

01-Market Risk Measurement and Management

单项选择题

1. Natural gas prices exhibit seasonal volatility. Specifically, the entire forward curve is more volatile during the wintertime. Which of the following statements concerning VAR is correct if the VAR is estimated using unweighted historical simulation and a three-year sample period?

- A. We will understate VAR in the summer and understate VAR in the winter.
- B. We will understate VAR in the summer and overstate VAR in the winter.
- C. We will overstate VAR in the summer and understate VAR in the winter.
- D. We will overstate VAR in the summer and overstate VAR in the winter.

参考答案: A

【莽学解析】 This method essentially estimates the average volatility over a three-year window, ignoring seasonality. As a result, if the conditional volatility is higher during the winter, the method will understate the true risk, and conversely for the summer. (0)

2. You are given the following information about the returns of stock P and stock Q: Variance of return of stock P = 100.0. Variance of return of stock Q = 225.0. Covariance between the return of stock P and the return of stock Q = 53.2. At the end of 1999, you are holding USD 4 million in stock P. You are considering a strategy of shifting USD 1 million into stock Q and keeping USD 3 million in stock P. What percentage of risk, as measured by standard deviation of return, can be reduced by this strategy?

- A. 0.005
- B. 0.05
- C. 0.074
- D. 0.097

参考答案: B

【莽学解析】 The variance of the original portfolio is 1,600, implying a volatility of 40. The new portfolio has variance of $3^2 \times 100 + 1^2 \times 225 + 2 \times 3 \times 1 \times 53.2 = 1,444$. This gives a volatility of 38, which is a reduction of 5%. (8)

3. You are asked to mark to market a book of plain-vanilla stock options. The trader is short deep out-of-the-money options and long at-the-money options. There is a pronounced smile for these options. The trader's bonus increases as the value of his book increases. Which approach should you use to mark the book?

- A. Use the implied volatility of at-the-money options because the estimation of the volatility is more accurate
- B. Use the average of the implied volatilities for the traded options for which you have data because
- C. For each option, use the implied volatility of the most similar option traded on the market.
- D. Use the historical volatility because doing so corrects for the pricing mistakes in the option market

参考答案: C

【莽学解析】 The book should be marked using volatilities that give prices that are closest to market prices. This means using the ISDs of the most similar options. Also, using ATM ISDs, as suggested in answer A, will understate the value of the short OTM options, which artificially inflates the trader's profit. (0)

4. A risk manager wants to study the behavior of a portfolio that depends on only two economic variables, X and Y . X is uniformly distributed between 4 and 7, and Y is uniformly distributed between 5 and 8. The risk manager wants to model their joint distribution, $H(X, Y)$. The theorem of Sklar proves that, for any joint distribution H , there is a copula C such that:

A. $H(3X + 4, 3Y + 5)$ is equal to $C[X, Y]$.

B. $H(X, Y)$ is equal to $C[u, d]$ where u is the density marginal distribution of X and d is the density marginal distribution of Y .

C. $H(X, Y)$ is equal to $C[(X - 4)/3, (Y - 5)/3]$.

D. $H[(X - 4)/3, (Y - 5)/3]$ is equal to $C(X, Y)$.

参考答案: C

【莽学解析】Sklar's theorem proves that if $F(x, y)$ is a joint distribution function with continuous marginals $F_X(x) = u$ and $F_Y(y) = v$, then $F(x, y)$ can be written in terms of a unique function $C(u, v)$ such as $F(x, y) = C(u, v)$. In this case $u = (X - 4)/3$ (the cumulative marginal function of X , which is uniformly distributed between 4 and 7) and $v = (Y - 5)/3$. (3)

5. A committee of risk management practitioners discusses the difference between pricing deep out-of-the-money call options on FBX stock and pricing deep out-of-the-money call options on the EUR/JPY foreign exchange rate using the Black-Scholes-Merton (BSM) model. The practitioners price these options based on two distinct probability distributions of underlying asset prices at the option expiration date:

- A lognormal probability distribution
- An implied risk-neutral probability distribution obtained from the volatility smile for options of the same maturity

Using the lognormal, instead of the implied risk-neutral probability distribution, will tend to:

A. Price the option on FBX relatively high and price the option on EUR/JPY relatively low.

B. Price the option on FBX relatively low and price the option on EUR/JPY relatively high.

C. Price the option on FBX relatively low and price the option on EUR/JPY relatively low.

D. Price the option on FBX relatively high and price the option on EUR/JPY relatively high.

参考答案: A

【莽学解析】The implied distribution of the underlying equity prices derived using the general volatility smile of equity options has a heavier left tail and a less heavy right tail than a lognormal distribution of underlying prices. Therefore, using the lognormal distribution of prices causes deep-out-of-the-money call options on the underlying to be priced relatively high. The implied distribution of underlying foreign currency prices derived using the general volatility smile of foreign currency options has heavier tails than a lognormal distribution of underlying prices. Therefore, using the lognormal distribution of prices causes deep-out-of-the-money call options on the underlying to be priced relatively low. (2)

6. Based on Basel II rules for backtesting, a penalty is given to banks that have more than four exceptions to their 1-day 99% VaR over the course of 250 trading days. The supervisor gives these penalties based on four criteria. Which of the following causes of exceptions is most likely to lead to a penalty?

A. The bank increases its intraday trading activity.

B. A large move in interest rates was combined with a small move in correlations.

C. The bank's model calculates interest rate risk based on the median duration of the bonds in the portfolio.

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D. A sudden market crisis in an emerging market leads to losses in the equity positions in that country

参考答案: C

【莽学解析】In the case of a bank that changed positions more frequently during the day, a penalty should be considered, but it is not necessarily given. In the case of bad luck, no penalty is given, as would be the case for a bank affected by unpredictable movements in rates or markets. However, when risk models are not precise enough, a penalty is typically given since model accuracy could have easily been improved. (0)

7. A portfolio manager owns a portfolio of options on a non-dividend paying stock LTM. The portfolio is made up of 5,000 deep in-the-money call options on LTM and 25,000 deep out-of-the-money call options on LTM. The portfolio also contains 10,000 forward contracts on LTM. LTM is trading at USD 84. Assuming 250 trading days in a year and the volatility of LTM is 23% per year, which of the following amounts would be closest to the 1-day VaR of the portfolio at the 99 percent confidence level?

- A. USD 2,701
- B. USD 14,235
- C. USD 30,151
- D. USD 42,706

参考答案: D

【莽学解析】We need to map the portfolio to a position in the underlying stock LTM. A deep in-the-money call has a delta of approximately 1, a deep out-of-the-money call has a delta of approximately zero and forwards have a delta of 1. The net portfolio has a delta of about $1 \times 5,000 + 0 \times 25,000 + 1 \times 10,000 = 15,000$ and is approximately gamma neutral. Let: $a = 2.33$ (99% confidence level) $S = \text{price per share of stock LTM} = \text{USD } 84$ Δ
 $= \text{delta of the position} = 15,000$ $\sigma = \text{volatility of LTM} = 0.23$ Therefore, the 1-day VaR estimate at 99 percent confidence level is computed as follows: $a * S * \Delta * \sigma * \sqrt{1/T} = 2.33 * 84 * 15,000 * 0.23 / \sqrt{250} = \text{USD } 42,706$ (0)

8. Which of the following about the most common distribution used for peaks-over-threshold is false? I. The distribution requires a threshold, shape and scaling parameter. II. The distribution of these extreme values follows the GEV distribution. III. The distribution produces a curve that dips below the normal distribution prior to the tail and then moves above the normal distribution in a curved shape until it reached the extreme tail. IV. The distribution provides a more accurate estimate of the event probabilities in the distribution tail, allowing VaR to be computed at high confidence levels.

- A. I and II
- B. II only
- C. III and IV
- D. IV only

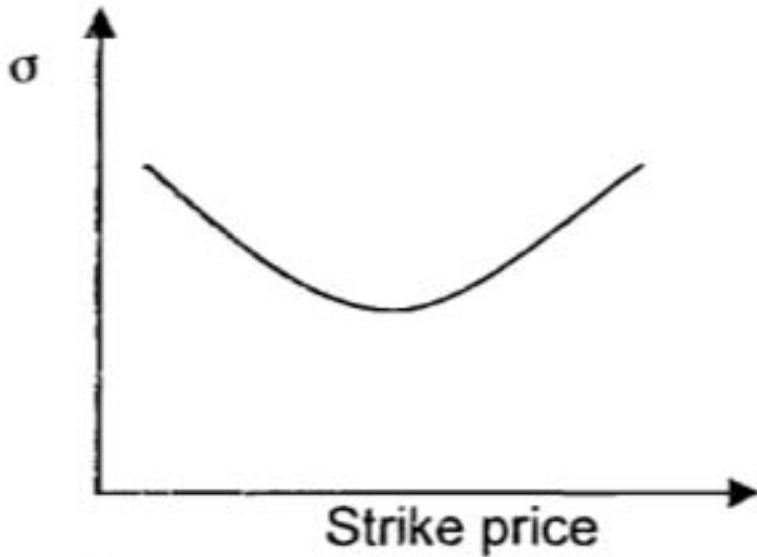
参考答案: A

【莽学解析】GPD requires a threshold, shape and scaling parameter. The distribution of these extreme values follow the GPD. GPD produces a curve that dips below the normal distribution prior to the tail and then moves above the normal distribution in a curved shape until it reached the extreme tail. GPD provides a more accurate estimate of the event probabilities in

the distribution tail, allowing VaR to be computed at high confidence levels. (3)

9. Suppose that a central bank's policy is to allow an exchange rate to fluctuate between 0.97 and 1.03. What pattern of implied volatilities for options on the exchange rate would you expect to see?

A.



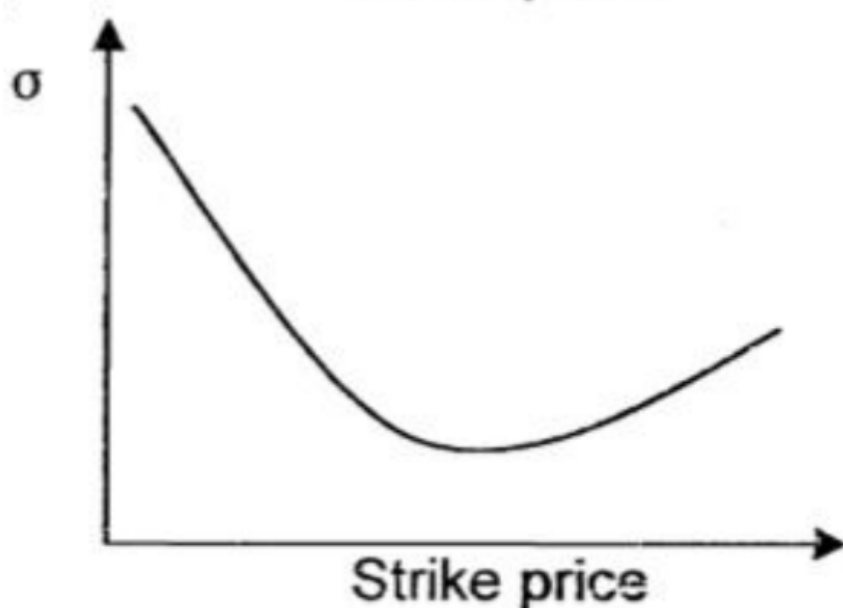
B.

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C.

D.



参考答案: A

【莽学解析】Because of the limiting range of volatility, it means that the minimum of the exchange rate is 0.97 and the maximum of it is 1.03. compared with the lognormal distribution, the distribution of the implied probability of the exchange rate have a thinner left tail and a thinner right tail. So the expected implied volatility of the call/ put option which is out-of-the-money or in-the-money is lower than that is at-the-money. (3)

10. Suppose an investor expects that the 1-year rate will remain at 6% for the first year for a 2-year zero-coupon bond. The investor also projects a 50% probability that the 1-year spot rate will be 8% in one year and a 50% probability that the 1-year spot rate will be 4% in one year. Which of the following inequalities most accurately reflects the convexity effect for this 2-year bond using Jensen's inequality formula?

- A. \$0.89031 > \$0.89000
- B. \$0.89000 > \$0.80000
- C. \$0.94340 > \$0.89031
- D. \$0.94373 > \$0.94340

参考答案: A

【莽学解析】

$$E\left(\frac{1}{1+r}\right) = 0.5 \times \frac{\$1}{1.08} + 0.5 \times \frac{\$1}{1.04} = 0.94373$$

$$\Rightarrow 0.94373/1.06 = 0.89031$$

$$\frac{1}{E(1+r)} = \frac{\$1}{0.5 \times 1.08 + 0.5 \times 1.04} = 0.94340$$

$$\Rightarrow 0.94340/1.06 = 0.89000$$

11. A risk analyst is comparing the use of parametric and non-parametric approaches for calculating VaR and is concerned about some of the characteristics present in the loss data. Which of the following distribution characteristics would make parametric approaches the favored method to use?

- A. Skewness in the distribution
- B. Fat tails in the distribution
- C. Scarcity of high magnitude loss events
- D. Heteroskedasticity in the distribution

参考答案: C

【莽学解析】Non-parametric approaches can accommodate fat tails, skewness, and any other non-normal features that can cause problems for parametric approaches. However, if the data period that is used in estimation includes few losses or losses with low magnitude, non-parametric methods will often produce risk measures that are too low. Hence parametric methods would be more appropriate in those situations. (0)

12. Computing VaR on a portfolio containing a very large number of positions can be simplified by mapping these positions to a smaller number of elementary risk factors. Which of the following mappings would be adequate?

- A. USD\EUR forward contracts are mapped on the USD\JPY\spot exchange rate.
- B. Each position in a corporate bond portfolio is mapped on the bond with the closest maturity among a
- C. Government bonds paying regular coupons are mapped on zero-coupon government bonds.
- D. A position in the stock market index is mapped on a position in a stock within that index.

参考答案: C

【莽学解析】Mapping government bonds paying regular coupons onto zero coupon government bonds is an adequate process, because both categories of bonds are government issued and therefore have a very similar sensitivity to risk factors. However, this is not a perfect mapping since the sensitivity of both classes of bonds to specific risk factors (i.e. changes in interest rates) may differ. (0)

13. A risk manager is pricing a 10-year call option on 10-year Treasuries using a successfully tested pricing model. Current interest rate volatility is high and the risk manager is concerned about the effect this may have on short-term rates when pricing the option. Which of the following actions would best address the potential for negative short-term interest rates to arise in the model?

- A. The risk manager uses a normal distribution of interest rates.
- B. When short-term rates are negative, the risk manager adjusts the risk-neutral probabilities.
- C. When short-term rates are negative, the risk manager increases the volatility.
- D. When short-term rates are negative, the risk manager sets the rate to zero.

参考答案: D

【莽学解析】Negative short-term interest rates can arise in models for which the terminal distribution of interest rates follows a normal distribution. The existence of negative interest rates does not make much economic sense since market participants would generally not lend cash at negative interest rates when they can hold cash and earn a zero return. One method that can be used to address the potential for negative interest rates when constructing interest rate trees is to set all negative interest rates to zero. This localizes the change in assumptions to points in the distribution corresponding to negative interest rates and preserves the original rate tree for all other observations. In comparison, adjusting the risk neutral probabilities would alter the dynamics across the entire range of interest rates and therefore not be an optimal approach. When a model displays the potential for negative short-term interest rates, it can still be a desirable model to use in certain situations, especially in cases where the valuation depends more on the average path of the interest rate, such as in valuing coupon bonds. Therefore, the potential for negative rates does not automatically rule out the use of the model. (2)

14. A large commercial bank is using VaR as its main risk measurement tool. Expected shortfall (ES) is suggested as a better alternative to use during market turmoil. What should be understood regarding VaR and ES before modifying current practices?

- A. Despite being more complicated to calculate, ES is easier to backtest than VaR.
- B. Relative to VaR, ES leads to more required economic capital for the same confidence level.
- C. While VaR ensures that the estimate of portfolio risk is less than or equal to the sum of the risks
- D. Both VaR and ES account for the severity of losses beyond the confidence threshold.

参考答案: B

【莽学解析】Expected shortfall is always greater than or equal to VaR for a given confidence level, since ES accounts for the severity of expected losses beyond a particular confidence level, while VaR measures the minimum expected loss at that confidence level. Therefore, ES would lead to a higher level of required economic capital than VaR for the same confidence level. In practice, however, regulators often correct for the difference between ES and VaR by lowering the required confidence level for banks using ES compared to those using VaR. (2)

15. Tycoon Bank announced that there were eight days in the previous year for which losses exceeded the daily 99% VAR. As a result, concerns emerged about the accuracy of the VAR implementation. Assuming that there are 250 days in the year, which of the following statements is/are correct? I. Using a two-tailed 99% confidence level z-score test, the current VAR implementation understates the actual risk in the bank's portfolio. II. Using a two-tailed 99%

confidence level z-score test, the current VAR implementation overstates the actual risk in the bank's portfolio. III. The bank's exception rates for VAR may be inaccurate if the bank's portfolio changes incorporate the returns from low-risk but highly profitable intraday market making activities. IV. If these eight exceptions all happened in the previous month, the model should be reexamined for faulty assumptions and invalid parameters.

A. I and III

B. I, III, and IV

C. III only

D. I, II, and IV

参考答案: B

【莽学解析】The z-score gives $(8-2.5) / (250 \times 0.01 \times 0.99)^{1/2} = 3.5$. This is too high (greater than 2), which leads to rejection of the null that the VAR model is well calibrated. Hence, VAR is too low and statement I. is correct. Statement II. Is incorrect. However, this may be due to intraday trading, so III. is incorrect, too. Finally, if all eight exceptions occurred in the last month, there is bunching, and the model should be reexamined, so IV. is correct. (2)

16. Which of these statements regarding risk factor mapping approaches is/are correct? I.

Under the cash flow (CF) mapping approach, only the risk associated with the average maturity of a fixed-income portfolio is mapped. II. Cash flow mapping is the least precise method of risk mapping for a fixed-income portfolio. III. Under the duration mapping approach, the risk of a bond is mapped to a zero-coupon bond of the same duration. IV. Using more risk factors generally leads to better risk measurement but also requires more time to be devoted to the modeling process and risk computation.

A. I and II

B. I, III, and IV

C. III and IV

D. IV only

参考答案: C

【莽学解析】Under the cash flow (CF) mapping approach, each payment (and not only the last one) is associated with a different risk factor, so statement I is incorrect. Statement II is incorrect because the CF mapping approach is more correct than duration or maturity mapping. (1)

17. The historical simulation (HS) approach is based on the empirical distributions and a large number of risk factors. The RiskMetrics approach assumes normal distributions and uses mapping on equity indices. The HS approach is more likely to provide an accurate estimate of VAR than the RiskMetrics approach for a portfolio that consists of

A. A small number of emerging market securities

B. A small number of broad market indexes

C. A large number of emerging market securities

D. A large number of broad market indexes

参考答案: A

【莽学解析】The question deals with the distribution of the assets and the effect of diversification. Emerging market securities are more volatile and less likely to be normally distributed than broad market indices. In addition, a small portfolio is less likely to be well represented by a mapping approach, and is less likely to be normal. The RiskMetrics approach assumes that the conditional distribution is normal and simplifies risk by mapping. This will be

acceptable with a large number of securities with distributions close to the normal, which is answer d. Answer a. describes the least diversified portfolio, for which the HS method is best. (10)

18. A hedge fund manager has to choose a risk model for a large “equity market neutral” portfolio, which has zero beta. Many of the stocks held are recent IPOs. Among the following alternatives, the best is:

- A. A single index model with no specific risk, estimated over the last year
- B. A diagonal index model with idiosyncratic risk, estimated over the last year
- C. A model that maps positions on industry and style factors
- D. A full covariance matrix model using a very short window

参考答案: C

【莽学解析】 Answer a. is incorrect because it only considers the portfolio beta, which is zero by construction. So, it would erroneously conclude that there is no risk. Answer b. is better but would miss the risk of the IPO positions because they have no history. Answer c. will produce unreliable numbers because of the short window. The best solution is to replace the IPO positions by exposures on industry and style factors. (4)

19. Brenda Williams is a risk analyst who wants to model the dependence between asset returns using copulas and must convince her manager that this is the best approach. Which of the following statements are correct? I. The dependence between the return distributions of portfolio assets is critical for risk measurement. II. Correlation estimates often appear stable in periods of low market volatility and then become volatile in stressed market conditions. Risk measures calculated using correlations estimated over long horizons will therefore underestimate risk in stressed periods. III. Pearson correlation is a linear measure of dependence between the return of two assets equal to the ratio of the covariance of the asset returns to the product of their volatilities. IV. Using copulas, one can construct joint return distribution functions from marginal distribution functions in a way that allows for more general types of dependence structure of the asset returns.

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

参考答案: D

【莽学解析】 The dependence is critical, so statement I is correct. The usual Pearson correlation is a linear measure of dependence, so statement III is correct. Statement IV is also correct. For statement II correlations indeed change over stressed periods, but it is not clear whether this biases long-term correlations upward or downward. Also, the effect on the portfolio risk depends on the positioning. Hence, there is not enough information to support statement II. (6)

20. In early 2000, a risk manager calculates the VAR for a technology stock fund based on the last three years of data. The strategy of the fund is to buy stocks and write out-of-the-money puts. The manager needs to compute VAR. Which of the following methods would yield results that are least representative of the risks inherent in the portfolio?

- A. Historical simulation with full repricing
- B. Delta-normal VAR assuming zero drift

C. Monte Carlo\nstyle VAR assuming zero drift with full repricing

D. Historical simulation using delta- -equivalents for all positions

参考答案: D

【莽学解析】Because the portfolio has options, methods a. or c. based on full repricing would be appropriate. Next, recall that technology stock have had a big increase in price until March 2000. From 1996 to 1999, the NASDAQ index went from 1300 to 4000. This creates a positive drift in the series of returns. So, historical simulation without an adjustment for this drift would bias the simulated returns upward, thereby underestimating VAR. (12)

21. Jim Johanssen has collected a large data set of daily market returns for three emerging markets. He is concerned about the non-normal skew in the data and is considering non-parametric estimation methods. Johanssen is not familiar with these techniques and he discusses the procedure with his colleague Lily Tong. During the course of their discussion, Lily makes the following statements: I. Age-weighted historical simulation reduces the impact of older observations only after surpassing a user-defined threshold. II. Volatility-weighted historical simulation augments historic returns with an additive volatility adjustment. III. Filtered historical estimation combines sophisticated parametric and dynamic volatility estimation techniques. How many of Ms. Tong's statements are correct?

A. Zero.

B. One.

C. Two.

D. Three

参考答案: A

【莽学解析】Statement I is incorrect because age-weighted historical simulation reduces the weighting of each successive observation by a constant decay factor. Statement II is incorrect as volatility-weighted historical simulation uses a multiplicative adjustment not additive. Statement III is incorrect because filtered historical simulation combines the historical simulation model with conditional volatility models. (0)

22. The term structure model that incorporates constant drift is referred to as Model 2. This model augments Model 1 and is expressed as: $dr = \lambda dt + \sigma dw$, where λ is the drift term. Using Model 2, if we assume that the current short-term rate is 8%, annual volatility is 200 bps, and annual drift is 0.48%, which of the following statements is incorrect?

A. The expected\nvalue of dw equals zero.

B. The monthly\ndrift is 4 basis points.

C. The annual risk\npremium is 68 basis points.

D. The drift may be\nattributed to a 20 basis point change in the rate and a 28 basis point risk

参考答案: C

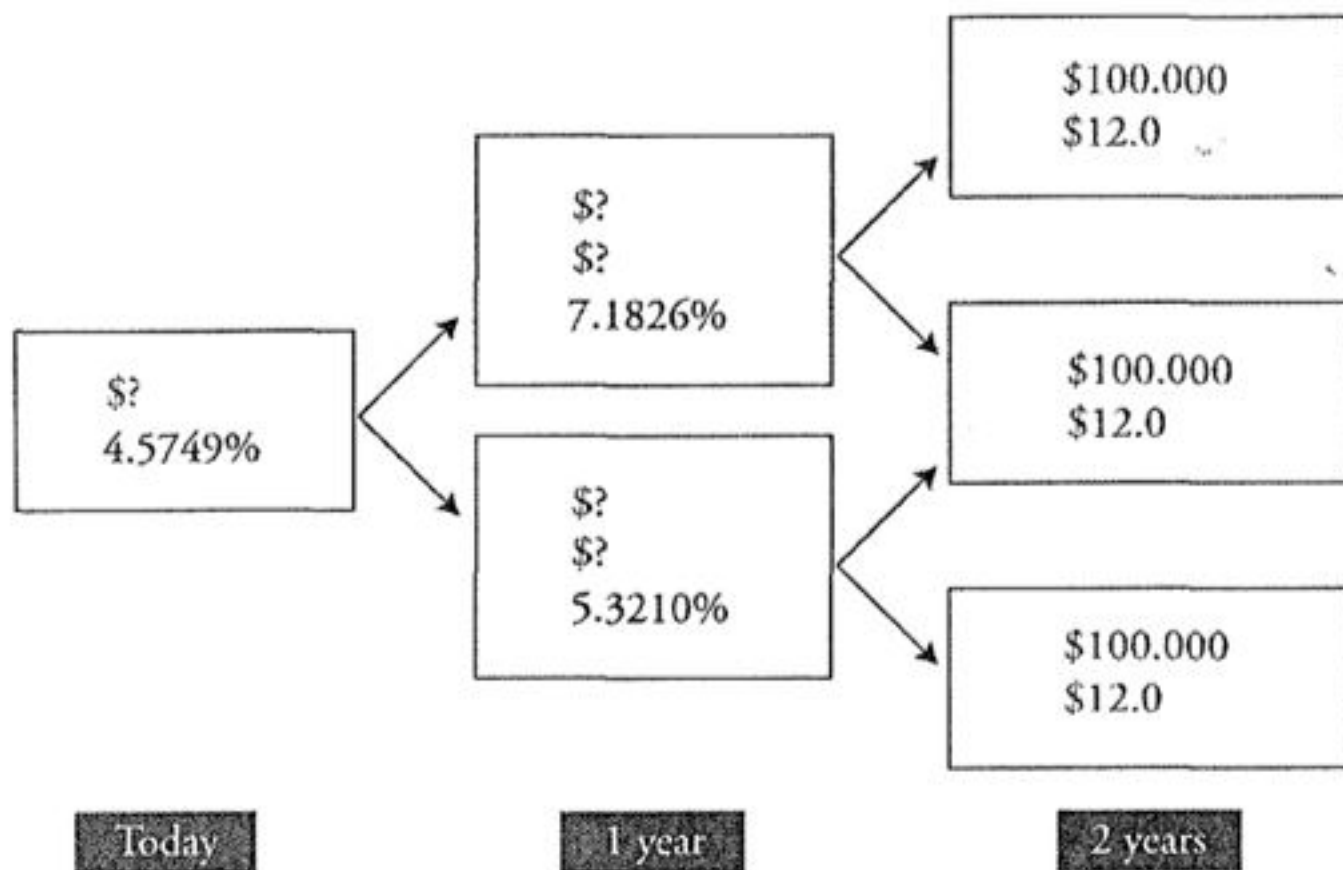
【莽学解析】The drift term is some combination of the expected change in the short-term rate and the risk premium, which is not necessarily entirely attributed to the risk premium. (11)

23. The value today of an option-free, 12% annual coupon bond with two years remaining until maturity is closest to:

A. 109.927

B. 111.485.

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C. 112.282.

D. 113.394.

参考答案: C

【莽学解析】

$$V_{1,U} = \frac{1}{2} \times \left(\frac{\$100 + \$12}{1.071826} + \frac{\$100 + \$12}{1.071826} \right) = \$104.495$$

$$V_{1,L} = \frac{1}{2} \times \left(\frac{\$100 + \$12}{1.053210} + \frac{\$100 + \$12}{1.053210} \right) = \$106.342$$

$$V_0 = \frac{1}{2} \times \left(\frac{\$104.495 + \$12}{1.045749} + \frac{\$106.342 + \$12}{1.045749} \right) = \$112.282$$

24. Mill Street Bank has accumulated a long history of loan returns. Mill Street believes that the underlying distribution of loan returns should follow a normal distribution with a mean of ten and a standard deviation of three. The following table identifies tail VaRs at different confidence level. Assume the initial analysis uses five tail slices. Calculate the expected shortfall at the 95% confidence level and identify the effect on ES when the number of tail slices increases.

<i>Confidence level</i>	<i>Tail VaR</i>
95%	3.00
96%	3.25
97%	3.60
98%	4.00
99%	4.75

- A.
- B. 无
- C. 无
- D. 无

参考答案: C

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<u>Expected Shortfall</u>	<u>Increasing Slices</u>
a. 3.72	ES increases
b. 3.72	ES decreases
c. 3.90	ES increases
d. 3.90	ES decreases

【莽学解析】The expected shortfall calculation takes the average of the expected shortfalls at varying confidences in the tail region. Since we are told that there are only five tail slices, there will be four (i.e., $n-1$) VaR quantiles. Therefore, $ES = [(3.25 + 3.6 + 4.00 + 4.75) / (5 - 1)] = 3.90$. Note that the tail VaR at 95% is not included in the calculations since ES is the average loss beyond 5% VaR. In addition, as the number of tail slices increases, the average ES will increase as the number of higher confidence tail VaRs increases. (1)

25. Suppose an investor expects that the 1-year rate will remain at 5% for the first year for a 2-year zero-coupon bond. In addition, the investor estimates a 50% probability that 1-year spot rates will be 6% in one year and a 50% probability that 1-year spot rates will be 4% in one year. Which of the following inequalities most accurately reflects the convexity effect for this 2-year bond using Jensen's inequality formula?

- A. $\$0.95247 > \0.95238 .
- B. $\$0.91584 > \0.91575 .
- C. $\$0.90711 > \0.90703 .
- D. $\$0.89856 > \0.89847 .

参考答案: C

【莽学解析】

$$E \left[\frac{\$1}{(1+r)} \right] = 0.5 \times \frac{\$1}{(1.06)} + 0.5 \times \frac{\$1}{(1.04)} = 0.5 \times \$0.94340 + 0.5 \times \$0.96154 = \$0.95247$$

$$\frac{\$1}{0.5 \times 1.06 + 0.5 \times 1.04} = \frac{\$1}{1.05} = 0.95238.$$

$$\left(\frac{1}{(1.05)^2} = 0.90703 \right).$$

Thus, Jensen's inequality reveals that $\$0.90711 > \0.90703 . (2)

26. A risk manager is analyzing a 1-day 98% VaR model. Assuming 252 days in a year, what is the

maximum number of daily losses exceeding the 1-day 98% VaR that is acceptable in a 1-year backtest to conclude, at a 95% confidence level, that the model is calibrated correctly?

- A. 5
- B. 9
- C. 10
- D. 12

参考答案: B

【莽学解析】The risk manager will reject the hypothesis that the model is correctly calibrated if the number x of losses exceeding the VaR is such that: $(x - pT) / \sqrt{p(1-p)T} > 1.96$ Where p represents the failure rate and is equal to 1-98%, or 2%; and T is the number of observations, 252. Then 1.96 = two-tail confidence level quantile $\rightarrow x > 1.96 * \sqrt{2\% * 98\% * 252} + p * T = 9.40$. So the maximum number of exceedances would be 9 to conclude that the model is calibrated correctly. (7)

27. A risk manager is constructing a term structure model and intends to use the Cox-Ingersoll-Ross Model. Which of the following describes this model?

- A. The model presumes that the volatility of the short rate will increase at a predetermined rate.
- B. The model presumes that the volatility of the short rate will decline exponentially to a constant level
- C. The model presumes that the basis-point volatility of the short rate will be proportional to the rate
- D. The model presumes that the basis-point volatility of the short rate will be proportional to the square root of the rate

参考答案: D

【莽学解析】In the CIR model, the basis-point volatility of the short rate is not independent of the short rate as other simpler models assume. The annualized basis-point volatility equals and therefore increase as a function of the square root of the rate. (2)

28. Which of the following statements about correlation and copula are correct? i. Copula enables the structures of correlation between variables to be calculated separately from their marginal distributions. ii. Transformation of variables does not change their correlation structure. iii. Correlation can be a useful measure of the relationship between variables drawn from a distribution without a defined variance. iv. Correlation is a good measure of dependence when the measured variables are distributed as multivariate elliptical.

- A. i and iv only
- B. ii, iii, and iv only
- C. i and iii only
- D. ii and iv only

参考答案: A

【莽学解析】“i” is true. Using the copula approach, we can calculate the structures of correlation variables separately from the marginal distributions. “iv” is also true. Correlation is a good measure of dependence when the measured variables are distributed as multivariate elliptical. “ii” is false. The correlation between transformed variables will not always be the same as the correlation between those same variables before transformation. Data transformation can sometimes alter the correlation estimate. “iii” is also false. Correlation is not defined unless variances are finite. (0)

29. A portfolio manager owns a portfolio of options on a non-dividend paying stock RTX. The portfolio is made up of 10,000 deep in-the-money call options on RTX and 50,000 deep out-of-the-money call options on RTX. The portfolio also contains 20,000 forward contracts on RTX. RTX is trading at USD 100. If the volatility of RTX is 30% per year, which of the following amounts would be closest to the 1-day VaR of the portfolio at the 95 percent confidence level, assuming 252 trading days in a year?

- A. USD 932
- B. USD 92,263
- C. USD 111,122
- D. USD 131,892

参考答案: B

【莽学解析】

$$\alpha \times S \times \Delta \times \sigma \times \sqrt{1/T} = 1.645 \times 100 \times 30,000 \times 0.30 \times \sqrt{1/252} =$$

30. Let X be a random variable representing the daily loss of your portfolio. The “peaks over threshold” (POT) approach considers a threshold value, u , of X and the distribution of excess losses over this threshold. Which of the following statements about this application of extreme value theory is correct?

- A. To apply the POT approach, the distribution of X must be elliptical and known.
- B. If X is normally distributed, the distribution of excess losses requires the estimation of only one
- C. To apply the POT approach, one must choose a threshold, u , which is high enough that the number of
- D. As the threshold, u , increases, the distribution of excess losses over u converges to a generalized

参考答案: D

【莽学解析】The distribution of excess losses over u converges to a generalized Pareto distribution as the threshold value u increases. The distribution of X itself can be any of the commonly used distributions: normal, lognormal, t , etc., and will usually be unknown. The distribution of excess losses requires the estimation of two parameters, a positive scale parameter β and a shape or tail index parameter ξ . One must choose a threshold u that is high enough so that the theory applies but also low enough so that there are observations in excess of u . (5)

31. The Chief Risk Officer of Martingale Investments Group is planning a change in methodology for some of the risk management models used to estimate risk measures. His aim is to move from models that use the normal distribution of returns to models that use the distribution of returns implied by market prices. Martingale Group has a large long position in the German equity stock index DAX which has a volatility smile that slopes downward to the right. How will the change in methodology affect the estimate of expected shortfall (ES)?

- A. ES with the updated models will be larger than the old estimate.

B. ES with the updated models will be smaller than the old estimate.

C. ES will remain unchanged.

D. Insufficient information to determine.

参考答案: A

【莽学解析】A volatility smile is a common graphical shape that results from plotting the strike price and implied volatility of a group of options with the same expiration date. Since the volatility smile is downward sloping to the right, the implied distribution has a fatter left tail compared to the lognormal distribution of returns. This means that an extreme decrease in the DAX has a higher probability of occurrence under the implied distribution than the lognormal. The ES will therefore be larger when the methodology is modified. (4)

32. Which of the following statements about correlation and copula are correct? i. Copula enables the structures of correlation between variables to be calculated separately from their marginal distributions. ii. Transformation of variables does not change their correlation structure. iii. Correlation can be a useful measure of the relationship between variables drawn from a distribution without a defined variance. iv. Correlation is a good measure of dependence when the measured variables are distributed as multivariate elliptical.

A. i and iv only

B. ii, iii, and iv only

C. i and iii only

D. ii and iv only

参考答案: A

【莽学解析】“i” is true. Using the copula approach, we can calculate the structures of correlation between variables separately from the marginal distributions. “iv” is also true. Correlation is a good measure of dependence when the measured variables are distributed as multivariate elliptical. “ii” is false. The correlation between transformed variables will not always be the same as the correlation between those same variables before transformation. Data transformation can sometimes alter the correlation estimate. “iii” is also false. Correlation is not defined unless variances are finite. (1)

33. If volatility(0) is the current (today's) volatility estimate and volatility(t) is the volatility estimate on a previous day(t), which best describes volatility-weighted historical simulation?

A. First conduct typical historical simulation (HS) on return series. Then multiply VaR by volatility

B. First conduct typical historical simulation (HS) on return series. Then multiply VaR by volatility

C. Each historical return(t) is replaced by: $\text{return}(t) \times \frac{\text{volatility}(0)}{\text{volatility}(t)}$. Then conduct typical

D. Each historical return(t) is replaced by: $\text{return}(t) \times \frac{\text{volatility}(t)}{\text{volatility}(0)}$. Then conduct typical

参考答案: C

【莽学解析】Each historical return(t) is replaced by: $\text{return}(t) \times \frac{\text{volatility}(0)}{\text{volatility}(t)}$. Then conduct typical historical simulation (HS) on adjusted return series. For example, if on the historical day (t), the return(t) was -2.0% and volatility(t) was 10%, while today's volatility estimate is 20%, then the adjusted return is $-2.0\% \times \frac{20\%}{10\%} = -4.0\%$. In this way,

“Actual returns in any period t are therefore increased (or decreased), depending on whether the current forecast of volatility is greater (or less than) the estimated volatility for period t . We now calculate the HS P/L using [the adjusted returns] instead of the original data set, and then proceed to estimate HS VaRs or ESs in the traditional way (i.e., with equal weights, etc.). (2)

34. Portfolios (X) and (Y) each have volatility of 20%, but portfolio (Y) has a higher return and therefore its absolute VaR is lower; i.e., Absolute VaR = $-\text{return} * T + \text{deviate} * \text{volatility} * \text{SQRT}(T)$. Which coherence property does this illustrate?

- A. Monotonicity
- B. Subadditivity
- C. Positive Homogeneity
- D. Translational invariance

参考答案: A

【莽学解析】Monotonicity means that a random cash flow or future value Y that is always greater than X should have a lower risk: this makes sense, because it means that less has to be added to Y than to X to make it acceptable, and the amount to be added is the risk measure. (2)

35. Consider a trader with an investment in a corporate bond with face value of \$100,000 and default probability of 0.5%. Over the next period, we can either have no default, with a return of zero, or default with a loss of \$100,000. The payoffs are thus \$100,000 with probability of 0.5% and +\$0 with probability of 99.5%. Since the probability of getting \$0 is greater than 99%, the VAR at the 99% confidence level is \$0, without taking the mean into account. This is consistent with the definition that VAR is the smallest loss, such that the right-tail probability is at least 99%. Now, consider a portfolio invested in three bonds (A, B, C) with the same characteristics and independent payoffs. Please compute the portfolio VAR at the 99% confidence level (using loss distribution method):

- A. \$0
- B. \$100,000
- C. \$200,000
- D. \$300,000

参考答案: B

【莽学解析】

State	Bonds	Probability	Payoff
No default		$0.995 \times 0.995 \times 0.995 = 0.9850749$	\$0
1 default	A,B,C	$3 \times 0.005 \times 0.995 \times 0.995 = 0.0148504$	-\$100,000
2 defaults	AB,AC,BC	$3 \times 0.005 \times 0.005 \times 0.995 = 0.0000746$	-\$200,000
3 defaults	ABC	$0.005 \times 0.005 \times 0.005 = 0.0000001$	-\$300,000

36. It is not always apparent how risk should be quantified for a given bank when there are many different possible risk measures to consider. Prior to defining specific measures, one should be

aware of the general characteristics of ideal risk measures. Such measures should be intuitive, stable, easy to understand, coherent, and interpretable in economic terms. In addition, the risk decomposition process must be simple and meaningful for a given risk measure. Standard deviation, value at risk (VaR), expected shortfall (ES), and spectral and distorted risk measures are commonly used measures to calculate economic capital. However, it is not easy to select a risk measure to calculate economic capital, as each measure has its respective pros and cons. Which of the following statements pertaining to the pros and cons of these risk measures is not accurate?

- A. Standard deviation does not have the property of monotonicity, and therefore, it is not coherent.
- B. VaR does not have the property of subadditivity, and therefore; it is not coherent.
- C. ES is not stable regardless of the loss distribution.
- D. Spectral and distorted risk measures are neither intuitive nor commonly used in practice.

参考答案: C

【莽学解析】Expected shortfall's stability as a measure of risk depends on the loss distribution. (2)

37. The annual mean and volatility of a portfolio are 10% and 40%, respectively. The current value of the portfolio is GBP 1,000,000. How does the 1-year 95% VaR that is calculated using a normal distribution assumption (normal VaR) compare with the 1-year 95% VaR that is calculated using the lognormal distribution assumption (lognormal VaR)?

- A. Lognormal VaR is greater than normal VaR by GBP130,400
- B. Lognormal VaR is greater than normal VaR by GBP 175,900
- C. Lognormal VaR is less than normal VaR by GBP 130,400
- D. Lognormal VaR is less than normal VaR by GBP 175,900

参考答案: C

【莽学解析】

$$\text{Normal VaR} = 0.1 - (1.645 \times 0.4) = 0.558$$

$$\text{Lognormal VaR} = 1 - \exp[0.1 - (1.645 \times 0.4)] = 0.4276$$

38. 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

参考答案: C

【莽学解析】

$$VAR(df) = \Delta \times VAR(dS) + (1/2) \Gamma \times VAR(dS)^2$$

$$VAR(df) = 100000 \times (-2.00) + (1/2) (-50000) \times (-2.00)^2 = -\$300,000$$

39. Katherine McCollin is a risk manager who has been assigned the task of designing a risk engine for VaR mapping. Which of the following statements accurately describes VaR mapping?

A. Beta is an important factor in mapping fixed-income portfolios.

B. Duration mapping is an appropriate method for estimating VaR for mapping forwards and interest-rate

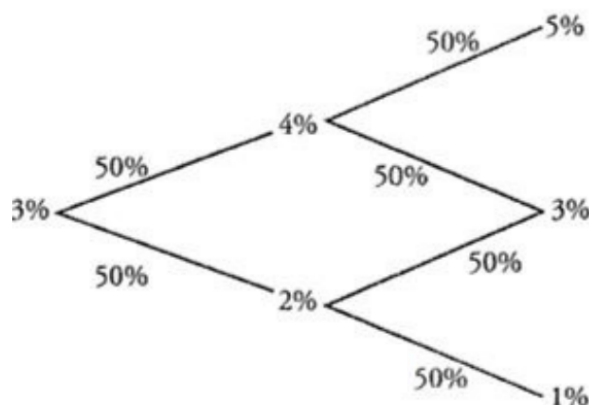
C. VaR mapping involves identifying common risk factors among positions in a portfolio and mapping all

D. A return-based analysis may fail to spot style drift or hidden risks.

参考答案: D

【莽学解析】VaR mapping involves identifying common risk factors among positions in a portfolio and mapping those positions to risk factors. A return-based analysis may fail to spot style drift or hidden risks. Duration, is an important factor in mapping fixed-income portfolios. The delta-normal method is an appropriate method for estimating VaR for mapping forwards and interest-rate swaps. (0)

40. The following decision tree of expected 1-year rates is for a 2-year zero-coupon bond with a face value of \$1.



Suppose that investors are risk averse and require a risk premium of 30 basis points for each year of interest rate risk. What is the investor's expected or required return for a 2-year zero-coupon bond with a face value of \$1 using the expected 1-year rates in the decision tree?

A. 2.7%.

B. 3.0%.

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C. 3.3%.

D. 3.6%.

参考答案: C

【莽学解析】

$$\$0.93995 = \frac{\left[\frac{\$1}{1.043} + \frac{\$1}{1.023} \right] / 2}{1.03} = \frac{[\$0.95877 + \$0.97752] / 2}{1.03}$$

$$\frac{\left[\frac{\$1}{1.04} - \frac{\$1}{1.02} \right] - \$0.93995}{\$0.93995} = \frac{\frac{\$0.96154 + \$0.98039}{2} - \$0.93995}{\$0.93995} = \frac{\$0.97097 - \$0.93995}{\$0.93995} = 0.033$$

41. An analyst is modeling spot rate changes using short rate term structure models. The current short-term interest rate is 5% with a volatility of 80 bps. After one month passes the realization of $d\omega$, a normally distributed random variable with mean 0 and standard deviation, is -0.5. Assume a constant interest rate drift, λ , of 0.36%. What should the analyst compute as the new spot rate?

A. 5.37%

B. 4.63%

C. 5.76%

D. 0.0424

参考答案: B

【莽学解析】

$$dr = \lambda dt + \sigma d\omega$$

$dr = (0.36\%/12) + (0.8 * (-0.5)) = -0.37\% = -37\text{bps}$ Since the initial short-term rate was 5% and dr is -0.37%, the new spot rate in one month is: $5\% - 0.37\% = 4.63\%$ (1)

42. John Jones, FRM, is discussing the appropriate usage of mean-reverting models relative to no-drift models, models that incorporate drift, and Ho-Lee models. Jones makes the following statements: Statement 1: Both Model 1 (no drift) and the Vasicek model assume parallel shifts from changes in the short-term rate. Statement 2: The Vasicek model assumes decreasing volatility of future short-term rates while Model 1 assumes constant volatility of future short-term rates. Statement 3: The constant drift model (Model 2) is a more flexible model than the Ho-Lee model. How many of his statements are correct?

A. 0

B. 1

C. 2

D. 3

参考答案: B

【莽学解析】 Only statement 2 is correct. The Vasicek model implies decreasing volatility and non-parallel shifts from changes in short-term rates. The Ho-Lee model is actually more general than Model 2 (the no drift and constant drift models are special cases of the Ho-Lee model). (5)

43. An empirical distribution of equity price derived from the price of options of such stock based on BSM that exhibits a fatter right tail than that of a lognormal distribution would indicate:

A. Equal implied volatilities across low and high strike prices.

B. Greater implied volatilities for low strike prices.

C. Greater implied volatilities for high strike prices.

D. Higher implied volatilities for mid-range strike prices.

参考答案: C

【莽学解析】 An empirical distribution with a fat right tail generates a higher implied volatility for higher strike prices due to the increased probability of observing high underlying asset prices. (8)

44. You are asked to mark to market a book of plain vanilla stock options. The trader is short deep out-of-the-money options and long at-the-money options. There is a pronounced smile for these options. The trader's bonus increases as the value of his book increases. Which approach should you use to mark the book?

A. Use the implied volatility of at-the-money options because the estimation of the volatility is more

B. Use the average of the implied volatilities for the traded options for which you have data because

C. For each option, use the implied volatility of the most similar option traded on the market.

D. Use the historical volatility because doing so corrects for the pricing mistakes in the option mark

参考答案: C

【莽学解析】 The prices obtained with C are the right ones because they correspond to prices at which you could sell or buy the options. (2)

45. A European put option has two years to expiration and a strike price of \$101.00. The underlying is a 7% annual coupon bond with three years to maturity. Assume that the risk-neutral probability of an up move is 0.76 in year 1 and 0.60 in year 2. The current interest rate is 3.00%. At the end of year 1, the rate will either be 5.99% or 4.44%. If the rate in year 1 is 5.99%, it will either rise to 8.56% or rise to 6.34% in year 2. If the rate in one year is 4.44%, it will either rise to 6.34% or rise to 4.70%. The value of the put option today is closet to:

A. \$1.17

B. \$1.30

C. \$1.49

D. \$1.98

参考答案: A

【莽学解析】

$$\frac{(\$2.44 \times 0.6) + (\$0.38 \times 0.4)}{1.0599} = \$1.52$$

$$\frac{(\$0.38 \times 0.6) + (\$0.00 \times 0.4)}{1.0444} = \$0.22$$

$$\frac{(\$1.52 \times 0.76) + (\$0.22 \times 0.24)}{1.0300} = \$1.17$$

46. An six-monthn analyst is using the delta-normal method to determine the VaR of a fixed income portfolio. The portfolio contains a long position in 1-year bonds with a \$1 million face value and a 6% coupon that is paid semi-annually. The interest rates and twelve-month maturity zero-coupon bonds are, respectively, 2% and 2.5%. Mapping the long position to standard positions in the six-month and twelve-month zeros, respectively, provides which of the following mapped positions?

- A. \$30,000 and 1,030,000
- B. \$29,500 and 975,610
- C. \$29,703 and 1,004,878
- D. \$30,300 and 1,035,000

参考答案: C

【莽学解析】

$$X_{six} = \frac{30,000}{1 + (0.02 / 2)} = 29,703$$

$$X_{twelve} = \frac{1,030,000}{1 + (0.025)} = 1,004,878$$

47. Basel II requires a backtest of a bank' s internal value at risk (VaR) model (IMA). Assume the bank' s ten-day 99% VaR is \$1 million (minimum of 99% is hard-wired per Basel). The null hypothesis is: the VaR model is accurate. Out of 1,000 observations, 25 exceptions are observed (we saw the actual loss exceed the VaR 25 out of 1000 observations). (Binomial CDF)

- A. We will probably call the VaR model good (accurate) but we risk a Type I error.
- B. We will probably call the VaR model good (accurate) but we risk a Type II error.

C. We will probably call the model bad (inaccurate) but we risk a Type I error.

D. We will probably call the model bad (inaccurate) but we risk a Type II error.

参考答案: C

【莽学解析】The probability of 25 or more exceptions will only be observed 1 - 99.996%. So, we reject the model. Null = good model. To decide the model is bad model is to reject null and this implies a risk of type I error. (5)

48. Which of the following statements regarding verification of a VAR model by examining its failure rates is false? I. The frequency of exceptions should correspond to the confidence level used for the model. II. According to Kupiec (1995), we should reject the hypothesis that the model is correct if the LR > 3.84. III. Backtesting VAR models with lower confidence levels is difficult because the number of exceptions is not high enough to provide meaningful information. IV. The range for the number of exceptions must strike a balance between the chances of rejecting an accurate model (a type I error) and the chance of accepting an inaccurate model (a type II error)

A. I and IV

B. II only

C. III only

D. II and IV

参考答案: C

【莽学解析】Backtesting VAR models with higher confidence levels is difficult because the number of exceptions is not high enough to provide meaningful information. (3)

49. An analyst is backtesting a daily holding period VaR model using a 97.5% confidence level over a 255-day period and is using a 3.84 test statistic. The following table shows the calculated values of a log-likelihood ratio (LR) at a 97.5% confidence level.

Number of Exceptions												
1	2	3	4	5	6	7	8	9	10	11	12	13
7.16	4.19	2.27	1.04	0.33	0.02	0.06	0.39	0.98	1.81	2.84	4.11	5.64

Based on the above information, which of the following statements accurately describes the VaR model that is being backtested?

A. If the number of exceptions is more than 3, we would not reject the model.

B. If the number of exceptions is more than 2 and less than 12, we may commit a Type II error.

C. If the number of exceptions is less than 2, we would accept the hypothesis that the model is correct

D. If the number of exceptions is less than 2, we may commit a Type II error.

参考答案: B

【莽学解析】If the number of exceptions is more than 2 and less than 12, we would not reject the model because the calculated LR is less than 3.84. If we do not reject the model, we may commit a Type II error. A Type II error is defined as accepting an inaccurate model. If the number of exceptions is less than 2, we reject the model because the calculated LR is greater than 3.84. If we accept the model, we cannot commit a Type I error. A Type I error is defined as rejecting an accurate model. (5)

50. The peaks-over-threshold (POT) approach is used by a firm to apply extreme value theory (EVT) to the distribution of excess losses over a high threshold. The firm estimated the following parameter values: distribution scale parameter = 0.90, distribution shape parameter = 0.15, threshold = 1%, and number of observations that exceed threshold / threshold = 5%. Compute the 1% VaR in percentage terms and the corresponding expected shortfall measure.

A. VaR = 2.64%, and ES = 3.98%.

B. VaR = 2.51%, and ES = 3.54%.

C. VaR = 2.27%, and ES = 3.21%.

D. VaR = 2.19%, and ES = 3.12%.

参考答案: A

【莽学解析】

$$VaR = 1 + \frac{0.9}{0.15} \left[\left[\frac{1}{0.05} (1 - 0.99) \right]^{0.15} - 1 \right] = 2.638\%$$

$$ES = \frac{2.638}{1 - 0.15} + \frac{0.9 - 0.15 \times 1}{1 - 0.15} = 3.98\%$$