movement, (d), by about 3.57% percentage points

D. Increase probability of down movement, (d), by about 10.79% percentage points

Q-18. The current price of a stock is $10, and it is known that at the end of three months the stock's price will be either $13 or $7. The risk-free rate is 4% per annum. What is the implied no arbitrage price of a three-month (T = 0.25) European call option on the stock with a strike price of $10? (Note: this does not include an assumption about the stock's volatility).

A. $0.97

B. $1.28

C. $1.53

D. $1.65

Q-19. A trader has an American put option with strike price of $50. The underlying asset is stock with a spot price of $40. Using an one-step binomial tree to evaluate the option. Suppose the stock price will go up or down by $8 in 6 month, the risk-free rate is 6.2%, what is the value of this American put?

A. USD 8.19

B. USD 8.45

C. USD 10.00

D. USD 10.32

Q-20. A stock with a current price of $32 and volatility of 15% pays a dividend of 2.0% per annum (with continuous compounding). The riskless rate is 2.0%. We use a twelve-step binomial model to price an American put option with one year to expiration; i.e., each step is one month. What is the risk-neutral probability of a down movement (1-p)?

A. 0.4646

B. 0.4962

C. 0.5108

D. 0.5375

Q-21. What is the risk-neutral probability of an up movement (p) in a two-step binomial model used to value an two-year American-style put option on a stock with a volatility of 38% when the risk-free rate is 4.0%; i.e., each step is one year?

A. 0.411

B. 0.459

C. 0.503

D. 0.548

Q-22. A stock with a (continuous) dividend yield of 1.0% has a current price of $30 and volatility of 22%. We use a two-step binomial model to value a two-year European style call option on the stock; i.e., each time step is one year. The risk-free rate is 3.0%. In the binomial tree, what is the stock price at the node with the lowest stock price?

A. $14.78

B. $19.32

C. $22.49

D. $25.25

Q-23. The current price of a non-dividend paying stock is $75. The annual volatility of the stock is 18.25%, and the current continuously compounded risk-free interest rate is 5%. A 3-year European call option exists that has a strike price of $90. Assuming that the price of the stock will rise or fall by a proportional amount each year, and that the probability that the stock will rise in any one year is 60%, what is the value of the European call option?

A. $22.16

B. $12.91

C. $3.24

D. $7.36

Q-24. The NASDAQ-100 stock index is currently 7,300.0 and has a volatility of 40.0% and a dividend yield of 1.0%. The risk-free rate is 3.0%. If we employ a two-step binomial tree, which is nearest to the value of a European 6-month call option with a strike price of 7,500.0; i.e., the call is out-of-the-money by exactly 200?

A. $714.77

B. $734.20

C. $756.93

D. $777.51

4.4. Black-Scholes-Merton Model

4.4.1. 重要知识点

4.4.1.1. Black-Scholes-Merton model on a non-dividend-paying stock

- $c = S_0N(d_1) - Ke^{-rT}N(d_2)$
- $p = Ke^{-rT}N(-d_2) - S_0N(-d_1)$
- $d_1 = \frac{\ln(S_0/K)+(r+\sigma^2/2)T}{\sigma\sqrt{T}}$
- $d_2 = d_1 - \sigma\sqrt{T}$

4.4.1.2. Black-Scholes-Merton model on a dividend-paying stock

- $c = S_0e^{-qT}N(d_1) - Ke^{-rT}N(d_2)$

4.4.1.3. Rules for Exercising American Option

- It is never optimal to exercise an American call on a non-dividend-paying stock before its expiration date.

- American puts can be optimally exercised early if they are sufficiently in-the-money.
- An American call on a dividend-paying stock may be exercised early if the dividend exceeds the amount of forgone interest.

4.4.2. 基础题

Q-25. Which of the following statements is correct about the early exercise of American options?

A. It is always optimal to exercise an American call option on a non-dividend-paying stock before the expiration date.

B. It can be optimal to exercise an American put option on a non-dividend-paying stock early.

C. It can be optimal to exercise an American call option on a non-dividend-paying stock early.

D. It is never optimal to exercise an American put option on a non-dividend-paying stock before the expiration date.

Q-26. Which of the following is not an assumption of the Black-Scholes options pricing model?

A. The price of the underlying moves in a continuous fashion.

B. The interest rate changes randomly over time.

C. The instantaneous variance of the return of the underlying is constant.

D. Markets are perfect, i.e. short sales are allowed, there are no transaction costs or taxes, and markets operate continuously.

Q-27. The current price of a stock is $25. A put option with a $20 strike price that expires in six months is available. $\mathrm{N}(\mathrm{d}_1) = 0.9737$ and $\mathrm{N}(\mathrm{d}_2) = 0.9651$**错误!请输入数字。**.If the underlying stock exhibits an annual standard deviation of 25%, and the current continuously compounded risk-free rate is 4.25%, the Black-Scholes-Merton value of the put is closest to:

A. $0.01

B. $0.03

C. $0.33

D. $0.36

Q-28. A European call option has a time to maturity of six months on a stock with a 2% dividend yield. The current stock and strike prices are both $50. The volatility of the stock is 18%

per annum. The risk free rate is 4%. What is the price of the call option?

A. $2.00

B. $2.75

C. $3.08

D. $3.16

Q-29. A one-year European call option on the Euro has an exercise price of $1.40 when the current exchange rate is EUR/USD $1.34. The risk-free rate in the United States is 4% and the Eurozone risk-free rate is 3%. The volatility of the spot exchange rate is 30% per annum. What is the price of the call option?

A. $0.136

B. $0.297

C. $0.355

D. $0.425

Q-30. What is the price of a three month European put option on a non-dividend-paying stock with a strike price of $50 when the current stock price is $50, the risk-free interest rate is 10% per annum, and the volatility is 30% per annum.

A. 2.37

B. 2.48

C. 2.25

D. 2.63

Q-31. Each of the following is an underlying assumption of the basic Black-Scholes option pricing model EXCEPT:

A. The stock price follows a geometric Brownian motion (GBM) which is a continuous process without jumps

B. The continuously compounded rate of return on the stock is normally distributed, such that the distribution of the future stock price is lognormal

C. The expected rate of return on the stock (mu) and volatility (sigma) are constant

D. The expected real-world (risky) rate of return on the stock is known and the value of the option is an increasing function of this rate of return

Q-32. The CFO at a non-dividend-paying firm asks a financial analyst to evaluate a plan by the firm to grant stock options to its employees. The firm has 60 million shares outstanding. Under the proposal, the firm would issue 3 million employee stock options, with each option giving the holder the right to buy one share of the firm's stock at a strike price of USD 70. The employee stock options would expire in 4 years. A four-year call option on the stock with the same strike price is currently valued at SGD 4.39 using the Black-Scholes-Merton model. Which of the following is the best estimate of the price of one employee stock option assuming that the call option is correctly priced?

A. SGD 3.97

B. SGD 4.18

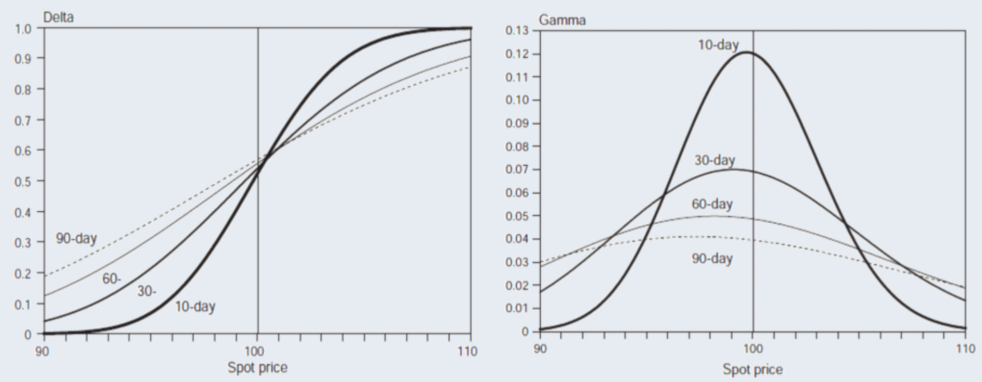
C. SGD 4.39

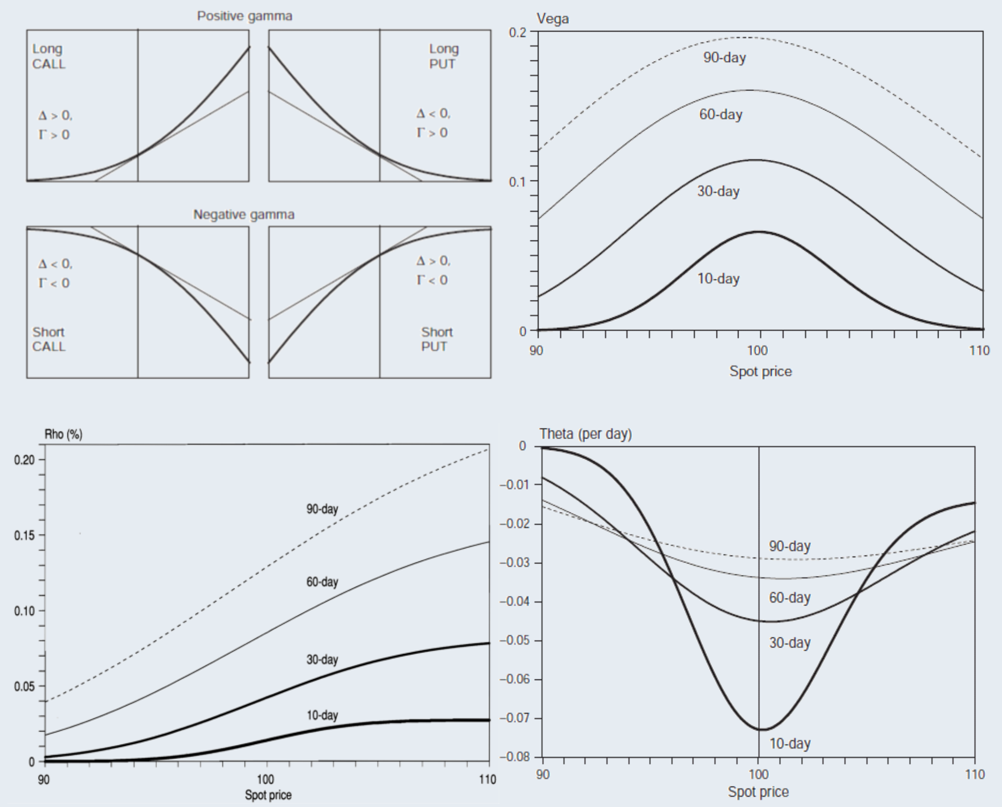
D. SGD 4.45

4.5. Greek Letters

4.5.1. 重要知识点

4.5.1.1.





- Delta of an at-the-money call option is close to 0.5. Delta moves to 1as the call goes deep in the money. It moves to zero as the call goes deep out of the money.
- Gamma is highest for short-term at-the-money options.
- Vega is highest for long-term at-the-money options.
- Rho is similar to Delta.
- Theta is the variation in option value due to the passage of time. This is also the time decay. Unlike other factors, however, the movement in remaining maturity is perfectly predictable. Time is not a risk factor.

4.5.2. 基础题

Q-33. If risk is defined as a potential for unexpected loss, which factors contribute to the risk of a short call option position?

A. Delta, Vega, Rho

B. Vega, Rho

C. Delta, Vega, Gamma, Rho

D. Delta, Vega, Gamma, Theta, Rho

Q-34. The dividend yield of an asset is 10% per annum. What is the delta of a long forward contract on the asset with 6-month to maturity?

A. 0.95

B. 1.00

C. 1.05

D. Cannot be determined without further information.

Q-35. You are given the following information about a call option:

- Time to maturity = 2 years
- Continuous risk-free rate = 4%
- Continuous dividend yield = 1%
- $N(d_1) = 0.64$

Calculate the delta of this option.

A. -0.64

B. 0.36

C. 0.63

D. 0.64

Q-36. Mr. Black has been asked by a client to write a large put option on the S&P 500 index. The option has an exercise price and a maturity that is not available for options traded on exchanges. He, therefore, has to hedge the position dynamically. Which of the following statements about the risk of his position are not correct?

A. He can make his portfolio delta neutral by shorting index futures contracts.

B. There is a short position in an S&P 500 futures contract that will make his portfolio insensitive to both small and large moves in the S&P 500.

C. A long position in a traded option on the S&P 500 will help hedge the volatility risk of the option he has written.

D. To make his hedged portfolio gamma neutral, he needs to take positions in options as well as futures.

Q-37. Portfolio manager Sally has a position in 100 option contracts with the following position Greeks: theta = +25,000; vega = +330,000 and gamma = -200; ie., positive theta, positive vega and negative gamma. Which of the following additional trades, utilizing generally at-the-money (ATM) options, will neutralize (hedge) the portfolio with respect to theta, vega and gamma?

A. Sell short-term options + sell long-term options (all roughly at-the-money)

B. Sell short-term options + buy long-term options (~ ATM)

C. Buy short-term options + sell long-term options (~ ATM)

D. Buy short-term options + buy long-term options (~ ATM)

Q-38. Which of the following statements is correct?

I. The rho of a call option changes with the passage of time and tends to approach zero as expiration approaches, but this is not true for the rho of put options.

II. Theta is always negative for long calls and long puts and positive for short calls and short puts.

A. I only.

B. II only

C. I and II

D. Neither

Q-39. Which of the following statements is true regarding options Greeks?

A. Theta tends to be large and positive when buying at-the-money options.

B. Gamma is greatest for in-the-money options with long maturities.

C. Vega is greatest for at-the-money options with long maturities.

D. Delta of deep in-the-money put options tends toward +1.

Q-40. Which position is most risky?

A. Gamma-negative, delta-neutral

B. Gamma-positive, delta-positive

C. Gamma-negative, delta-positive

D. Gamma-positive, delta-neutral

Q-41. A portfolio of stock A and options on stock A is currently delta neutral, but has a positive gamma. Which of the following actions will make the portfolio both delta and gamma neutral?

A. Buy call options on stock A and sell stock A

B. Sell call options on stock A and sell stock A

C. Buy put options on stock A and buy stock A

D. Sell put options on stock A and sell stock A

Q-42. Which of the following choices will effectively hedge a short call option position that exhibits a delta of 0.5?

A. Sell two shares of the underlying for each option sold.

B. Buy two shares of the underlying for each option sold.

C. Sell the number of shares of the underlying equal to one-half the options sold.

D. Buy the number of shares of the underlying equal to one-half the options sold.

Q-43. Consider the following statements, which one is incorrect?

A. Short a coupon bond is equivalent to long effective duration and short effective convexity.

B. Long a plain vanilla call option is equivalent to long delta and also long gamma.

C. Short a plain vanilla put option is equivalent to short vega.

D. Long a deep in the money up and out call option is equivalent to long delta and short vega.

Q-44. The current stock price of a company is USD 80. A risk manager is monitoring call and put options on the stock with exercise prices of USD 50 and 5 days to maturity. Which of these scenarios is most likely to occur if the stock price falls by USD 1?

Scenario	Call Value	Put Value
A	Decrease by USD 0.94	Increase by USD 0.08
B	Decrease by USD 0.94	Increase by USD 0.89
C	Decrease by USD 0.07	Increase by USD 0.89
D	Decrease by USD 0.07	Increase by USD 0.08

A. Scenario A

B. Scenario B

C. Scenario C

D. Scenario D

Q-45. Wanda Zheng (FRM) is responsible for the options desk in a London bank. Zheng is concerned about the impact of dividends on the options held by the options desk. She asks you to assess which options are the most sensitive to dividend payments. What would be your answer if the value of the options is found by using the Black-Scholes model adjusted for dividends?

A. Everything else equal, out-of-the-money call options experience a larger decrease in value than in-the-money call options as expected dividends increase.

B. The increase in the value of in-the-money put options caused by an increase in expected dividends is always larger than the decrease in value of in-the-money call options.

C. Keeping the type of option constant, in-the-money options experience the greatest absolute change in value and out-of-the-money options the smallest absolute change in value as expected dividends increase.

D. Keeping the type of option constant, at-the-money options experience the largest absolute change in value and out of-the-money options the smallest absolute change in value as a result of dividend payment.

Q-46. If the current market price of a stock is USD 50, which of the following options on the stock has the highest gamma?

A. Call option expiring in 30 days with strike price of USD 50

B. Call option expiring in 5 days with strike price of USD 30

C. Call option expiring in 5 days with strike price of USD 50

D. Put option expiring in 30 days with strike price of USD 30

4.6. Delta Hedging

4.6.1. 重要知识点

4.6.1.1. A position with a delta of zero is called a delta neutral position.

4.6.1.2. A position is delta neutral only instantaneously (for a very short period of time). To maintain a delta neutral position, the trader must re-balance the portfolio.

4.6.2. 基础题

Q-47. A bank has sold USD 300,000 of call options on 100,000 equities. The equities trade at 50, the option strike price is 49, the maturity is in 3 months, volatility is 20%, and the interest rate is 5%. How does it the bank delta hedge? (round to the nearest thousand share)

A. Buy 65,000 shares

B. Buy 100,000 shares

C. Buy 21,000 shares

D. Sell 100,000 shares

4.7. Gamma and Vega Hedging

4.7.1. 重要知识点

4.7.1.1. **Gamma** is used to correct the hedging error associated with delta-neutral positions by providing added protection against large movements in the underlying asset's price. If gamma is highly negative or highly positive, delta is very sensitive to price of the underlying asset.

4.7.1.2. **Gamma Neutral Positions:** hedge against larger changes in stock price

4.7.1.3. Vega is the rate of change of the value of the option with respect to the volatility of the underlying asset.

4.7.2. 基础题

Q-48. An option portfolio exhibits high unfavorable sensitivity to increases in implied volatility and while experiencing significant daily losses with the passage of time. Which strategy would the trader most likely employ to hedge his portfolio?

A. Sell short dated options and buy long dated options

B. Buy short dated options and sell long dated options

C. Sell short dated options and sell long dated options

D. Buy short dated options and buy long dated options

4.8. Financial Institutions

4.8.1. 重要知识点

4.8.1.1. Banks

- Private Placement
- Public Offering
  - Best Efforts
  - Firm Commitment
- The Originate-to-Distribute Model
- Three Main Types of Risk Facing Banks
  - Market Risk
  - Credit Risk
  - Operational Risk

4.8.1.2. Insurance Companies

- Insurance is usually classified as life insurance and nonlife insurance, with health insurance often being considered to be a separate category. Nonlife insurance is also referred to as property-casualty insurance.
- A life insurance contract typically lasts a long time and provides payments to the policyholder's beneficiaries that depend on when the policyholder dies.
- A property-casualty insurance contract typically lasts one year (although it may be renewed) and provides compensation for losses from accidents, fire, theft, and so on.

Loss Ratio : Payouts/Premiums	Expense Ratio : Expenses/Premiums
Combined Ratio : Loss Ratio + Expense Ratio	Combined Ratio after Dividends: Combined Ratio + Dividend Yield

Operating Ratio : Combined Ratio after Dividend – Investment Income

- A pension plan is a form of insurance arranged by a company for its employees. It is designed to provide the employees with income for the rest of their lives once they have retired.

4.8.1.3. Hedge Funds vs. Mutual Funds

- Mutual funds, which are called "unit trusts" in some countries, serve the needs of relatively small investors, while hedge funds seek to attract funds from wealthy individuals and large investors such as pension funds.
- Hedge funds are subject to much less regulation than mutual funds because they accept funds only from financially sophisticated individuals and organizations. This gives them a great deal of freedom to develop sophisticated, unconventional, and proprietary investment strategies. Hedge funds are sometimes referred to as alternative investments.
- Hedge funds are free to use a wider range of trading strategies than mutual funds and are usually more secretive about what they do. Mutual funds are required to explain their investment policies in a prospectus that is available to potential investors.

4.8.2. 基础题

Q-49. The minimum level of capital a bank needs to maintain, according to its own estimates, models, and risk assessments, is best described as its:

A. Equity capital.

B. Financial capital.

C. Economic capital.

D. Regulatory capital.

Q-50. Which of the following actions in the banking system is most likely intended to address the problem of moral hazard?

A. Deposit insurers charge risk-based premiums.

B. Banks increase loans to higher-risk borrowers.

C. Governments implement deposit insurance programs.

D. Banks increase the interest rates they offer to depositors.

Q-51. An investment bank is most likely to earn a trading profit from buying and selling securities if it arranges a:

A. Dutch auction.

B. Private placement.

C. Best efforts offering.

D. Firm commitment offering.

Q-52. The purpose of a “Chinese wall” in banking is to:

A. Prevent a bank failure from endangering other banks.

B. Prevent a bank’s departments from sharing information.

C. Restrict companies from offering both banking and securities services.

D. Restrict companies from engaging in both commercial and investment banking.

Q-53. A drawback of the originate-to-distribute banking model is that it has led to:

A. Too little liquidity in certain sectors.

B. Too much liquidity in certain sectors.

C. Looser credit standards in certain sectors.

D. Tighter credit standards in certain sectors

Q-54. The relevant interest rate for insurance contracts is 2% per annum (semiannual compounding applies) and all premiums are paid annually at the beginning of the year. A $2,000,000 term insurance contract is being proposed for a 40-year-old male in average health. Assume that payouts occur halfway throughout the year. Using the mortality rates estimated by the U.S. Social Security Administration, which of the following amounts is closest to the insurance company’s breakeven premium for a two-year term?

Age	**Male**		
	Probability of Death within 1 Year	**Survival Probability**	**Life Expectancy**
40	0.002092	0.95908	38.53
41	0.002240	0.95708	37.61

A. $4,246.

B. $4,287.

C. $4,332.

D. $8,482.

Q-55. The following information pertains to a property and casualty (P&C) insurance company:

- Investment income 5%
- Dividends 2%
- Loss ratio 74%
- Expense ratio 23%

Based on the information provided, what is this company's operating ratio?

A. 90%

B. 94%

C. 97%

D. 99%

Q-56. Which of the following problems would most likely be a concern for life insurance companies that are worried about differentiating between good risks and bad risks?

A. Adverse selection.

B. Catastrophic risk.

C. Longevity risk.

D. Moral hazard.

Q-57. Which of the following characteristics is a key differentiator between mutual funds and hedge funds?

A. Professional asset management.

B. Immediate access to withdrawals from the fund.

C. Charging a fee for providing investment services.

D. Easy diversification for an investor.

4.9. Market Risk

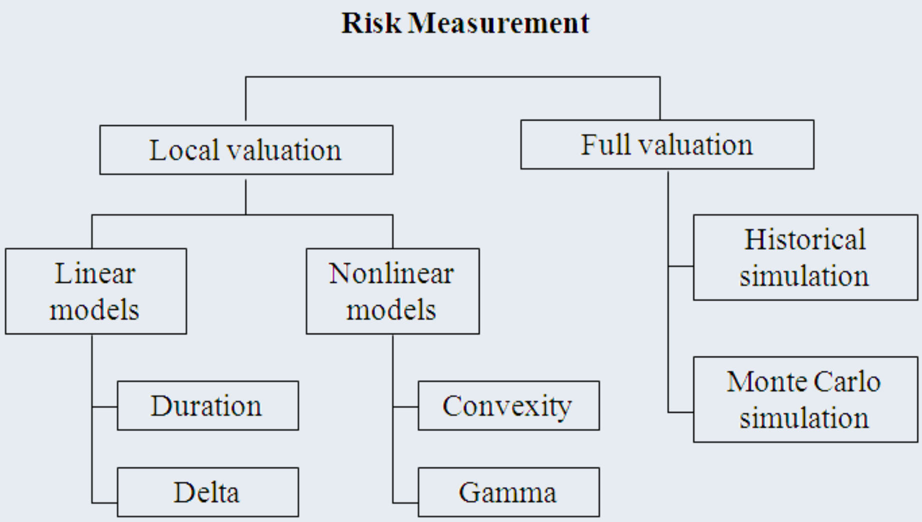
4.9.1. 重要知识点

4.9.1.1. Value at Risk

➢ **Calculating and Applying VaR**

- $\text{VaR} = Z_\alpha \times \sigma$
- $\text{VaR}_{T-days} = \text{VaR}_{1-days} \times \sqrt{T}$
- $\text{VaR}_p^2 = \text{VaR}_1^2 + \text{VaR}_2^2 + 2\rho \times \text{VaR}_1 \times \text{VaR}_2$
- $\text{VaR}(dP) = |-D^*P| \times \text{VaR}(dy)$
- $\text{VaR}(df) = |\Delta| \times \text{VaR}(dS)$
- $\text{VaR}(dP) = |-D^*P| \times \text{VaR}(dy) - (1/2)(C \times P) \times \text{VaR}(dy)^2$
- $\text{VaR}(df) = |\Delta| \times \text{VaR}(dS) - (1/2)\Gamma \times \text{VaR}(dS)^2$

4.9.1.2. Risk Measurement



4.9.1.3. EWMA Model:

$$\sigma_n^2 = \lambda\sigma_{n-1}^2 + (1-\lambda)\mu_{n-1}^2$$

4.9.1.4. GARCH (1, 1) Model:

$$\sigma_n^2 = \omega + \alpha\mu_{n-1}^2 + \beta\sigma_{n-1}^2$$

4.9.1.5. Correlation Estimation:

$$\hat{\rho}_{xy} = \frac{cov_n}{\sigma_{x,n}\sigma_{y,n}}$$

$$cov_n = \lambda cov_{n-1} + (1-\lambda)x_{n-1}y_{n-1}$$

4.9.1.6. Foreign Exchange Markets

- Currency pairs are typically indicated as XXXYYY or XXX/YYY (with XXX as the base currency and YYY as the quote currency).
- Forward rates are quoted with the same base currency as spot exchange rates. They are usually shown as points that are multiplied by 1/10,000 and then added to the spot quote.
- **Outright (Forward) vs. Swap**
- **Outright (Forward):** A forward foreign exchange transaction
- **Swap:** FX swap refers to buying (selling) a foreign currency in the spot market and then selling (buying) in the forward market.
- **FX Risk**
- **Transaction Risk:** Risk related to receivables and payables.
- **Translation Risk:** Risk arises from assets and liabilities denominated in a foreign currency.
- **Economic Risk:** Risk that an enterprise's future cash flow will be affected by exchange rate movements.

4.9.2. 基础题

Q-58. A risk manager states that the VaR of the portfolio at 95% confidence interval and 1-day holding period is $1 million. Which of the following statement is TRUE?

A. The daily loss on the portfolio will exceed $1 million 95% of time.

B. The daily loss on the portfolio will not exceed $1 million 95% of time.

C. The maximum loss that the portfolio can incur is $1 million at any point in time.

D. 95% of risk managers will agree that the maximum loss on the portfolio will be $1 million.

Q-59. Hugo Nelson is preparing a presentation on the attributes of value at risk. Which of Nelson's following statements is not correct?

A. VaR can account for the diversified holdings of a financial institution, reducing capital requirements.

B. VaR(10%) = $0 indicates a positive dollar return is likely to occur on 90 out of 100 days.

C. VaR(1%) can be interpreted as the number of days that a loss in portfolio value will exceed 1%.

D. VaR was developed in order to more closely represent the economic capital necessary to ensure commercial bank solvency.

Q-60. An analyst at Bergman International Bank has been asked to explain the calculation of VaR for linear derivatives to the newly hired junior analysts. Which of the following statements best describes the calculation of VaR for a linear derivative on the S&P 500 Index?

A. For a futures contract, multiply the VaR of the S&P 500 Index by a sensitivity factor reflecting the percent change in the value of the futures contract for a 1% change in the index value.

B. For an options contract, multiply the VaR of the S&P 500 Index by a sensitivity factor reflecting the percent change in the value of the futures contract for a 1% change in the index value.

C. For a futures contract, divide the VaR of the S&P 500 Index by a sensitivity factor reflecting the absolute change in the value of the futures contract per absolute change in the index value.

D. For an options contract, divide the VaR of the S&P 500 Index by a sensitivity factor reflecting the percent change in the value of the futures contract for a 1% change in the index value.

Q-61. The VaR on a portfolio using a 1-day horizon is USD 100 million. The VaR using a 10-day horizon is:

A. USD 316 million if returns are not independently and identically distributed.

B. USD 316 million if returns are independently and identically distributed.

C. USD 100 million since VaR does not depend on any day horizon.

D. USD 31.6 million irrespective of any other factors.

Q-62. In the presence of fat tails in the distribution of returns, VaR based on the delta-normal method would (for a linear portfolio):

A. Underestimate the true VaR.

B. Be the same as the true VaR.

C. Overestimate the true VaR.

D. Cannot be determined from the information provided.

Q-63. Consider the following single bond position of $10 million, a modified duration of 3.6 years, an annualized yield volatility of 2%. Using the duration method and assuming that the daily return on the bond position is independently identically normally distributed, calculate the 10-day holding period VaR of the position with a 99% confidence interval assuming there are 252 business days in a year.

A. $409,339

B. $396,742

C. $345,297

D. $334,186

Q-64. A commodity-trading firm has an options portfolio with a two-day Value-at-Risk (VaR) of 2.5 million. What would be an appropriate translation of this VaR to a ten-day horizon under normal conditions?

A. $3.713 million

B. $4.792 million

C. $5.590 million

D. Cannot be determined

Q-65. A risk manager would like to measure VaR for a bond. He notices that the bond has a puttable feature. What effect on the VaR will this puttable feature have?

A. The VaR will increase.

B. The VaR will decrease.

C. The VaR will remain the same.

D. The effect on the VaR will depend on the volatility of the bond.

Q-66. Mixed Fund has a portfolio worth USD 12,428,000 that consists of 42% of fixed income investments and 58% of equity investments. The 95% annual VaR for the entire portfolio is USD 1,367,000 and the 95% annual VaR for the equity portion of the portfolio is USD 1,153,000. Assume that there are 250 trading days in a year and that the correlation between stocks and bonds is zero. What is the 95% daily VaR for the fixed income portion of the portfolio?

A. USD 21,263

B. USD 46,445

C. USD 55,171

D. USD 72,635

Q-67. You have been asked to estimate the VaR of an investment in Big Pharma Inc. The company's stock is trading at USD 23 and the stock has a daily volatility of 1.5%. Using the delta-normal method, the VaR at the 95% confidence level of a long position in an at-the-money put on this stock with a delta of -0.5 over a 1-day holding period is closest to which of the following choices?

A. USD 0.28

B. USD 0.40

C. USD 0.57

D. USD 2.84

Q-68. Rational Investment Inc. is estimating a daily VaR for its fixed income portfolio currently valued at USD 800 million. Using returns for the last 400 days (ordered in decreasing order, from highest daily return to lowest daily return), the daily returns are the following: 1.99%, 1.89% 1.88% 1.87% ……, -1.76%, -1.82%, -1.84%, -1.87%, -1.91%

At the 99% confidence level, what is your estimate of the daily VaR using the historical simulation method?

A. USD 14.08 million

B. USD 14.56 million

C. USD 14.72 million

D. USD 15.04 million

Q-69. A market risk manager uses historical information on 1,000 days of profit/loss information to calculate a daily VaR at the 99th percentile, of USD 8 million. Loss observations beyond the 99th percentile are then used to estimate the conditional VaR. If the losses beyond the VaR level, in millions, are USD 9, USD 10, USD 11, USD 13, USD 15, USD 18, USD 21, USD24, and USD 32, then what is the conditional VaR?

A. USD 9 million

B. USD 32 million

C. USD 15 million

D. USD 17 million

Q-70. A trader has an option position in crude oil with a delta of 100000 barrels and gamma of -50000 barrels per dollar move in price. Using the delta-gamma methodology, compute the VaR on this position, assuming the extreme move on crude oil is $2.00 per barrel.

A. $100,000

B. $200,000

C. $300,000

D. $400,000

Q-71. An at-the-money European call option on the DJ EURO STOXX 50 index with a strike of 2200 and maturing in 1 year is trading at EUR 350, where contract value is determined by EUR 10 per index point. The risk-free rate is 3% per year, and the daily volatility of the index is 2.05%. If we assume that the expected return on the DJ EURO STOXX 50 is 0%, the 99% 1-day VaR of a short position on a single call option calculated using the delta-normal approach is closest to:

A. EUR 8

B. EUR 53

C. EUR 84

D. EUR 525

Q-72. Howard Freeman manages a portfolio of investment securities for a regional bank. The portfolio has a current market value equal to USD 6,247,000 with a daily variance of 0.0002. Assuming there are 250 trading days in a year and that the portfolio returns follow a normal distribution, the estimate of the annual VaR at the 95% confidence level is closest to which of the following?

A. USD 32,595

B. USD 145,770

C. USD 2, 297,854

D. USD 2,737,868

Q-73. Bank A and Bank B are two competing investment banks that are calculating the 1-day 99% VaR for an at-the-money call on a non-dividend-paying stock with the following information:

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

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

A. Bank A.

B. Bank B.

C. Both will have the same VaR estimate.

D. Insufficient information to determine.

Q-74. Assume that portfolio daily returns are independently and identically normally distributed. A new quantitative analyst has been asked by the portfolio manager to calculate portfolio VaRs for 10-, 15-, 20-, and 25-day periods. The portfolio manager notices something amiss with the analyst's calculations displayed below. Which one of following VaRs on this portfolio is inconsistent with the others?

A. VaR(10-day) = USD 316M

B. VaR(15-day) = USD 465M

C. VaR(20-day) = USD 537M

D. VaR(25-day) = USD 600M

Q-75. Which of the following GARCH models will take the shortest time to revert to its mean?

A. $h_t = 0.05 + 0.03r_{t-1}^2 + 0.96h_{t-1}$

B. $h_t = 0.03 + 0.02r_{t-1}^2 + 0.95h_{t-1}$

C. $h_t = 0.02 + 0.01r_{t-1}^2 + 0.97h_{t-1}$

D. $h_t = 0.01 + 0.01r_{t-1}^2 + 0.98h_{t-1}$

Q-76. The current estimate of daily volatility is 1.5%. The closing price of an asset yesterday was $30.00. The closing price of the asset today is $30.50. Using the EWMA (Exponentially Weighted Moving Average) model (with λ = 0.94), the updated estimate of volatility is:

A. 1.5096%

B. 1.5085%

C. 1.5092%

D. 1.5083%

Q-77. Given λ of 0.94, under an infinite series, what is the weight assigned to the seventh prior daily squared return?

A. 4.68%

B. 4.40%

C. 4.14%

D. 3.89%

Q-78. Which of the following four statements on models for estimating volatility is INCORRECT?

A. In the exponentially weighted moving average (EWMA) model, some positive weight is assigned to the long-run average variance.

B. In the EWMA model, the weights assigned to observations decrease exponentially as the observations become older.

C. In the GARCH (1,1) model, a positive weight is estimated for the long-run average variance.

D. In the GARCH (1,1) model, the weights estimated for observations decrease exponentially as the observations become older.

Q-79. The interest rate in XXX is 1%and in YYY 4%. The XXXYYY spot rate is 1. 3000. How would three-month forward rate be quoted points?

A. 67

B. 78

C. 92

D. 95

4.10. Credit Ratings

4.10.1. 重要知识点

4.10.1.1.

Explanation	Standard & Poor’s	Moody’s Services

Investment grade:		
Highest grade	AAA	Aaa
High grade	AA	Aa
Upper medium grade	A	A
Medium grade	BBB	Baa
Speculative grade:		
Lower medium grade	BB	Ba
Speculative	B	B
Poor standing	CCC	Caa
Highly speculative	CC	Ca
Lowest quality, no interest	C	C
In default	D	
Modifiers: A+, A, A-, and A1, A2, A3		

4.10.2. 基础题

Q-80. You are considering an investment in one of three different bonds. Your investment guidelines require that any bond you invest in carry an investment grade rating from at least two recognized bond rating agencies. Which, if any, of the bonds listed below would meet your investment guidelines?

A. Bond A carries an S&P rating of BB and a Moody’s rating of Baa.

B. Bond B carries an S&P rating of BBB and a Moody’s rating of Ba.

C. Bond C carries an S&P rating of BBB and a Moody’s rating of Baa.

D. None of the above.

Q-81. What is the lowest tier of an investment grade credit rating by Moody's?

A. Baa1

B. Ba1

C. Baa3

D. Ba3

4.11. Transition Matrix

4.11.1. 重要知识点

4.11.1.1. Agencies publish cumulative default rates categorized by rating (i.e., the cumulative default rate per rating category) and transition matrices. Transition matrices plot the frequency of rating migrations over time

4.11.1.2. Lower rated obligors tend to default more frequently.

4.11.1.3. Better (worse) ratings are associated with lower (higher) default rates.

4.11.2. 基础题

Q-82. Which of the following statements is incorrect, given the following one-year rating transition matrix?

From/To (%)	AAA	AA	A	BBB	BB	B	CCC/C	D	Non Rated
AAA	87.44	7.37	0.46	0.09	0.06	0,00	0.00	0.00	4.59
AA	0.60	86.65	7.78	0.58	0.06	0.11	0.02	0.01	4.21
A	0.05	2.05	86.96	5.50	0.43	0.16	0.03	0.04	4.79
BBB	0.02	0.21	3.85	84.13	4.39	0.77	0.19	0.29	6.14
BB	0.04	0.08	0.33	5.27	75.73	7.36	0.94	1.20	9.06
B	0.00	0.07	0.20	0.28	5.21	72.95	4.23	5.71	11.36
CCC/C	0.08	0.00	0.31	0.39	1.31	9.74	46.83	28.83	12.52

A. BBB loans have a 4.08% chance of being upgraded in one year.

B. BB loans have a 75.73% chance of staying at BB for one year.

C. BBB loans have an 88.21% chance of being upgraded in one year.

D. BB loans have a 5.72% chance of being upgraded in one year.

Q-83. Given the following ratings transition matrix, calculate the two-period cumulative probability of default for a B credit.

Rating at beginning of period	**Rating at End of period**			
	A	B	C	D
A	0.95	0.05	0.00	0.00
B	0.03	0.90	0.05	0.02
C	0.01	0.10	0.75	0.14
Default	0.00	0.00	0.00	1.00

A. 2.0%

B. 2.5%

C. 4.0%

D. 4.5%

4.12. Expected Credit Loss and Unexpected Credit Loss

4.12.1. 重要知识点

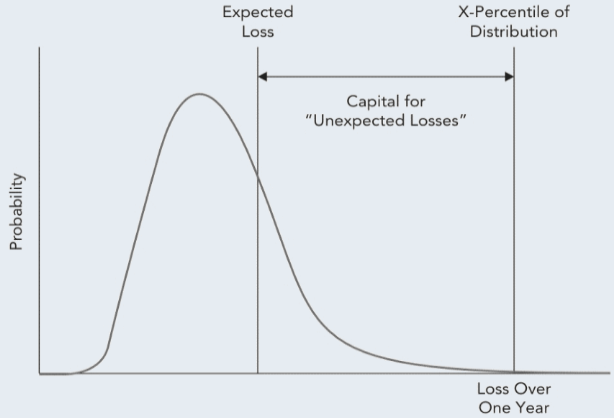
4.12.1.1. Expected Credit Loss

➢ The losses that banks take into account when setting lending rates.

$$EL = EA \times EDF \times LGD$$

4.12.1.2. Unexpected Credit Loss

➢ The actual loss in a given year above the expected loss



4.12.1.3. Mean and Standard Deviation of Credit Losses

$$\mu_i = p_i \times L_i(1-R_i) + (1-p_i) \times 0 = p_i L_i (1-R_i)$$

$$\sigma_i = \sqrt{p_i - p_i^2}(L_i(1-R_i))$$

$$\sigma_P^2 = n\sigma^2 + n(n-1)\rho\sigma^2$$

4.12.1.4. Gaussian Copula Model

➢ Used by regulators to determine capital for loan portfolios. It uses the Gaussian copula model to define the correlation between defaults.

4.1.1.1. One-Factor Correlation Model

$$U_i = a_i F + \sqrt{1-a_i^2} Z_i$$

- F is a factor common to all the U_i, Z_i is the component that is unrelated to the common factor F, a_i are parameters. The variables F and Z_i have standard normal distributions.

4.1.1.2. Vasicek Model

$$(WCDR - PD) \times LGD \times EAD$$

$$99.9 \text{ percentile for default rate} = N\left(\frac{N^{-1}(PD) - aN^{-1}(0.001)}{\sqrt{1-a^2}}\right)$$

4.12.2. 基础题

Q-84. An investor holds a portfolio of $100 million. This portfolio consists of A-rated bonds ($40 million) and BBB-rated bonds ($60 million). Assume that the one-year probabilities of default for A-rated and BBB-rated bonds are 3%and 5%, respectively, and that they are independent. If the recovery value for A-rated bonds in the event of default is 70% and the recovery value for BBB-rated bonds is 45%, what is the one-year expected credit loss from this portfolio?

A. $1672000

B. $1842000

C. $2010000

D. $2218000

Q-85. Consider the following four short-term loans held by a bank:

Loan	Remaining Term (in months)	Exposure at default (millions)	One-year Probability of Default (*)	Loss Given Default
a.	3	$100.00	4.00%	90.0%
b.	6	$120.00	3.00%	60.0%
c.	9	$150.00	2.00%	60.0%
d.	12	$200.00	1.00%	50.0%

(*) Hazard rate (aka, default intensity) which is by definition continous, but it is okay to assume discrete as difference is not here material

Which loan has the highest expected loss in dollar terms? (this question is a variation on FRM Handbook Example 24.3)

A. Loan (a)

B. Loan (b)

C. Loan (c)

D. Loan (d)

Q-86. Bank regulators are examining the loan portfolio of a large, diversified lender. The regulators' main concern is that the bank remains solvent during turbulent economic times. Which of the following statements is most likely the area on which the regulators will want to focus?

A. Expected loss, since each asset can expect, on average, to decline in value from a positive probability of default.

B. Expected loss, given the decrease in underwriting standards of new loans.

C. Unexpected loss, since the bank will need to set aside additional capital for the unlikely event that recovery rates are smaller than expected.

D. Unexpected loss, since the bank will need to set aside additional capital for the unlikely event that loss rates are smaller than expected.

Q-87. Expected loss (EL) has three components: probability of default (PD), exposure amount (EA), and loss rate (LR). With respect to these components of EL, each of the following is true EXCEPT which is not accurate?

A. Exposure amount (EA) is the standard deviation of credit losses estimated at the end of the horizon excluding outstanding interest payments

B. Probability of default (PD) is the probability that a borrower will default before the end of a predetermined period of time (the estimation horizon typically chosen is one year)

C. Loss rate (LR) represents the ratio of actual losses incurred at the time of default (including all costs associated with the collection and sale of collateral) to the exposure amount

D. Expected loss (EL) is equal to the product of: the probability of default up to time H (horizon); the exposure amount at time H; and the loss rate experienced at time H; i.e., $\mathrm{EL(H)} = \mathrm{PD(H)} * \mathrm{EA(H)} * \mathrm{LR(H)}$

4.13. Country Risk

4.13.1. 重要知识点

4.13.1.1. Sources of country risk

- Where the country is in the economy growth life cycle;
- Political risks;
- The legal systems of a country, including both the structure and the efficiency of legal system;
- The disproportionate reliance of a country on one commodity or service.

4.13.1.2. Factors influencing sovereign default risk

- A country's level of and stability of tax receipts;
- Political risks;
- A country's level of indebtedness;
- Obligations such as pension and social service commitments;
- Backing from other countries or entities.

4.13.2. 基础题

Q-88. One of the traders whose risk you monitor put on a carry trade where he borrows in yen and invests in some emerging market bonds whose performance is independent of yen. Which of the following risks should you not worry about?

A. Unexpected devaluation of the yen.

B. A currency crisis in one of the emerging markets the trader invests in.

C. Unexpected downgrading of the sovereign rating of a country in which the trader invests.

D. Possible contagion to emerging markets of a credit crisis in a major country.

Q-89. In an attempt to understand country risk, Mary Ann Small, an analyst at Global Funds, examines multiple sources of information to determine the truest measure of risk. She considers sovereign risk ratings, default risk spreads, and composite measures of risk. Which of the following sources relies on surveys of several hundred economists to measures sovereign risk?

A. Political Risk Services.

B. The Economist.

C. Standard and Poor.

D. Euromoney.

4.14. Operational Risk

4.14.1. 重要知识点

4.1.1.3. The definition of Operational Risk for Basel Committee: the risk of loss resulting from inadequate or failed internal processes, people and systems, or from external events, includes legal risk, but excludes strategic and reputational risk, which would be very difficult to measure.

4.1.1.4. Methods for capital requirements of Operational Risk

- Basic Indicator Approach: $\text{Capital}_{\text{BIA}} = \frac{\sum_{\text{i=last three years}} \text{GI}_\text{i} \times \alpha}{\text{n}}$

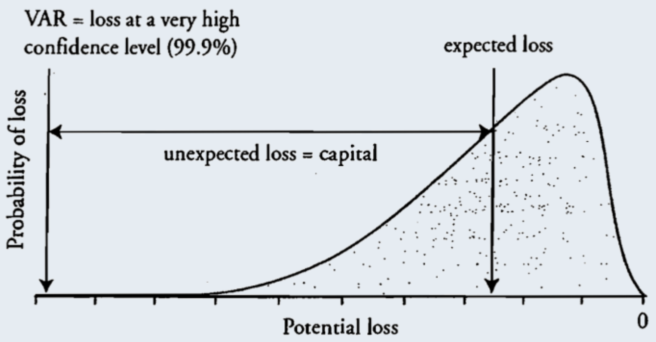
- Standardized Approach: $\text{Capital}_{\text{SA}} = \frac{\sum_{\text{i=last three years}} \max\left(\sum \text{GI}_{\text{line 1-8}} \times \beta_{\text{line 1-8}}, 0\right)}{3}$

Business Line	Beta Factor
Corporate finance	18%
Trading and sales	18%
Retail banking	12%
Commercial banking	15%
Payment, settlement	18%
Agency services	15%

Asset management	12%
Retail brokerage	12%

- Advanced Measurement Approach: Capital_{AMA} = VaR(1-year, 99.9% confidence)

Figure 1: Captial Requirement



  - Construction of the Loss Distribution: loss frequency (Possion distribution) and loss severity (lognormal distribution)
- Standardized Measurement
  - The Basel committee provides a formula for calculating the required capital from the loss component and the BI component.

4.14.2. 基础题

Q-90. According to current Basel committee proposals, banks using the advanced measurement approach must calculate the operational risk capital charge at a:

A. 99 percentile confidence level and a 1-year time horizon.

B. 99 percentile confidence level and a 5-year time horizon.

C. 99.9 percentile confidence level and a 1-year time horizon.

D. 99.9 percentile confidence level and a 5-year time horizon.

Q-91. Which of the following measurement approaches for assessing operational risk would be most appropriate for small banks?

A. Loss frequency approach

B. Basic indicator approach

C. Standardized approach

D. Advanced measurement approach (AMA)

Q-92. Which of the following correctly describe the similarities between Operational VaR and Market VaR?

I Both VaRs, when used for regulatory capital measurement, need to be validated against actual loss experience.

II Both are built on data (market prices for Market VaR and operational loss data for Operational VaR) that is readily available.

III Both are modeled based on a normal distribution.

IV Extreme Value Theory can be used to model extreme losses at the tail of the distribution for both Operational and Market VaR.

A. I and IV
B. I, II and III
C. I, II and IV
D. II, III and IV

Q-93. Which of the following statements concerning the measurement of operational risk is correct?

A. Economic capital should be sufficient to cover both expected and worst-case operational risk losses.
B. Loss severity and loss frequency tend to be modeled with lognormal distributions.
C. Operational loss data available from data vendors tend to be biased towards small losses.
D. The standardized approach used by banks in calculating operational risk capital allows for different beta factors to be assigned to different business lines.

Q-94. The standardized approach for calculating operational risk capital requirements uses beta factors for a given business line and annual gross income for business lines over a 3-year period. Which of the following business units has the highest beta factor?

A. Trading and sales.
B. Retail banking.
C. Agency and custody services.
D. Asset management.

Q-95. Your supervisor is an expert in market and credit risk. He recruits you to manage the operational risk department. He would like to use VaR to measure the firm's operational risk and proposes that you use the same VaR framework previously developed for market and credit risk. Which of the following arguments is a valid argument for why it is difficult to estimate an operational VaR using the same framework as market and credit VaR?

A. Market risk events are easier to map to risk factors than operational risk events.

B. Quantitative methods for estimating operational risk VaR do not exist.

C. Market and credit VaRs are estimated using only frequency distribution, but operational VaR is estimated using both a frequency distribution and a severity distribution.

D. Monte Carlo techniques cannot be used for an operational risk VaR because the underlying risk factors are not normally distributed.

4.15. Stress Testing

4.15.1. 重要知识点

4.1.1.5. Governance over Stress Testing

- Governance Structure
- Policies, Procedures and Documentation
- Internal Audit
- Validation and Independent Review

4.15.2. 基础题

Q-96. A manager at an asset management firm relies on a VaR-based risk measurement system that calculates VaR for each of the firm's portfolios as well as an aggregate firm-wide VaR. The CRO proposes implementation of a stress testing approach to supplement the VaR system. Which of the following statements best supports the CRO's proposal?

A. In practice, stress tests utilize a great number of scenarios while VaR measures rely on just a few scenarios to create their loss estimates.

B. Stress testing makes it possible to capture dependencies between asset classes in specific scenarios that cannot be captured well through a VaR-based system.

C. Stress testing is more accurate than a VaR-based system in predicting the probability of losses at a point in time.

D. While stress testing is similar to VaR, it is restricted to using only distributions of macroeconomic variables to generate its predictions.

Q-97. Which of the following statements about governance structure is/are not accurate?

I. Senior management has ultimate oversight responsibility and accountability for an entire institution.

II. Senior management should use scenario analysis, not stress testing, to evaluate an institutions risk decisions.

III. The board of directors has responsibility for implementing authorized stress testing activities.

IV. The board of directors can change an institution's capital levels and exposures following a review of stress test results.

A. II only.

B. I, II, III.

C. IV only.

D. All not.

Q-98. Which of the following statements best reflects the responsibilities of an internal audit?

I. An internal audit should assess the staff involved in stress testing activities.

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

III. The internal audit function needs to be impartial but does not need to be independent.

A. I and II only.

B. I, II and III.

C. II.

D. I only.

Q-99. Which of the following reasons best explains why institutions use reverse stress rests?

I. To test events that threatens the viability of the institution.

II. To assess where multiple risks occur simultaneously.

A. I only.

B. II only.

C. Neither I nor II.

D. Both I and II.

Q-100. Which of the following statements regarding differences between stress tests and economic capital (EC) methods is (are) not correct?

I. Stress tests tend to analyze a shorter period of time compared to EC methods.

II. Stress tests tend to compute losses from the perspective of the market as opposed to EC methods that compute losses from an accounting perspective.

III. Stress tests tend to use ordinal rank arrangements, while EC methods use cardinal probabilities.

IV. Stress tests tend to focus on unconditional scenarios, which EC methods tend to focus on conditional scenarios.

A. I and II only.

B. I, II and III.

C. II only.

D. I ,II and IV.

Solutions

Q-1. Solution: A

For European and American call options, the maximum possible price is equal to current stock price. The option price can never be higher than the stock. The stock price is thus the “upper bound”. For a European Put, the upper bound is the present value of strike price, while for American put it is equal to the strike price.

Q-2. Solution: B

The upper and lower bounds for American options are given by:

Option	Minimum Value	Maximum Value
American Call	$C \geq \max(0, S_0 - Xe^{-rT}) = 5.13$	$S_0 = 40$
American Put	$P \geq \max(0, X - S_0) = 0$	$X = 35$

Subtracting the put values from the call values in the table above:

$=5 \leq C - P \leq 5.13$

(Note: the minimum and maximum values are obtained by comparing the results of the subtraction of the put price from the call price. For instance, in this example, the upper bound is obtained by subtracting the minimum value of the American put option from the minimum value of the American call option and vice versa).

Q-3. Solution: C

We can use the Put-Call parity here to easily solve for the continuous dividend yield.

We have $c + Ke^{-rt} = Se^{-qt} + p$, so $85e^{-q\times5} = 10 + 90e^{-5\%\times5} - 15$, Solving for q, we get 5.34%.

Q-4. Solution: C

From the equation for put-call parity, this can be solved by the following equation:

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

where PV represents the present value, so that:

$PV(K) = Ke^{-rT}$ and $PV(D) = D \times e^{-rt}$

Where:

p represents the put price,

c is the call price,

K is the strike price of the put option,

D is the dividend,

S_0 is the current stock price.

T is the time to maturity of the option, and

t is the time to the next dividend distribution.

Calculating PV (K), the present value of the strike price, results in a value of $25 \times e^{-0.05 \times 0.5}$ or 24.38, while PV (D) is equal to $1 \times e^{-0.05 \times 0.25}$ or 0.99. Hence p = 3 + 24.38 + 0.99 - 24 = USD 4.37.

Q-5. Solution: D

The easiest thing to do is to find the net profit or loss for each position and then add them together, recognizing whether a position is short or long.

For 1 long \$43 strike put position: [1 × (43 – 19)] – 6 = 18

For 2 short \$37 strike puts position: -[2 × (37 – 19)] + (2 × 4) = -28

For 1 long \$32 strike put position: [1 × (32 – 19)] – 1 = 12

The sum of these profit/loss numbers is a \$2 gain

Q-6. Solution: C

Payoff of the long put = Max[0, K – S(t)] and payoff of short call = -Max[0, S(t) – K] = Min[K – S(t),0], 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)

Q-7. Solution: B

The pay-off structure to this strategy leaves the upside and downside potential at the difference between the premium collected on the calls sold and the premium paid on the calls purchased.

Q-8. Solution: D

A calendar spread is created by transacting in two options that have different expirations. Both options have the same strike price. The strategy sells the short-dated option and buys the long-dated option. The investor profits only if the stock remains in a narrow range, but losses are limited. Overall, the payoff is most similar to the butterfly spread.

Q-9. Solution: A

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

The cost of the strategy will be:

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

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

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

Q-10. Solution: B

The sum of the price of an up-and-in barrier call and an up-and-out barrier call is the price of an otherwise equivalent European call. The price of the European call is EUR 3.52 + EUR 1.24 = EUR 4.76.

The sum of the price of a down-and-in barrier put and a down-and-out barrier put is the price of an otherwise equivalent European put. The price of the European put is EUR 2.00 + EUR 1.01 = EUR 3.01.

Using put-call parity, where C represents the price of a call option and P the price of a put option,

$C + Ke^{-rT} = P + S$

$K = e^{rT} (P + S - C)$

Hence, $K = e^{0.02} \times (3.01 + 40.96 - 4.76) = 40.00$

Q-11. Solution: C

The sum of the price of up-and-in barrier call and up-and-out barrier call is the price of an otherwise the same European call. The price of the European call is therefore USD 5.21 + USD 1.40 = USD 6.61. The put-call parity relation gives Call – put = Forward (with same strikes and maturities). Thus 6.61 – put = 1.50. Thus put = 6.61 – 1.50 = 5.11

Q-12. Solution: C

As the underlying assets' price increases the up-and-out call options become more vulnerable since they will cease to exist when the barrier is reached. Hence their price decreases. This is negative delta.

Q-13. Solution: B

A down-and-out call where the barrier has not been touched is still alive and hence benefits from an increase in *S*, so a. is incorrect. A down-and-in call only comes alive when the barrier is touched, so an increase in *S* brings it away from the barrier. This is not favorable, so b. is correct. An up-and-in put would benefit from an increase in *S* as this brings it closer to the barrier of $110, so c. is not correct. Finally, an up-and-in call would also benefit if *S* gets closer to the barrier.

Q-14. Solution: A

A floating lookback call pays the difference between the expiration price and the minimum price of the stock over the horizon of the option. Therefore, its payoff is equal to: $50- $35 = $15. A fixed lookback call has a payoff function equal to the difference between the maximum price during the option's life and the strike price. Therefore, its payoff is equal to: $53-$40 = $13. The payoff difference between the two exotic options is equal to $2.

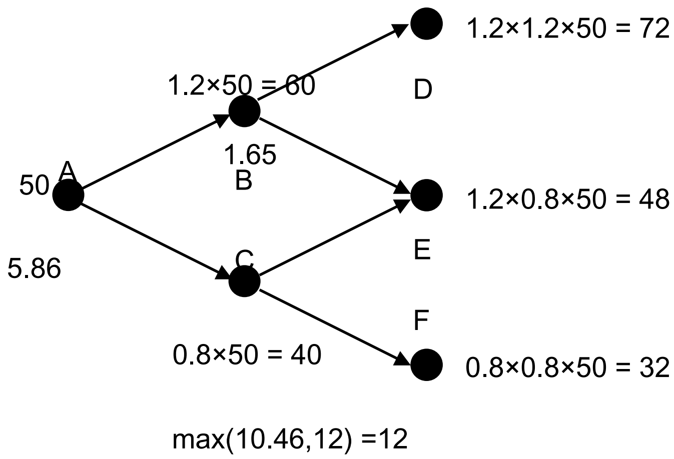
Q-15. Solution: B

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-16. 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: (0.5761 × 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 × 1.65 + 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-17. Solution: C

Under the initial set of assumptions, $u = e^{\sigma\sqrt{\Delta t}} = e^{0.2840\sqrt{1}} = 1.32950$ and $d = 1/1.32950 = 0.75216$, such that $p = d = 0.50$.

If the dividend is included, then $p = \frac{e^{(r-q)\Delta t} - d}{u-d} = 0.46427$. Therefore, $d = 1 - 0.46427 = 0.53573$, and the increase is about 3.570%.

Q-18. Solution: C

Following Hull, a riskless portfolio consists of long delta (d) shares + short one option.

If the stock moves up, value of the riskless portfolio = $13×delta - $3 loss on the written call option; and

If the stock moves down, value of the riskless portfolio = $7×delta. Setting them equal (i.e., riskless payoff):

$\$13 * d - \$3 = \$7 * d$, and $6d = 3$, so $d = 0.5$.

If delta (d) = 0.5, then value of portfolio today is:

$\$10 * 0.5 - f = 5 - f = \$3.5 * \exp(-1\%)$, such that

$f = 5 - 3.5 * \exp(-1\%) = \$1.53483$

Notationally,

- $u = 13/10 = 1.3;\ d = 7/10 = 0.7$
- $p = [\exp(rt) - d]/[u - d] = [\exp(1\%) - 0.7]/(1.3 - 0.7) = 0.51675$
- $f = \exp(-rT) * [0.51675 * \$3 + 0) = \$1.53483$

Q-19. Solution: C

$u = 48/40 = 1.2$

$d = 32/40 = 0.8$

$$P_{up} = \frac{e^{r\Delta t} - d}{u - d} = \frac{e^{6.2\% \times 0.5} - 0.8}{1.2 - 0.8} = 57.87\%$$

$f = [(50 - 48) \times 0.5787 + (50 - 32) \times (1 - 0.5787)] \times e^{-6.2\% \times 0.5} = 8.47$

Early Exercise, therefore, the value of this American put is 10.

Q-20. Solution: C

$a = e^{(r-q)\Delta t} = e^{(2\%-2\%)\times 1/12} = 1.0$

$u = e^{\sigma\sqrt{\Delta t}} = e^{15\%\sqrt{1/12}} = 1.044,\ d = 0.958$

$p = (a-d)/(u-d) = (1.0-0.958)/(1.044 - 0.958) = 0.4892;$

$1-p = 0.51082$

Q-21. Solution: B

$u = 1.462\ d = 0.684$

$p = \dfrac{e^{r\times\Delta t}-d}{u-d} = (1.040811 - 0.684)/(1.462 - 0.684) = 0.4586$

Q-22. Solution: B

A two-step binomial has six nodes; the lower price occurs at S(0)×d×d, in the lower right.

$d = \exp[-\text{volatility} * \text{SQRT}(\text{time\_step})] = \exp[-22\% * \text{SQRT}(1)] = 0.8025;$

The lowest node = $\$30 * \exp(-22\%)^{\wedge}2 = \$19.321$

Q-23. Solution: D

$u = e^{\sigma\sqrt{\Delta t}} = e^{18.25\%\times\sqrt{1}} = 1.2 \quad d = e^{-\sigma\sqrt{\Delta t}} = 0.83$

Next, we project the various paths the stock's price can follow over the 3 year period. The stock has 4 potential ending values:

$S_{uuu} = \$75 \times 1.2 \times 1.2 \times 1.2 = \$129.60$

$S_{uud} = S_{duu} = S_{udu} = \$75 \times 1.2 \times 1.2 \times 0.83 = \$89.64$

$S_{udd} = S_{dud} = S_{ddu} = \$75 \times 1.2 \times 0.83 \times 0.83 = \$62.00$

$S_{ddd} = \$75 \times 0.83 \times 0.83 \times 0.83 = \$42.89$

The only point at which the option finishes in the money is after 3 upward moves, with a probability of $60\%^3 = 21.6\%60\%^3 = 21.6\%$.

The value of the option today is therefore$(129.60-90) \times 21.6\% \times e^{-5\%\times 3} = 7.36$**错误!请输入数字。**.

Q-24. Solution: A

Inputs			
call or put? c/p	c	1	toggle for formula

		Params			
Asset price	$7,300.00				
Strike price	$7,500.00		u	1.221	u = exp[σ*sqrt(Δt)]
Time/step, Δt	0.25 yrs		d	0.819	d = 1/u = exp[-σ*sqrt(Δt)]
Volatility, σ	40.0%		a	1.005	a = exp[(r-q)*Δt]
Riskfree rate, r	3.0%		p	0.4626	< probability of up jump
Dividend, q	1.0%		1-p	0.5374	< probability of down jump

Node Time (yrs)	0.0	0.25		0.50
			S =	10,890.32
			c =	3,390.32
		8,916.24		
		1,556.69		
Stock	7,300.00			7,300.00
Option	$ 714.77			-
		5,976.73		
		-		
				4,893.34
				-

Q-25. 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-26. Solution: B

The BSM model assumes:

The price of the underlying asset moves in a continuous fashion.

Interest rates are known and constant.

Variance of returns is constant.

Perfect liquidity and transaction capabilities.

Q-27. Solution: B

$$\text{put} = Ke^{-rT}N(-d_2) - SN(-d_1) = 20 \times e^{-4.25\% \times 0.5} \times (1 - 0.9651) - 25 \times (1 - 0.9737)$$
$$= 0.03$$

Q-28. Solution: B

$$d_1 = \frac{\ln(S_0/K) + \left(r - q + \frac{\sigma^2}{2}\right)T}{\sigma\sqrt{T}} = 0.1422;\ d_2 = 0.0149$$

$$N(d_1) = 0.5565 \text{ and } N(d_2) = 0.5060$$

$c = S_0 e^{-qT} N(d_1) - Ke^{-rT} N(d_2) = \$2.753$

Q-29. Solution: A

$d_1 = [LN(1.34/1.40) + (4\% - 3\% + 30\%^{\wedge}2/2) * 1] / [30\% * SQRT(1)] = 0.0373$

$d_2 = d_1 - 30\% * SQRT(1) = -0.2627$

$N(d_1) = 0.5149$ and $N(d_2) = 0.3964$

The foreign risk-free rate replaces the dividend yield, such that:

$c = S(0) * \exp(-rate\_foreign * T) * N(d_1) - K * \exp(-rate\_domestic * T) * N(d_2).$

In this case,

$c = 1.34 * \exp(-3\%) * 0.5149 - 1.40 * \exp(-4\%) * 0.3964 = \$0.1364$

Q-30. 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:

$$50N(-0.0917)e^{-0.1\times0.25} - 50N(-0.2417)$$

$$= 50 \times 0.4634e^{-0.1\times0.25} - 50 \times 0.4045 = 2.37$$

Q-31. Solution: D

While the drift rate (%) is assumed constant, per the risk-neutral valuation, we let drift rate equal the riskless rate. The real-world rate of return is not required, is not an input in the Black-Scholes, and as Hull explains, is not an increasing function of the option (as a higher implied discount rate offsets the higher expected growth rate).

In regard to (A), (B) and (C), EACH is TRUE as a key assumption underlying the Black-Scholes OPM.

Q-32. Solution: B

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

Q-33. 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-34. Solution: A

The delta of the forward $= e^{-qT} = e^{-10\% \times 0.5} = 0.95$

Q-35. Solution: C

The delta of a call option with a continuous dividend yield is given by the following formula:
$\text{Delta} = e^{-qT}N(d_1) = 0.64 \times e^{-1\% \times 2} = 0.63$

Q-36. Solution: B

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

Q-37. Solution: C

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 options ≥ positive theta,negative vega; negative gamma.

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

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

Q-38. 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-39. 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-40. 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-41. 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-42. 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-43. Solution: D

Q-44. 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-45. 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:

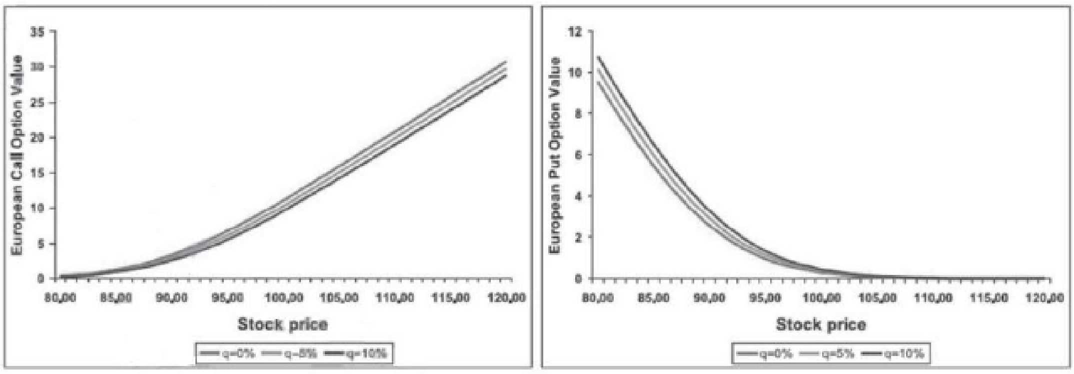
S = 93

K = 90

T = 60 days

r = 5%

sigma = 20%



Q-46. 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-47. 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 $N(d_l)$.

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

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-48. 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-49. Solution: C

Economic capital refers to a bank's own assessment of the minimum level of capital it needs to maintain. Economic capital is often less than regulatory capital, which is the minimum level a bank must maintain to comply with capital adequacy regulations.

Q-50. Solution: A

Charging risk-based premiums is a measure intended to address the problem of moral hazard, which exists when insured parties take greater risks than they would take in the absence of insurance.

Q-51. Solution: D

With a firm commitment offering, an investment bank buys an entire issue of securities from the issuer and attempts to sell them to the public at a higher price. In a private placement or a best efforts offering, an investment bank earns fee income rather than trading income. Dutch auction is a method of price discovery for an initial public offering that does not involve buying and reselling shares.

Q-52. Solution: B

Chinese walls are internal controls to prevent a banking company's commercial banking, securities, and investment banking operations from sharing information.

Q-53. Solution: C

One drawback to the originate-to-distribute model is that it has led to looser credit standards in certain sectors, such as residential mortgages. A benefit of the model is that it has increased liquidity in certain sectors.

Q-54. Solution: B

One-year term:

The expected payout for a one-year term is 0.002092 * $2,000,000 = $4,184. Assuming the payout occurs in six months, the breakeven premium is $4,184 / 1.01 = $4,142.57.

Two-year term:

The expected payout for a two-year term is the sum of the expected payouts in both the first year and the second year. The probability of death in the second year is (1 - 0.002092)* 0.00224 = 0.0022353, so the expected payout in the second year is 0.0022353*$2,000,000 =$4,470.63. If the payout occurs in 18 months, then the present value is $4,470.63 /$(1.01)^3$ = $4,339.15. The total present value of the payouts is then $4,142.57 + $4,339.15 = $8,481.72.

The first premium payment occurs immediately (i.e., beginning of the first year) so it is certain to be received. However, the probability of the second premium payment being made at the beginning of the second year is the probability of not dying in the first year, which is 1 - 0.002092

= 0.997908. The present value of the premium payments is as follows (using Y as the breakeven premium): Y + (0.997908Y / 1.01^2) = 1.978245Y.

Computing the breakeven annual premium equates the present value of the payouts and the premium payments as follows: 8,481.72 = 1.978245Y. Solving for Y, the breakeven annual premium is $4,287.50.

Response A ($4,246) is not correct because it performs the computation on the assumption that all payouts occur at the end of the year instead of halfway throughout the year. Response C ($4,332) is not correct because it did not apply any discounting (at the 1% semiannual rate). Response D ($8,482) is not correct because it is simply the total present value of the payouts.

Q-55. Solution: B

The operating ratio is computed as follows:

loss ratio (74%) + expense ratio (23%) + dividends (2%) - investment income (5%) =94%

The combined ratio is computed as follows:

loss ratio (74%) + expense ratio (23%) = 97%

The combined ratio after dividends is computed as follows:

loss ratio (74%) + expense ratio (23%) + dividends (2%) = 99%

Q-56. Solution: A

Adverse selection describes the situation where an insurer is unable to differentiate between a good risk and a bad risk. In the context of life insurance, by charging the same premiums to all policyholders (healthy and unhealthy individuals), the insurer may end up insuring more bad risks (e.g., unhealthy individuals). To mitigate adverse selection, a life insurance company might require physical examinations prior to providing coverage. Property and casualty insurance companies typically have a greater amount of equity than a life insurance company because of the highly unpredictable nature of P&C claims (both timing and amount).

Q-57. Solution: B

Mutual funds must offer immediate access to withdrawals from their fund. This is an SEC requirement. Hedge funds have advance notification and lock-up periods, which prevent immediate access to withdrawals from the fund.

Q-58. Solution: B

This is standard definition of VaR, reworded slightly.

Q-59. Solution: C

VaR(X%) is defined as the dollar or percentage loss in portfolio value that will be exceeded only X% of the time. $\mathrm{VaR}(10\%) = \$0$ indicates that there is a 10% probability that on any given day the dollar loss will be greater than $0. Alternatively, we can say there is a 90% probability that on any given day the dollar gain will be greater than $0. VaR was developed by commercial banks to provide a more accurate measure of their economic capital requirements, taking into account the effects of diversification.

Q-60. Solution: A

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

$\mathrm{VaRp} = |\Delta| * \mathrm{VaR}_f$

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.

Q-61. Solution: B

If returns are independently and identically distributed, then

$\mathrm{VaR}_{10-\mathrm{day}} = \mathrm{VaR}_{1-\mathrm{day}} \times \sqrt{10} = 316{,}000{,}000$VaR10-day=VaR1-day×10=316,000,000

Q-62. Solution: A

The VaR would be underestimated because of the greater frequency of losses in the tails of the distribution.

Q-63. Solution: D

$\mathrm{VaR(dy)} = 2.33 \times 2\% \times \sqrt{10/252}$=0.0093

$\mathrm{VaR(dP)} = 3.6 \times 10{,}000{,}000 \times 0.0093 = 334{,}186$

Q-64. Solution: C

$\mathrm{VAR}_{10-\mathrm{day}}=\mathrm{VAR}_{2-\mathrm{day}}\times\frac{\sqrt{10}}{\sqrt{2}} = 5.59$

Q-65. Solution: B

With a puttable feature, the investor is long an option, because he or she can “put” back the bond to the issuer. This will create positive gamma, or lower VaR than otherwise.

Q-66. Solution: B

The computation follows: $\mathrm{VaR}^2_{(\text{portfolio})} = \mathrm{VaR}^2_{(\text{stocks})} + \mathrm{VaR}^2_{(\text{fixed income})}$

Assuming the correlation is $1{,}367{,}000^2 = 1{,}153{,}000^2 + \mathrm{VaR}^2_{(\text{fixed income})}$

$\mathrm{VaR}_{(\text{fixed income})} = 734{,}357$

Next convert the annual VaR to daily VaR: $734{,}357/\sqrt{250} = 46{,}445$

Q-67. Solution: A

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

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

Q-68. Solution: B

800*1.82%=14.56million

Q-69. 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-70. Solution: C

$$\mathrm{VaR} = |\Delta| \times \mathrm{VAR(dS)} - \left(\frac{1}{2}\right)\Gamma \times \mathrm{VAR(dS)}^2 = 100{,}000 \times 2 - \frac{1}{2} \times (-50{,}000) \times 2^2 = \$300{,}000$$

Q-71. Solution: D

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.

Q-72. Solution: C

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

Q-73. Solution: A

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

Q-74. Solution: A

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

$\text{VaR}(10-\text{day}) = 316 \rightarrow \text{VaR}(1-\text{day}) = 316/\sqrt{10} = 100$

$\text{VaR}(15-\text{day}) = 465 \rightarrow \text{VaR}(1-\text{day}) = 465/\sqrt{15} = 120$

$\text{VaR}(20-\text{day}) = 537 \rightarrow \text{VaR}(1-\text{day}) = 537/\sqrt{20} = 120$

$\text{VaR}(25-\text{day}) = 600 \rightarrow \text{VaR}(1-\text{day}) = 600/\sqrt{25} = 120$

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

Q-75. Solution: B

The model that will take the shortest time to revert to its mean is the model with the lowest persistence defined by α＋β. So B is the right answer with α＋β = 0.97.

Q-76. Solution: A

$\boldsymbol{\sigma_n^2 = \lambda\sigma_{n-1}^2 + (1-\lambda)\mu_{n-1}^2}$

$$\sigma_t = \sqrt{(0.94)(0.015)^2 + (1-0.94)[\ln(\frac{30.5}{30.0})]^2} = 0.015096 = 1.5096\%$$

Q-77. Solution: C

$\text{Weight} = 0.94^6 \times (1-0.94) = 4.14\%$

Q-78. Solution: A

The EWMA model does not involve the long-run average variance in updating volatility, in other words, the weight assigned to the long-run average variance is zero. Only the current estimate of the variance is used. The other statements are all correct.

Q-79. Solution: D

The forward rate is

1.3000×[(1.04)^0.25/(1.01)^0.25]=1.3095,The forward rate would be quoted as 95.

Q-80. Solution: C

Q-81. Solution: C

Investment grade debt is debt rated BBB- rated or better by Standard's and Poor and Baa3 or better by Moody's.

Q-82. 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-83. 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-84. Solution: C

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

Q-85. Solution: C

- Loan (c) has the highest dollar EL, which is
  $\$1.34\text{ million} = \$150\text{ mm} * [1 - \exp(-2\% * 9/12)] * 60.0\%.$
- Loan (a) with default intensity of 4.0% and remaining term of three (3) months has
  $$PD = 1 - \exp(-4\% * 3/12) = 1.00\%$$
- Loan (b) with default intensity of 3.0% and remaining term of six (6) months has
  $$PD = 1 - \exp(-3\% * 6/12) = 1.49\%$$
- Loan (c) with default intensity of 2.0% and remaining term of nine (9) months has
  $$PD = 1 - \exp(-2\% * 9/12) = 1.49\%$$
- Loan (d) with default intensity of 1.0% and remaining term of twelve (12) months has
  $$PD = 1 - \exp(-1\% * 12/12) = 1.00\%$$

Q-86. Solution: C

As a precaution, the bank needs to set aside sufficient capital in the event that actual losses exceed expected losses with a reasonable likelihood. For example, smaller recovery rates would be indicative of larger actual losses.

Q-87. Solution: A

Exposure amount (EA) is the expected amount of the bank's credit exposure to a customer or counterparty at the time of default.

Q-88. Solution: A

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

Q-89. Solution: D

Numerous services attempt to evaluate country risk in its entirety. They include Political Risk Services (PRS), The Economist, 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-90. Solution: C

Q-91. Solution: B

Q-92. Solution: A

I and IV are correct comparisons.

II is not a correct comparison. While market risk data is readily available, operational losses (especially extreme operational losses) data are relatively sparse and pose significant difficulty for operational VaR modeling.

III is not a correct comparison. Other statistical distributions also are in use for modeling VaR.

E.g, an operational VaR can be derived from convolution of a frequency distribution (e.g. Poisson distribution) and a severity distribution (e.g. lognormal distribution).

Q-93. 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-94. Solution: A

The beta factors used in the standardized approach for operational risk are as follows: trading and sales: 18% ; retail banking : 12% ; agency and custody services: 15 % ; asset management: 12% .

Q-95. Solution: A

Operational losses are not easy to map to risk factors. Operational VaR can be calculated by both severity and frequency distribution. Monte Carlo techniques can be used for other distributions than the normal distribution.

Q-96. 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-97. 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-98. 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. The internal audit function needs to be independent and objective.

Q-99. 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-100. Solution: 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.