2020年06月CFA一级百题预测

1. ETHICS AND PROFESSIONAL STANDARDS
2. QUANTITATIVE METHODS
3. ECONOMICS
4. FINANCIAL REPORTING AND ANALYSIS
5. CORPORATE FINANCE
6. EQUITY
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10. PORTFOLIO MANAGEMENT

2. Quantitative

2.1. Interest Rate

2.1.1. 重要知识点

2.1.1.1. Decompose required rate of return

- Interest rate = real risk free rate + expected inflation rate + risk premium
- Nominal risk free rate = real risk-free rate + expected inflation rate

2.1.2. 基础题

Q-1. Which of the following risk least likely has an impact on nominal risk free return?

A. Expected inflation rate.

B. Real risk free rate.

C. Credit risk.

Q-2. Now, the nominal risk-free rate decreases. Keep the credit risk, liquidity risk and maturity risk constant, if the inflation rate increases, the real risk-free rate will be:

A. Decrease.

B. No change.

C. Increase.

Q-3. The liquidity premium can be best described as compensation to investors for the:

A. risk of loss relative to an investment's fair value if the investment needs to be converted to cash quickly.

B. increased sensitivity of the market value of debt to a change in market interest rates as maturity is extended.

C. possibility that the borrower will fail to make a promised payment at the contracted time and in the contracted amount.

Q-4. The minimum rate of return an investor must receive in order to accept an investment is best described as the:

A. internal rate of return.

B. required rate of return.

C. expected return.

Q-5. Once an investor chooses a particular course of action, the value forgone from alternative actions is best described as a(n):

A. opportunity cost.

B. required return.

C. sunk cost.

2.2. Time Value of Money

2.2.1. 重要知识点

2.2.1.1. Annuities 年金：FV, PV, required interest, payment

- N = number of periods
- I/Y = interest rate per period
- PMT = amount of each periodic payment
- FV = future value
- PV = present value
- 考察方法：计算——N, I/Y, PMT, FV, PV 中任意给定四个，求另外一个

2.2.1.2. Ordinary annuity 后付年金

- The first cash flow occurs at the end of the first period (t=1)

2.2.1.3. Annuity due 先付年金 (BGN mode)

- The first cash flow occurs immediately (at t=0)

2.2.1.4. Perpetuity

- A perpetuity is a set of level never-ending sequential cash flows, with the first cash flow occurring one period from now.
- 计算：$PV = \frac{A}{r}$

2.2.2. 基础题

Q-6. As winning a lottery, Mikey has three options to get bonus.

Option 1: An ordinary annuity with 20 annual payments of $2,000.

Option 2: An annuity due with 20 annual payments of $2,000.

Option 3: A perpetuity with annual payments of $2,000.

Assuming the annual discount rate is 5 percent, which option is the last one for Mikey to choose?

A. Option 1.

B. Option 2.

C. Option 3.

Q-7. For planning purposes, an individual wants to be able to spend €160,000 per year, at the end of each year, for an anticipated 30 years in retirement. In order to fund this retirement account, he will make annual deposits of €11,748 at the end of each of his working years. What is the minimum number of such deposits he will need to make to fund his desired retirement? Use 5% interest compounded annually for all calculations.

A. 49 payments

B. 50 payments

C. 51 payments

Q-8. A financial contract offers to pay €2,400 per month for 4 years with the first payment made immediately. Assuming an annual discount rate of 5.5%, compounded monthly the present value of the contract is closest to:

A. €61,330.

B. €63,731.

C. €103,670.

Q-9. A client invests €20,000 in a four-year certificate of deposit (CD) that annually pays interest of 3.5%. The annual CD interest payments are automatically reinvested in a separate savings account at a stated annual interest rate of 2% compounded monthly. At maturity, the value of the combined asset isclosest to:

A. €21,670.

B. €22,890.

C. €22,950.

2.3. Calculation of HPR

2.3.1. 重要知识点

2.3.1.1. **概念**：Total return an investor earns between the purchase date and the sale or maturity date.

2.3.1.2. **公式**：$HPY=\frac{FV-PV}{PV}$ （非年化）

Notes: 这个指标没有年度化，所以不同的 HPR 是不具可比性的。

2.3.2. 基础题

Q-10. An investment in 10,000 common shares of a company for one year earned a 15.5% return. The investor received a $2,500 dividend just prior to the sale of the shares at $24 per share. The price that the investor paid for each share one year earlier was closest to:

A. $20.80.

B. $20.50.

C. $21.00.

2.4. Calculation and conversion among HPY, r_{MM}, r_{BD}, EAY, BEY

2.4.1. 重要知识点

2.4.1.1. **HPY 和 EAY/EAR 的计算及转化**

- $HPY=\frac{FV-PV}{PV}$
- Effective annual rate of return (EAY/EAR)
  - $EAY=(1+HPY)^{365/t}-1$
  - $EAY=(1+\frac{r}{m})^{m}-1$
  - 性质：$r\uparrow$，$m\uparrow$，$EAR\uparrow$；When m $\to\infty$，$EAR_{\max}=e^{r}-1$
- 单利时用$\frac{360}{t}$，复利时用$\frac{365}{t}$

2.4.2. 基础题

Q-11. If the stated annual interest rate is 9% and the frequency of compounding is daily, the effective annual rate (EAR) is closest to:

A. 9.00%.

B. 9.86%.

C. 9.42%.

Q-12. A money manager has $2,000,000 to invest for one year. She has identified two alternative one-year certificates of deposit (CD) shown below:

	Compounding frequency	Annual interest rate
CD1	Quarterly	6.00%
CD2	Continuously	8.00%

Which CD has the *highest* effective annual rate (EAR) and how much interest will it earn?

	Highest EAR	Interest earned
A.	CD1	$122,727.1
B.	CD2	$166,574.1
C.	CD2	$164,864.3

Q-13. If the stated annual interest rate on a credit card is 11% and its effective annual rate is 11.57%. The interest of the credit card is *most likely* compounded:

A. daily.

B. monthly.

C. semi-annually.

2.5. Ratio, Ordinal, Interval, Nominal Scales

2.5.1. 重要知识点

2.5.1.1. Nominal, ordinal, interval, ratio scales

- **Nominal scales:** weakest level of measurement, categorize data but do not rank them, only has mode.
- **Ordinal scales (>, <):** stronger level of measurement, sort data into categories that are ordered with respect to some characteristics. Has mode and median.
- **Interval scales (>, <, +, -):** provide not only ranking but also assurance that the differences between scale values are equal, no absolute zero, can add and deduct.
- **Ratio scales (>, <, +, -, *, /):** the strongest level of measurement. Have absolute zero; can do all kinds of calculations.
- Notes：一般 CFA 协会会给出具体场景，让考生判断属于哪种类型。

2.5.2. 基础题

Q-14. An analyst gathered the price-earnings ratios (P/E) for the firms in the S&P 500 and then ranked the firms from highest to lowest P/E. She then assigned the number 1 to the group with the lowest P/E ratios, the number 2 to the group with the second lowest P/E ratios, and so on. The measurement scale used by the analyst is *best* described as:

A. ratio.

B. ordinal.

C. interval.

2.6. Relative Frequencies and Cumulative Relative Frequencies

2.6.1. 重要知识点

2.6.1.1. Relative frequencies and cumulative relative frequencies:

- Relative frequency of observations in an interval is the number of observations (the absolute frequency) in the interval divided by the total number of observations.
- Cumulative relative frequency cumulates (adds up) the relative frequencies as we move from the first interval to the last.

2.6.2. 基础题

Q-15. An analyst gathered the following information about the price-earning (P/E) ratios for the common stocks held in a foundation's portfolio:

Interval	P/E range	Frequency
I	7.00-15.00	12
II	15.00-23.00	24
III	23.00-31.00	11
IV	31.00-39.00	8

The relative frequency and the cumulative relative frequency, respectively, for interval III are closest to:

	Relative frequency	Cumulative relative frequency
A.	20.00%	85.45%
B.	22.00%	36.00%
C.	20.00%	36.00%

2.7. Measures of Mean

2.7.1. 重要知识点

2.7.1.1. Measures of mean

- The arithmetic mean: $\overline{X}=\dfrac{\sum_{i=1}^{N}X_i}{n}$
- The weighted mean: $\overline{X_W}=\sum_{i=1}^{n}w_iX_i=(w_1X_1+w_2X_2+\cdots+w_nX_n)$
- The geometric mean: $G=\sqrt[N]{X_1X_2X_3...X_N}=(\prod_{i=1}^{N}X_i)^{1/N}$
- The harmonic mean: $\overline{X_H}=\dfrac{n}{\sum_{i=1}^{n}(1/X_i)}$
- Harmonic mean≤ geometric mean ≤ arithmetic mean

2.7.1.2. Performance measurement with means

- The geometric mean of past annual return is the appropriate measure of past performance.
- The arithmetic mean is the statistically best estimator of the next year's returns.

2.7.2. 基础题

Q-16. The following information is available for a portfolio:

Asset Class / **Time**	Equities (70%)	Bonds (30%)
First year returns	13%	12%
Second year returns	11%	-5.6%
Third year returns	-14.86%	15%

The geometric mean return on the portfolio is closest to:

A. 4.0298%.

B. 3.5697%.

C. 4.5361%.

Q-17. If the observations in a data set have different values, is the geometric mean for that data set *less* than that data set's:

	Harmonic mean?	Arithmetic mean?
A.	No	No
B.	No	Yes
C.	Yes	No

Q-18. Over the past four years, a portfolio experienced returns of –7%, 5%, 18%, and –11%.

The geometric mean return of the portfolio over the four-year period is closest to:

A. 0.990%.

B. 0.632%.

C. 0.250%.

Q-19. The arithmetic and geometric mean are calculated for the same data. If there is variability in the data, compared with the arithmetic mean, the geometric mean will most likely be:

A. smaller.

B. equal.

C. greater.

Q-20. A portfolio manager would like to calculate the compound rate of return on an investment. Which of the following mean returns will he most likely use?

A. Geometric

B. Harmonic

C. Arithmetic

Q-21. A manager invests €5,000 annually in a security for four years at the prices shown in the following table.

Purchase Price of Security (€)	
Year 1	62.00
Year 2	76.00
Year 3	84.00
Year 4	90.00

The average price paid for the security is closest to:

A. €76.48.

B. €77.26.

C. €78.00.

2.8. Describe, Calculate and Interpret Quartiles, Quintiles, Deciles and Percentiles

2.8.1. 重要知识点

2.8.1.1. Quantiles

- Quartile/Quintile/Deciles/Percentile
  - The third quintile: 60%, or there are three-fifths of the observations fall below that value.
- Calculation formula: $L_y = (n+1)y/100$,
  - Where L_y is the quantile position expressed in percentage.

2.8.2. 基础题

Q-22. Which of the following statements is *most accurate*?

A. The first quintile generally exceeds the median

B. The first quintile generally exceeds the first decile

C. The first quintile generally exceeds the first quartile

Q-23. The following table shows the volatility of a series of funds that belong to the same peer group, ranked in ascending order:

Volatility (%)		Volatility (%)	
Fund 1	9.80	Fund 8	14.00
Fund 2	10.22	Fund 9	14.50
Fund 3	10.94	Fund 10	14.87
Fund 4	11.43	Fund 11	15.01
Fund 5	12.35	Fund 12	17.38
Fund 6	13.29		
Fund 7	13.40		

The value of the 75th percentile is closest to:

A. 14.78%.

B. 14.50%.

C. 13.04%.

2.9. Measure of Dispersion

2.9.1. 重要知识点

2.9.1.1. Measure of dispersion:

- Range = highest value-lowest value

- $\text{MAD} = \frac{\sum_{i=1}^{n}|X_i - \bar{X}|}{n}$
- $\sigma^2 = \frac{\sum_{i=1}^{N}(X_i - \mu)^2}{N}$ (for population)
- $s^2 = \frac{\sum_{i=1}^{n}(X_i - \bar{X})^2}{n-1}$ (for sample)

2.9.1.2. MAD 和 variance 掌握计算和比较：

- 理解：Variance 比 MAD 要好，因为 variance 是连续的，处处可导。MAD 计算的是绝对值，相对比较繁琐。但是 variance 和 MAD 都是表示风险的。注意 MAD ≤ σ

2.9.2. 基础题

Q-24. The least accurate statement about measures of dispersion for a distribution is that the:

A. range provides no information about the shape of the data distribution.

B. arithmetic average of the deviations around the mean will be equal to one.

C. mean absolute deviation will be either less than or equal to the standard deviation.

Q-25. In 2017, an analyst gathered the following annual return information about a portfolio since its inception on 1 January 2013:

Year	Portfolio return
2013	8.5%
2014	11.1%
2015	12.8%
2016	15.2%
2017	-9.5%

The portfolio's mean absolute deviation and variance of annual returns, respectively, for the five-year period are closest to:

	Mean absolute deviation	Population variance
A.	6.85%	0.78%
B.	6.85%	0.96%
C.	7.62%	0.77%

Q-26. The following ten observations are a sample drawn from an approximately normal population:

Observation	1	2	3	4	5	6	7	8	9	10
Value	-2	-10	4	-17	19	21	-6	10	3	-15

The sample standard deviation is closest to:

A. 11.97.

B. 12.55.

C. 13.23.

2.10. Chebyshev's Inequality

2.10.1. 重要知识点

2.10.1.1. Chebyshev's inequality 掌握计算及理解：

- For any set of observations (samples or population), the proportion of the values that lie within k standard deviations of the mean is at least 1 – 1/k2, where k is any constant greater than 1.
- $P(\mu - k\sigma \le X \le \mu + k\sigma) \ge 1 - \frac{1}{k^2}$（对任意一组观测值，个体落于均值周围 k 个标准差之内的概率不小于$1-\frac{1}{k^2}$，任意 k > 1）
- This relationship applies regardless of the shape of the distribution.

2.10.2. 基础题

Q-27. An investor's portfolio had a mean monthly return of 0.80%, with a standard deviation of monthly returns of 1.18%. Over the past 60 months, at least 54 monthly returns fall into a return range. According to Chebyshev's inequality, what is the lower and upper limit of this return range?

A. -2.9315% to 4.5315%

B. -2.9395% to 4.5315%

C. -2.9315% to 4.5395%

Q-28. Approximately, what is the percentage of a symmetrical distribution lies on the left tail that is 3.16 standard deviations below the mean?

A. 44.9928%

B. 10.0144%

C. 5.0072%

Q-29. Over the past 60 months, an investor's portfolio had a mean monthly return of 0.80%, with a standard deviation of monthly returns of 1.18%. According to Chebyshev's inequality, the minimum number of the 60 monthly returns that fall into the range of -1.00% to 2.60% is closest to:

A. 20.

B. 27.

C. 34.

2.11. Coefficient of Variation & Sharpe Ratio

2.11.1. 重要知识点

2.11.1.1. Coefficient of variation (CV) measures the amount of risk (standard deviation) per unit of mean return.

$$CV = \frac{S_X}{\overline{X}} \times 100\%$$

2.11.1.2. The Sharpe ratio measures the reward, in terms of mean excess return, per unit of risk, as measured by standard deviation of return.

$$Sharpe\ Ratio = \frac{R_P - R_f}{\sigma_P}$$

- Sharpe ratio 只能用于 Rank，没有实在含义；当小于零时，可能会得到错误的结论。

2.11.2. 基础题

Q-30. If the risk-free rate is equal to zero and the mean is less than the standard deviation, compared with Sharpe ratio, the coefficient of variation is?

A. Greater

B. Same

C. Less

Q-31. An analyst gathered the following information:

Portfolio	Mean Return (%)	Standard Deviation of Returns (%)

1	10	19
2	11	20
3	13	34

If the risk-free rate of return is 4.0 percent, the portfolio that had the best risk-adjusted performance based on the Sharpe ratio is:

A. Portfolio 1.

B. Portfolio 2.

C. Portfolio 3.

Q-32. An analyst gathered the following information:

Portfolio	Mean Return (%)	Sharpe ratio (%)
1	10	34
2	10	37

If the risk-free rate of return is 5.0 percent, which portfolio's coefficient of variation is larger?

A. Portfolio 1

B. Portfolio 2

C. The same

Q-33. Based on historical returns, a portfolio has a Sharpe ratio of 3.0. If the mean return to the portfolio is 21%, and the mean return to a risk-free asset is 5%, the standard deviation of return on the portfolio is closest to:

A. 7%.

B. 5.33%.

C. 8%.

2.12. Skewness and Kurtosis

2.12.1. 重要知识点

2.12.1.1. Skewness 掌握概念：

- 概念：A distribution that is not symmetrical is called skewed.
- 种类：
  - **Positively skewed**–A return distribution with positive skew has frequent

small losses and a few extreme gains, (long right tail) (skewness > 0) (mean > median > mode);

- **Negatively skewed**–A return distribution with negative skew has frequent small gains and a few extreme losses. (long left tail) (skewness < 0) (mean < median < mode)

2.12.1.2. Kurtosis 掌握概念：

- 概念：It deals with whether or not a distribution is more or less "peaked" than a normal distribution.
- 种类：leptokurtic, normal and platykurtic

	Leptokurtic	Normal distribution	Platykurtic
Sample kurtosis	>3	=3	<3
Excess kurtosis	>0	=0	<0

- 理解：

  A leptokurtic return distribution is more peaked and has fatter tails than the normal distribution.

- 可能在考试中会和 skew 合并考核综合知识

2.12.2. 基础题

Q-34. A distribution with mode 2.6, median 2.2, mean 2, the distribution can be described as:

A. long tail in the left and positively skewed.

B. long tail in the right and negatively skewed.

C. long tail in the left and negatively skewed.

Q-35. There is a set of number. Which of following description is right?

Order	**1**	**2**	**3**	**4**	**5**	**6**
Data	**-2**	**-1**	**1**	**2**	**2**	**6**

A. Mean<Mode<Median

B. Mean<Median<Mode

C. Mean>Median>Mode

Q-36. One year ago, an analyst expected his one year investment returns would present a normal distribution. However, the actual distribution of one year investment returns had an excess kurtosis. Based on the given information, which of following item would be mostly undervalued by the analyst one year ago?

A. The mean return of the one year investment returns.

B. The median return of the one year investment returns.

C. The probability that extreme returns occurs.

Q-37. Investors should be most attracted to return distributions that are:

A. normal.

B. negatively skewed.

C. positively skewed.

Q-38. An analyst gathered the following information about the return distribution for two portfolios during the same time period:

Portfolio	skewness	kurtosis
A	-0.9	1.9
B	0.6	4.0

The analyst stated that the distribution for Portfolio A is more peaked than a normal distribution and that the distribution for Portfolio B has a long tail on the left side of the distribution. Is the analyst's statement correct with respect to:

	Portfolio A?	Portfolio B?
A.	No	No
B.	No	Yes
C.	Yes	No

Q-39. When we calculate the kurtosis, what is the power of the kurtosis?

A. 3

B. 2

C. 4

Q-40. Equity return series are best described as, for the most part:

A. platykurtotic (less peaked than a normal distribution).

B. leptokurtotic (more peaked than a normal distribution).

C. mesokurtotic (identical to the normal distribution in peakedness).

2.13. Empirical, Priori or Subjective Probability

2.13.1. 重要知识点

2.13.1.1. Empirical, priori, or subjective probability

- **Objective probability 客观概率**

  - **Empirical probability 经验概率（分析过去/历史，得到将来）**

    e.g. Historically, the Dow Jones Industrial Average has closed higher than the previous close two out of every three trading days. Therefore, the probability of the Dow going up tomorrow is two-thirds, or 66.7%.

  - **Priori probability 先验概率（分析过去/历史，得到过去）**

    e.g. Yesterday, 24 of the 30 DJIA stocks increased in value. Thus, if 1 of 30 stocks is selected at random, there is an 80%(24/30) probability that its value increased yesterday

- **Subjective probability 主观概率**

  - e.g. An investor judges that the probability that the Dow Jones Industrial Average will close higher tomorrow is 90%.

2.13.2. 基础题

Q-41. A fund manager would like to estimate the probability of a daily loss higher than 5% on the fund he manages. He decides to use a method that uses the relative frequency of occurrence based on historical data. The resulting probability is best described as a(n):

A. subjective probability.

B. a priori probability.

C. empirical probability.

2.14. Properties of Probability

2.14.1. 重要知识点

2.14.1.1. Properties of probability 掌握基本公式：

- "×" rule: P(AB)=P(B)×P(A|B)=P(A)×P(B|A);
- "+" rule: P(A or B) = P(A) + P(B) - P(AB)

2.14.1.2. Mutually exclusive v.s. independent events

- For mutually exclusive events: P(AB) = 0, P(A or B) = P(A) + P(B)

  For independent events: P(A|B) = P(A), P(B|A) = P(B), P(AB) = P(A) × P(B)

- 注意：不独立未必互斥，互斥一定不独立。

2.14.1.3. Odds for an event

- **Odds for** an event: P(E)/(1-P(E))
- **Odds against** an event: (1-P(E))/P(E)

2.14.2. 基础题

Q-42. Which of the following statement best describe the addition rule?

A. The probability that event A or event B occurs, or both occur.

B. The probability that event A or event B are mutually exclusive.

C. The probability that event A occurs given that event B has occurred.

Q-43. A portfolio manager estimates the probabilities of the following events for a mutual fund:

- Event A: the fund will earn a return of 5%.
- Event B: the fund will earn a return below 5%.

The least appropriate description of the events is that they are:

A. mutually exclusive.

B. exhaustive.

C. dependent.

Q-44. The probability of price change is as follows:

Price change	0.9
Price increase	0.6

What is the probability that the two situations happen simultaneously?

A. 0.54

B. 0.6

C. 0.9

Q-45. An analyst finds that the probability of stock A outperform the market is 65%. What is the odds for of the stock A underperform the market?

A. 0.5385

B. 0.4615

C. 1.8571

Q-46. The probability of X is 0.3 [P(X) = 0.3] and the probability of Y is 0.6 [P(Y) = 0.6]. The joint probability of X and Y [P(XY)] is 0.15. Event X and Y are most likely:

A. mutually exclusive events.

B. independent events.

C. dependent events.

Q-47. The probability of Event A is 30%. The probability of Event B is 70%. The joint probability of P(AB) is 21%. The probability that A or B occurs, or both occur, is closest to:

A. 21%.

B. 50%.

C. 79%.

Q-48. An analyst applies four valuation screens to a set of potential investments. The screens are independent of each other.

Valuation Screen	Probability of Passing
1	0.75
2	0.55
3	0.50
4	0.40

If there are 2,400 potential investments, the number expected to simultaneously pass all four screens is closest to:

A. 360.

B. 198.

C. 150.

Q-49. Two events A and B are independent if the probability of occurrence of A:

A. equals the product of the individual probabilities of occurrence of A and B.

B. is related to the occurrence of B.

C. does not affect the probability of occurrence of B.

Q-50. If two events, A and B, are independent and the probability of A does not equal the probability of B [i.e., P(A) ≠ P(B)], then the probability of event A given that event B has occurred [i.e., P(A|B)] is best described as:

A. P(A).

B. P(B|A).

C. P(B).

Q-51. Assume that a stock's price over the next two periods is as shown below.

Time = 0	Time = 1	Time = 2
S_0 = 200	S_u = 220	S_{uu} = 242
	S_d = 184	$S_{ud,du}$ = 202.40
		S_{dd} = 169.28

The initial value of the stock is \$200. The probability of an up move in any given period is 30% and the probability of a down move in any given period is 70%. Using the binomial model, the probability that the stock's price will be \$202.40 at the end of two periods is *closest* to:

A. 14%.

B. 21%.

C. 42%.

2.15. Expected Value and Variance

2.15.1. 重要知识点

2.15.1.1. Expected value E(X)

- The expected value of a random variable is the probability-weighted average of the possible outcomes of the random variable.
- $E(X)=\sum P_i \times X_i$

2.15.1.2. Variance Var(X) or σ²(X)

- The expected value (the probability-weighted average) of squared deviations from the random variable's expected value.
- $\sigma^2=\sum_{i=1}^{N} P_i(X_i-E(X))^2$

2.15.2. 基础题

Q-52. An analyst gathered the following information: the probability of economy prosperity is 70%, the probability of economy recession is 30%. For a company, when the economy is prosperity, there is 15% of probability that its EPS is $4.0 and 85% of probability that the EPS is $8.0. However, when the economy is recession, there is 20% of probability that the EPS is $4.0 and 80% of probability that the EPS is $8.0. What is the variance of this company's EPS, when the economy is recession?

A. 3.52

B. 1.64

C. 2.56

Q-53. The following information is available for a portfolio:

Asset Class	**Asset Allocation Weight (%)**	**Asset Class Return (%)**	**Correlation with Equities Class (%)**
Equities	55	18	100
Mortgages	20	14	35
Cash and equivalents	25	4	15

The return on the portfolio is closest to:

A. 12.0%.

B. 8.5%.

C. 13.7%.

Q-54. An individual want to invest $100,000 in the following investment products:

Investment products	Expected Return	Weights
Stock	12%	70%
Fund	16%	30%

What will be the rate of expected portfolio return?

A. 13.2%.

B. 8.4%.

C. 4.8%.

2.16. Correlation and Covariance

2.16.1. 重要知识点

2.16.1.1. Covariance:

- Covariance is a measure of the co-movement between random variables.

- X 与 Y 同向变化，covariance >0.
- X 与 Y 反向变化，covariance < 0.
- $Covariance \in (-\infty, +\infty)$.

- Covariance ranges from negative infinity to positive infinity
  - $Cov(X,Y) = E[(X - E(X))(Y - E(Y))]$
- The covariance of a random variable with itself is its own variance.
  - $Cov(X,X) = E[(X - E(X))(X - E(X))] = \sigma^2(X)$

2.16.1.2. Correlation:

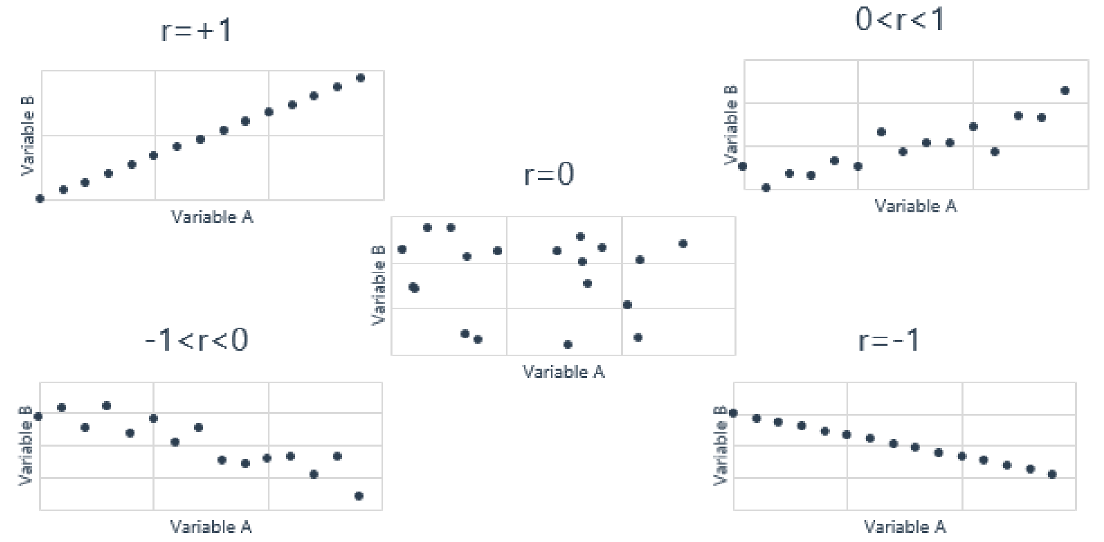
- Correlation measures the co-movement (linear association) between two random variables.
- $\rho_{XY} = \dfrac{\mathrm{COV(X,Y)}}{\sqrt{\mathrm{Var(X)Var(Y)}}} = \dfrac{\mathrm{COV(X,Y)}}{\sigma_X \sigma_Y}$
- Correlation is a number between −1 and +1.
- 理解：$\rho_{XY} \in [-1, 1]$
  - If $\rho_{x,y}$ = 0, a correlation of 0 (uncorrelated variables) indicates an **absence** of any linear (straight-line) relationship between the variables.
  - Increasingly positive correlation indicates an increasingly **strong** positive linear relationship (up to 1, which indicates a perfect linear relationship).
  - Increasingly negative correlation indicates an increasingly **strong** negative (inverse) linear relationship (down to -1, which indicates a perfect inverse linear relationship).

2.16.1.3. Expected return, variance and standard deviation of a portfolio

- $E(r_{\mathrm{p}}) = \sum_{i=1}^{n} w_i E(R_i)$
- $\sigma^2{}_p = \sum_{i=1}^{n}\sum_{j=1}^{n} w_i w_j \operatorname{cov}(R_i, R_j)$

2.16.1.4. Scatter plot & limitation of correlation

- A **scatter plots** is a graph that shows the relationship between the observations for two data series in two dimensions.
- **Scatter plots charts**



➢ Three limitations of correlation analysis.

- **Nonlinear relationships**: Two variables can have a strong nonlinear relation and still have a very low correlation.
- **Outliers**: Outliers are small numbers of observations at either extreme (small or large) of a sample.
- **Spurious correlation**: Correlations can be spurious in the sense of misleadingly pointing towards associations between variables.

2.16.2. 基础题

Q-55. Having two high-risk investment products, an investment portfolio earns a risk-free rate of return. The value of correlation between these two high-risk investment products will most likely be:

A. -1

B. 0

C. +1

Q-56. The joint probability of returns, for securities A and B, are as follows:

Joint Probability Function of Security A and Security B Returns. (Entries are joint probabilities)

	Return on security B =32%	Return on security B=24%
Return on security A= 24%	0.70	0
Return on security A= 18%	0	0.30

The covariance of the returns between securities A and B is closest to:

A. 0.0005.

B. 0.0010.

C. 0.0032.

Q-57. An analyst gathered information about three economic variables, He noted that whenever variable A increased by one unit, variable B increased by 0.6 units but variable C decreased by 0.6 units. The correlation between variables A and B and the correlation between variables A and C respectively, are closest to:

	Correlation between variables A and B	Correlation between variables A and C
A.	0.6	-1.0
B.	0.6	-0.6
C.	1.0	-1.0

Q-58. The correlation coefficient that indicates the weakest linear relationship between variables is:

A. -0.85.

B. -0.12.

C. 0.55.

Q-59. The correlation between the historical returns of Stock A and Stock B is 0.85. If the variance of Stock A is 0.26 and the variance of Stock B is 0.19, the covariance of returns of Stock A and Stock B is closest to:

A. 0.04.

B. 0.19.

C. 0.16.

Q-60. An equally weighted portfolio is composed of four stocks. An analyst knows the mean and variance for each of the four stocks. In order to estimate the portfolio mean and variance, the analyst will require the stocks':

A. skewness.

B. pairwise correlations.

C. kurtosis.

Q-61. Which of the following correlation coefficients indicates the weakest linear relationship between two variables?

A. –0.67

B. –0.24

C. 0.33

Q-62. An analyst develops the following covariance matrix of returns:

	Hedge Fund	**Market Index**
Hedge fund	256	110
Market index	110	81

The correlation of returns between the hedge fund and the market index is closest to:

A. 0.005.

B. 0.073.

C. 0.764

Q-63. All else being equal, as the correlation between two assets approaches +1.0, the diversification benefits:

A. decrease.

B. stay the same.

C. increase.

2.17. Bayes' Formula

2.17.1. 重要知识点

2.17.1.1. Bayes' formula 掌握计算：

- **Updated probability:** Given a set of prior probabilities for an event of interest, if you receive new information, the rule for updating your probability of the event is Updated probability of event given the new information = (probability of new information given event/ unconditional probability of new information) ×prior probability of event.
  - $P(AB) = P(B|A) \times P(A) = P(A|B) \times P(B)$

    $$P(A|B) = \frac{P(B|A)}{P(B)} \times P(A)$$

- **Posterior probability（后验概率）**
  - $$P(A|B) = \frac{P(B|A)P(A)}{P(B)} = \frac{P(B|A)P(A)}{P(B|W_1)P(W_1) + P(B|W_2)P(W_2)}$$

- $P(\mathrm{B}) = P(\mathrm{B}|W_1)\times P(W_1)+P(\mathrm{B}|W_2)\times P(W_2)+\ldots+ P(\mathrm{B}|W_n)\times P(W_n)$

2.17.2. 基础题

Q-64. The probability that a firm releases an increasing net income is 50%, and if it does, the firm's stock will have 70% chance to increase and 30% chance to decrease. The probability that the firm releases an decreasing net income is 50%, and if it does, the firm's stock will have 40% chance to increase, and 60% chance not to increase. What's the probability that the firm's stock increases?

A. 0.2

B. 0.35

C. 0.55

Q-65. As from the record of CFA Institute and GARP, the pass-through rate of CFA level I exam is 30%, and the pass-through rate of FRM exam is 40%. And as an investigation led by the two institutes, among the people who has passed the FRM, the pass-through rate of CFA level 1 exams is 50%. So what is the pass-through rate of FRM members who has also passed the CFA level 1 exam before?

A. 48%

B. 60%

C. 67%

Q-66. With Bayes' formula, it is possible to update the probability for an event given some new information. Which of the following most accurately represents Bayes' formula?

A. $\mathrm{P}(Event|Information) = \frac{P(Information|Event)}{P(Information)}\mathrm{P(Event)}$

B. $\mathrm{P}(Event|Information) = \frac{P(Information)}{P(Information|Event)}\mathrm{P(Event)}$

C. $\mathrm{P}(Event|Information) = \frac{P(Information|Event)}{P(Event)}\mathrm{P(Information)}$

2.18. Principals of Counting

2.18.1. 重要知识点

2.18.1.1. Principals of counting

- Multiplication rule: $n_1 \times n_2 \times \ldots\ldots \times n_k$
- Factorial: n!

- Labeling (or Multinomial): $\dfrac{n!}{n_1!\times n_2!\times\ldots\times n_k!}$
- Combination: ${}_nC_r=\binom{n}{r}=\dfrac{n!}{(n-r)!\times r!}$
- Permutation: ${}_nP_r=\dfrac{n!}{(n-r)!}$

2.18.2. 基础题

Q-67. How many ways are there to sell three stocks out of five if the order of the sales is important?

A. 10.

B. 60.

C. 120.

2.19. Discrete and Continuous Random Variables

2.19.1. 重要知识点

2.19.1.1. Discrete and continuous random variables

- Discrete random variables: take on at most a **countable** number of possible outcomes **but do not necessarily to be limited**.
- Continuous random variables: cannot describe the possible outcomes of a continuous random variable Z with a list z_1, z_2, ... because the outcome $(z_1 + z_2)/2$, not in the list, would always be possible.
  - P(x) = 0 even though x can happen.
  - $P(x_1<X<x_2)$
- Probability function: p(x)=P(X=x)
  - For discrete random variables
  - $0 \le p(x) \le 1$
  - $\Sigma p(x)=1$
- Probability density function (p.d.f): f(x)
  - For continuous random variable commonly
- Cumulative probability function (c.p.f): F(x)
  - F(x)=P(X<=x)

2.19.2. 基础题

Q-68. What is the range for a random variable from cumulative probability function

A. [0, +∞)

B. [1, +∞)

C. (-∞, +∞)

Q-69. Which of the following is a discrete random variable considering a company's stock?

A. Quoted price

B. Rate of return

C. Price-to-earnings ratio

2.20. Discrete Random Distribution

2.20.1. 重要知识点

2.20.1.1. Discrete uniform random variable would be a known, finite number of outcomes equally likely to happen. Every one of n outcomes has equal probability 1/n.

2.20.1.2. Bernoulli random variable: p(1) = P(X = 1) = p, p(0) = P(X = 0) = 1 - p

2.20.1.3. Binomial random variable X is defined as the number of success in n Bernoulli trials.

$$P(x) = P(X = x) = C_n^x p^x (1-p)^{n-x}$$

2.1.1.1. Expectations and variances

	Expectation	Variance
Bernoulli random variable (Y)	P	p(1-p)
Binomial random variable (X)	np	np(1-p)

2.1.2. 基础题

Q-70. Which of the following *best* describes the discrete uniform distribution? The discrete uniform distribution:

A. has an infinite number of unspecified outcomes.

B. is based on the Bernoulli random variable.

C. has a finite number of specified outcomes.

Q-71. The following table shows the discrete uniform probability distribution of gross profits from the purchase of an option:

Profit	**Cumulative Distribution Function**
$0	0.2

$1	0.4
$2	0.6
$3	0.8
$4	1.0

The probability of a profit greater than or equal to $1 and less than or equal to $4 is closest to:

A. 0.4.

B. 0.6.

C. 0.8.

Q-72. If the probability that a portfolio outperforms its benchmark in any quarter is 0.75, the probability that the portfolio outperforms its benchmark in three or fewer quarters over the course of a year is closest to:

A. 0.26.

B. 0.42.

C. 0.68.

2.21. Continuous Uniform Distribution

2.21.1. 重要知识点

2.21.1.1. Definition

- All intervals of the same length on the Continuous Uniform Distribution's support are equally probable.

2.21.1.2. Properties

- P(X < a or X > b) = 0
- For all $a \le x_1 < x_2 \le b$, $P(x_1 \le X \le x_2) = (x_2 - x_1)/(b - a)$

2.21.2. 基础题

Q-73. An energy analyst forecasts that the price per barrel of crude oil five years from now will range between USD$150 and USD$210. Assuming a continuous uniform distribution, the probability that the price will be less than USD$160 five years from now is closest to:

A. 5.8%.

B. 16.7%.

C. 43.4%.

2.22. Normal Distribution

2.22.1. 重要知识点

2.22.1.1. Properties

- $X \sim N(\mu, \sigma^2)$
- Symmetrical distribution: skewness=0, kurtosis=3
- A linear combination of two or more normal random variables is also normally distributed.
- As the values of x gets farther from the mean, the probability density get smaller and smaller but are always positive.

2.22.1.2. Confidence intervals

- 68% confidence interval is $[\mu - \sigma, \mu + \sigma]$
- 90% confidence interval is $[\mu - 1.65\sigma, \mu + 1.65\sigma]$
- 95% confidence interval is $[\mu - 1.96\sigma, \mu + 1.96\sigma]$
- 99% confidence interval is $[\mu - 2.58\sigma, \mu + 2.58\sigma]$

2.22.1.3. Standardization

- If $X \sim N(\mu,\sigma^2)$, then $Z=(X-\mu)/\sigma \sim N(0,1)$

2.22.1.4. Cumulative probabilities for a standard normal distribution

- $F(-z)=1-F(z)$
- $P(Z>z) = 1 - F(z)$

2.22.2. 基础题

Q-74. Using a certain level of significant level, 2.33 is the critical value under a one-tailed test. If the level of significant level do not change, which of following statement about the critical value is the best description under a two-tailed test?

A. The critical value will be large than 2.33.

B. The critical value will be smaller than 2.33

C. The critical value will be range from -2.33 to 2.33.

Q-75. Based on a portfolio's historical performance, the portfolio's returns follows a normal distribution, with a mean return of 20% and a standard deviation of 10%. If an analyst expected that the portfolio's return of next time period is lower than 10% and want to get the corresponding probability, what is the critical value when analyst using a standard normal distribution?

A. 1

B. 0

C. -1

Q-76. The return of a portfolio follows a normal distribution, with its mean return of 13% and its standard deviation of 5%. Given the following z-table, the probability that its return falls between 7% and 19% is *closest* to:

Cumulative Probabilities for a Standard Normal Distribution **P(Z ≤ z) = N(z) for z ≥ 0**										
z	**0**	**0.01**	**0.02**	**0.03**	**0.04**	**0.05**	**0.06**	**0.07**	**0.08**	**0.09**
1.20	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.30	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.40	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.50	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.60	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.70	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.80	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706

A. 83.84%.

B. 76.98%.

C. 93.32%.

Q-77. For a standard normal distribution, what is the probability that a random variable lies within 1 standard deviation to 2 standard deviation P(1$<\mathbf{x}<$2)?

A. 13.5%

B. 27%

C. 15.5%

Q-78. Which of the following is the least likely characteristic of the normal probability distribution? The normal probability distribution:

A. has kurtosis of 3.0.

B. has the same value for mean, median, and mode.

C. is more suitable as a model for asset prices than for returns.

2.23. Safety First Ratio

2.23.1. 重要知识点

2.23.1.1. SFR 掌握计算及理解：

- $SFR = \left[E(R_p) - R_L\right] / \sigma_p$: the bigger, the better.
- Shortfall risk: R_L= threshold level return, minimum return required.
- Roy's safety-first criterion states that the optimal portfolio minimizes the probability that portfolio return, R_P, falls below the threshold level, R_L. In symbols, the investor's objective is to choose a portfolio that minimizes $P(R_P<R_L)$.

2.23.1.2. SFR 与 Sharpe ratio 的区别

- $SFR = \left[E(R_p) - R_L\right] / \sigma_p$
- $Sharpe\ ratio = \left[E(R_P) - R_F\right] / \sigma_P$
- Sharpe ratio will be a special case of SFR if $r_L = r_F$

2.23.2. 基础题

Q-79. On 1 January 2014, the value of an investor's portfolio is $90,000. The investor plans to donate $7,000 to charity organization and pay $3,000 to his insurance account on 31 December 2014, but meanwhile he does not want the year-end portfolio value to be below $90,000. If the expected return on the existing portfolio is 14% with a variance of 0.0225, the safety-first ratio that would be used to evaluate the portfolio based on Roy's criterion is closest to:

A. 0.193.

B. 0.465.

C. 0.415.

Q-80. An investor wants to maximize the possibility of earning at least 6% on her investments each year. Using Roy's safety-first criterion, which of the following portfolios is the most appropriate choice?

Portfolio	Expected return	Standard deviation	Roy's Safety-First value
1			0.45
2			0.74

3	24%	42%	

A. Portfolio 1

B. Portfolio 2

C. Portfolio 3

2.24. Lognormal Distribution

2.24.1. 重要知识点

2.24.1.1. Lognormal distribution

- Definition: If lnX is normal, then X is lognormal, which is used to describe the price of asset.
- Bounded from below by zero: the values of random variables that follow lognormal distribution are always be positive, so it is useful for modeling asset prices. $X \in (0, \infty)$
- Right skewed.
- Stock price follows lognormal distributionl, while the rate of return follows normal distribution.

2.24.2. 基础题

Q-81. An analyst stated that normal distributions are suitable for describing asset returns and that lognormal distributions are suitable for describing distributions of asset prices. The analyst's statement is correct in regard to:

A. both normal distributions and lognormal distributions.

B. normal distributions, but incorrect in regard to lognormal distributions.

C. lognormal distributions, but incorrect in regard to normal distributions.

Q-82. Which of the following is the best description about lognormal distribution?

A. Lognormal distributions are left/negatively skewed with excess kurtosis.

B. Lognormal distributions have a mean that is greater than its median.

C. Lognormal distributions is used to describe returns of an investment asset.

Q-83. If a stock's continuously compounded return is normally distributed, then the distribution of the future stock price is best described as being:

A. normal.

B. lognormal.

C. a Student's t-distribution.

2.25. Monte Carlo and Historical Simulation

2.25.1. 重要知识点

2.25.1.1. Lognormal distribution

- **Monte Carlo** simulation is to generate a large number of random samples from specified probability distribution(s) to represent the operation of risk in the system. It is used in planning, in financial risk management, and in valuing complex securities;
- Limitations:
  - The operating of Monte Carlo simulation is very complex and we must assume a parameter distribution in advance.
  - Monte Carlo simulation provides only statistical estimates, not exact results.
- **Historical simulation** is to repeat sampling from a historical data series. Historical simulation is grounded in actual data but can reflect only risks represented in the sample historical data.
- Limitations:
  - Compared with Monte Carlo simulation, historical simulation does not lend itself to ‘‘what if ’’ analyses.

2.25.2. 基础题

Q-84. A limitation of Monte Carlo simulation is:

A. its failure to do “what if” analysis.

B. that it requires historical records of returns.

C. its inability to independently specify cause-and-effect relationships.

2.26. Cross-Sectional Data vs Time Series Data

2.26.1. 重要知识点

2.26.1.1. Time-series data

- A time series is a sequence of returns collected at discrete and equally spaced intervals of time (such as a historical series of monthly stock returns).

2.26.1.2. Cross-sectional data

- Cross-sectional data are data on some characteristic of individuals, groups, geographical regions, or companies at a single point in time.

2.26.2. 基础题

Q-85. An analyst collects data relating to five commonly used measures of financial leverage and interest coverage for a randomly chosen sample of 300 firms. The data come from those firms' fiscal year 2013 annual reports. These data are best characterized as:

A. time series.

B. longitudinal.

C. cross sectional.

2.27. Central Limit Theorem

2.27.1. 重要知识点

2.27.1.1. Central limit theorem

- Definition: The sampling distribution of the sample mean approaches a normal distribution as the sample size becomes large (>= 30);
- The mean of sample mean distribution=μ; The variance of sample mean distribution = σ^2/n.

2.27.1.2. Standard error of the sample mean

- Known population variance: $\sigma_{\bar{x}} = \sigma / \sqrt{n}$
- Unknown population variance: $s_{\bar{x}} = s / \sqrt{n}$

2.27.2. 基础题

Q-86. Which of the following items best describe the standard deviation of a sample statistic?

A. Sampling error

B. Standard error of the sample statistic

C. Standard deviation of population

Q-87. Given a negatively skewed population distribution, if a sample is drawn from the distribution and the sample size is large, the distribution of the sample means is *most likely*:

A. approximately normal.

B. also negatively skewed.

C. with a variance that equals the population variance.

Q-88. The central limit theorem is best described as stating that the sampling distribution of the sample mean will be approximately normal for large-size samples:

A. if the population distribution is symmetrical.

B. for populations described by any probability distribution.

C. if the population distribution is normal.

Q-89. The following sample of 10 items is selected from a population. The population variance is unknown.

11	21	-7	3	-8	6	0	-7	4	22

The standard error of the sample mean is closest to:

A. 10.89.

B. 3.44.

C. 3.70.

2.28. Sampling and Estimation

2.28.1. 重要知识点

2.28.1.1. Concept of sampling and estimation

- **Methods of sampling:** simple random sampling, stratified random sampling and systematic sampling.
  - **Definition of Sampling Distribution of a Statistic:** The sampling distribution of a statistic is the distribution of all the distinct possible values that the statistic can assume when computed from samples of the same size randomly drawn from the same population.
- Sample Statistic itself is a random variable, thus following specific distribution.
- **Sampling error:** sampling error of mean=sample mean-population mean.

2.28.1.2. The desirable properties of an estimator

- **Unbiasedness:** the expected value of the estimator equals the population parameter.
- **Efficiency:** An unbiased estimator is efficient if no other unbiased estimator of the same parameter has a sampling distribution with smaller variance.
- **Consistency:** A consistent estimator is one for which the probability of estimates close to the value of the population parameter increases as sample size increases (the standard deviation of the parameter estimate decreases as the sample size increases).
  - As the sample size increases, the standard error of the sample mean falls.

2.28.1.3. Point estimation: the statistic, computed from sample information, which is used to estimate the population parameter.

2.28.1.4. Interval estimation:

- Level of significance (alpha)
- Degree of Confidence (1-alpha)
- Confidence Interval = [Point Estimate +/- (reliability factor) × Standard error]

2.28.1.5. Biases in sampling

- **Data-mining bias:** Data-mining bias comes from finding models by repeatedly searching through databases for patterns. To detect this bias, out-of-sample test and economic significance testing.
- **Sample selection bias:** When data availability leads to certain assets being excluded from the analysis, we call the resulting problem sample selection bias.
- **Survivorship bias:** usually derives from sample selection for only the existing portfolio are included.
- **Look-ahead bias:** Look-ahead bias exists if the model uses data not available to market participants at the time the market participants act in the model.
- **Time-period bias:** time-period bias is present if the time period used makes the results time-period specific or if the time period used includes a point of structural change. If too long, cannot find the law.

2.28.2. 基础题

Q-90. Researchers found all data sampled from a population concentrating in tails of the sampling distribution. Which of the following sampling method is most likely used?

A. Stratified random sampling

B. Systematic sampling

C. Simple random sampling

Q-91. A sample of 64 observations has a mean of 8. The standard deviation of the sample is 15. Which of the following is the best estimate of the 95% confidence interval for this sample?

A. 4.325 to 11.675.

B. 4.906 to 11.094.

C. 3.031 to 12.969

Q-92. All else held constant, the width of a confidence interval for a population mean is most likely to be smaller if the sample size is:

A. larger and the degree of confidence is lower.

B. larger and the degree of confidence is higher.

C. smaller and the degree of confidence is lower.

Q-93. The distribution of all the distinct possible values for a statistic when calculated from samples of the same size randomly drawn from the same population is most accurately referred to as:

A. the sampling distribution of a statistic.

B. a discrete uniform distribution.

C. a multivariate normal distribution.

Q-94. If the accuracy of a sample enhances when the size is becoming larger, which of the characteristic does it represent?

A. Unbiasedness

B. Consistency

C. Efficiency

Q-95. An analyst stated that, all else equal, increasing sample size will decrease both the standard error and the width of the confidence interval. The analyst's statement is correct in regard to:

A. both the standard error and the confidence interval.

B. the standard error, but incorrect in regard to the confidence interval.

C. the confidence interval, but incorrect in regard to the standard error.

Q-96. Use the following values from a Student's t-distribution to establish a 95% confidence interval for the population mean given a sample size of 12, a sample mean of 5.76, and a sample standard deviation of 14. Assume that the population from which the sample is drawn is normally distributed and the population variance is not known.

Degrees of Freedom	p = 0.10	p = 0.05	p = 0.025	p = 0.01
9	1.383	1.833	2.262	2.821
10	1.372	1.812	2.228	2.764
11	1.363	1.796	2.201	2.718

The 95% confidence interval is closest to a:

A. lower bound of –0.81 and an upper bound of 14.21.

B. lower bound of –3.20 and an upper bound of 15.70.

C. lower bound of –3.14 and an upper bound of 14.66.

Q-97. The confidence interval is most likely to be:

A. wider as the point estimate increases.

B. narrower as the reliability factor decreases.

C. wider as the sample size increases.

Q-98. Survivorship bias is most likely an example of which bias?

A. Look-ahead

B. Data mining

C. Sample selection

2.29. Student's-distribution

2.29.1. 重要知识点

2.29.1.1. Student's t-distribution

- Symmetrical
- Degrees of freedom (df): n-1
- Less peaked than a normal distribution ("fatter tails")
- As the degrees of freedom increase, the Student's t-distribution approaches the standard normal distribution.

2.29.2. 基础题

Q-99. Use the following values from a Student's t-distribution to establish a 95% confidence interval for the population mean given a sample size of 10, a sample mean of 6.25, and a sample standard deviation of 12. Assume that the population from which the sample is drawn is normally distributed and the population variance is not known.

Degrees of Freedom	p = 0.10	p = 0.05	p = 0.025	p = 0.01
9	1.383	1.833	2.262	2.821
10	1.372	1.812	2.228	2.764
11	1.363	1.796	2.201	2.718

The 95% confidence interval is closest to a:

A. lower bound of –2.20 and an upper bound of 14.70.

B. lower bound of –2.33 and an upper bound of 14.83.

C. lower bound of –0.71 and an upper bound of 13.21.

Q-100. Compared with normal distribution, which of the following statements about t-distribution is the most accurate if the significance levels of these two distributions are the same?

A. It has no difference with normal distribution

B. Its tails are fatter than the tails of normal distribution

C. It has less probability in the tails than the normal distribution

Q-101. An analyst stated that as degrees of freedom increase, a t-distribution will become more peaked and the tails of the t-distribution will become less fat. Is the analyst's statement correct with respect to the t-distribution:

	Becoming more peaked?	Tails becoming less fat?
A.	No	Yes
B.	Yes	No
C.	Yes	Yes

2.30. Hypothesis Testing

2.30.1. 重要知识点

2.30.1.1. Steps of hypothesis testing

- Step 1: Define Hypothesis
- Step 2: Choose and Calculate Test statistic
- Step 3: Find Critical value
- Step 4: Form Decision rule
- Step 5: Draw a conclusion

2.30.1.2. Hypothesis testing:

- $T\text{-}Statistic = \dfrac{\overline{X} - \mu_0}{\sigma / \sqrt{n}}$; $T\text{-}Statistic = \dfrac{\overline{X} - \mu_0}{s/\sqrt{n}}$
- Test Statistic follows Normal, T, Chi Square or F distributions.
- Test Statistic has formula. Calculate it with the sample data.
- This is the general formula but only for Z and T distribution.

2.30.1.3. Relation between Confidence Intervals and Hypothesis Tests

- Confidence Interval = point estimate ± (critical value)×(standard error)
  - Center of Interval = point estimate (sample statistic)
  - Length of Interval = 2 × (critical value) × (standard error)

2.30.1.4. t-test 和 z-test 的不同应用：

Sampling from:	Statistic for small sample size (n<30)	Statistic for large sample size (n≥30)
Normal distribution with known variance	z-Statistic	z-Statistic
Normal distribution with unknown variance	t-Statistic	t-Statistic/z
Nonnormal distribution with known variance	not available	z-Statistic
Nonnormal distribution with unknown variance	not available	t-Statistic/z

2.30.1.5. Z 分布、T 分布、卡方分布、F 分布

Test type	**Assumptions**	**H_0**	**Test-statistic**	**Critical value**
Mean hypothesis testing	Normally distributed population, known population variance	$\mu=\mu_0$	$z=\dfrac{\bar{x}-\mu_0}{\sigma/\sqrt{n}}$	N(0,1)
	Normally distributed population, unknown population variance	$\mu=\mu_0$	$t=\dfrac{\bar{x}-\mu_0}{s/\sqrt{n}}$	t(n-1)
	Independent populations, unknown population variances assumed equal	$\mu_1-\mu_2=0$	$t=\dfrac{(\bar{x}_1-\bar{x}_2)-(\mu_1-\mu_2)}{\sqrt{s_p^2/n_1+s_p^2/n_2}}$ $Where\ s_p^2=\dfrac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}$	$t(n_1+n_2-2)$
	Independent populations, unknown population variances not	$\mu_1-\mu_2=0$	$t=\dfrac{(\bar{x}_1-\bar{x}_2)-(\mu_1-\mu_2)}{\sqrt{s_1^2/n_1+s_2^2/n_2}}$	*t**

	assumed equal			
	Samples not independent, <u>Paired comparisons test</u> for example, two returns of stocks in the market, the return of gas and that of oil	$\mu_d=0$	$t=\dfrac{\bar{d}}{s_{\bar{d}}}$	t(n-1)
		For example, the same population after and before an event, or comparison with the two different styles, which are affected by the same macro factors.		
Variance hypothesis testing	Normally distributed population	$\sigma^2=\sigma_0^2$	$\chi^2=\dfrac{(n-1)s^2}{\sigma_0^2}$	$\chi^2(n-1)$
	Two independent normally distributed population	$\sigma_1^2=\sigma_2^2$	$F=\dfrac{s_1^2}{s_2^2}$	$F(n_1-1,n_2-1)$

2.30.1.6. Test Correlation

Test type	Assumptions	H_0	Test-statistic	Critical value
Correlation	Both of the variables are normally distributed	$\rho = 0$	$t=\dfrac{r-0}{\sqrt{\dfrac{1-r^2}{n-2}}}$	t(n-2)

2.30.1.7. Nonparametric tests

- A nonparametric test either **is not concerned with a parameter** or **makes minimal assumptions about the population** from which the sample comes.
- Nonparametric tests are used:
  - when data do not meet distributional assumptions.
    - Example: hypothesis test of the mean value for a variable, but the distribution of the variable is not normal and the sample size is small so that neither the t-test nor the z-test are appropriate.
  - when data are given in ranks.
  - when the hypothesis we are addressing does not concern a parameter.

2.30.2. 基础题

Q-102. A sample has less than 30 data selecting from a normal distributed population with known variance. If an analyst wants to test the sample mean, which of the following distribution should be used?

A. t-student distribution

B. Z distribution

C. F distribution

Q-103. Independent samples drawn from normally distributed populations exhibit the following characteristics:

Sample	Size	Sample Mean	Sample Standard Deviation
A	25	200	45
B	18	185	60

Assuming that the variances of the underlying populations are equal, the pooled estimate of the common variance is 2,678.05. The t-test statistic appropriate to test the hypothesis that the two population means are equal is closest to:

A. 0.29.

B. 0.94.

C. 1.90.

Q-104. Investment analysts often use earnings per share (EPS) forecasts. One test of forecasting quality is the zero-mean test, which states that optimal forecasts should have a mean forecasting error of 0. (Forecasting error = Predicted value of variable − Actual value of variable.)

Performance in Forecasting Quarterly Earnings per Share		
Number of Forecasts	**Mean Forecast Error (Predicted – Actual)**	**Standard Deviations of Forecast Errors**
100	0.06	0.20

To test whether the mean forecasting error is 0, the t-statistic calculated is most likely:

A. 3.015.

B. 3.000.

C. 0.060.

Q-105. An analyst conducts a two-tailed test to determine if earnings estimates are significantly different from reported earnings. The sample size was over 90. The computed Z-statistic is 1.30. Using a 5 percent significant level, which of the following statements is TRUE?

A. Both the null and the alternative are significant

B. You cannot determine what to do with the information given

C. Fail to reject the null hypothesis and conclude that the earnings estimates are not significantly different from reported earnings

Q-106. An analyst wants to test the samples selecting from a population are random or not, he should choice:

A. T-test.

B. χ^2-test.

C. nonparametric test.

Q-107. Which of the following statements of null and alternative hypotheses requires a two-tailed test?

A. H_0: $\theta = \theta_0$ versus H_a: $\theta \neq \theta_0$

B. H_0: $\theta \leq \theta_0$ versus H_a: $\theta > \theta_0$

C. H_0: $\theta \geq \theta_0$ versus H_a: $\theta < \theta_0$

Q-108. Consider a two-tailed test of the hypothesis that the population mean is zero. The sample has 50 observations. The population is normally distributed with a known variance.

t Distribution			
Degree of freedom	p=0.10	p=0.05	p=0.025
49	1.299	1.677	2.010
50	1.299	1.676	2.009
z-Distribution	α=0.10	α=0.05	α=0.025
	1.645	1.960	2.330

At a 0.05 significance level, the rejection points are most likely at:

A. -2.010 and 2.010.

B. -2.009 and 2.009.

C. -1.960 and 1.960.

Q-109. A small-cap growth fund's monthly returns for the past 36 months have been consistently outperforming its benchmark. An analyst is determining whether the standard deviation of monthly returns is greater than 5%. Which of the following best describes the hypothesis to be tested?

A. $H_0: \sigma^2 \leq 0.25\%$

B. $H_a: \sigma^2 > 5\%$

C. $H_0: \sigma^2 \geq 0.25\%$

Q-110. Using a two-tailed test of the hypothesis that the population mean is zero, the calculated test statistic is 2.41. The sample has 24 observations. The population is normally distributed with an unknown variance.

Degrees of freedom	p = 0.10	p = 0.05	p = 0.025	p = 0.01	p = 0.005
21	1.323	1.721	2.080	2.518	2.831
22	1.321	1.717	2.074	2.508	2.819
23	1.319	1.714	2.069	2.500	2.807
24	1.318	1.711	2.064	2.492	2.797

An analyst will most likely reject the null hypothesis at significance levels of:

A. 0.10, 0.05, and 0.01.

B. 0.10 and 0.05.

C. 0.10 only.

Q-111. The value of a test statistic is best determined as the difference between the sample statistic and the value of the population parameter under H_0 divided by the:

A. appropriate value from the t-distribution.

B. standard error of the sample statistic.

C. sample standard deviation.

Q-112. In setting the confidence interval for the population mean of a normal or approximately normal distribution and given that the sample size is small, Student's t-distribution is the preferred approach when the variance is:

A. large.

B. known.

C. unknown.

Q-113. Jill Batten is analyzing how the returns on the stock of Stellar Energy Corp. are related with the previous month's percent change in the US Consumer Price Index for Energy (CPIENG). Based on 248 observations, she has computed the sample correlation between the Stellar and CPIENG variables to be −0.1452. She also wants to determine whether the sample correlation is statistically significant. The critical value for the test statistic at the 0.05 level of significance is approximately 1.96. Batten should conclude that the statistical relationship between Stellar and CPIENG is:

A. significant, because the calculated test statistic has a lower absolute value than the critical value for the test statistic.

B. significant, because the calculated test statistic has a higher absolute value than the critical value for the test statistic.

C. not significant, because the calculated test statistic has a higher absolute value than the critical value for the test statistic.

2.31. P-Value

2.31.1. 重要知识点

2.31.1.1. P-value method

- The p-value is the smallest level of significance at which the null hypothesis can be reject
- $p-value \in [0,1]$
- p-value < α: reject H_0; p-value > α: do not reject H_0.
- P↓, easier to reject H_0

2.31.2. 基础题

Q-114. The null hypothesis is most appropriately rejected when the p-value is:

A. close to zero.

B. negative.

C. close to one.

Q-115. The null hypothesis is most likely to be rejected when the p-value of the test statistic:

A. exceeds a specified level of significance.

B. is negative.

C. falls below a specified level of significance.

Q-116. The null hypothesis of a two-tailed test is most likely to be rejected when the p-value of the test statistic:

A. exceeds a specified level of significance.

B. falls below half of a specified level of significance.

C. falls below a specified level of significance.

Q-117. A two-tailed test of the null hypothesis that the mean of a distribution is equal to 4.00 has a p-value of 0.0567. Using a 5% level of significance (i.e., α = 0.05), the best conclusion is to:

A. fail to reject the null hypothesis.

B. increase the level of significance to 5.67%.

C. reject the null hypothesis.

Q-118. A one-tailed hypothesis testing has a p-value for a test statistic of 4%. An analyst would not reject the null hypothesis at a significance level of:

A. 0.01.

B. 0.10.

C. 0.05.

2.32. Type I and Type II Errors

2.32.1. 重要知识点

2.32.1.1. Type I and type II error

- **Type I error(拒真):** reject a true null hypothesis
  - Significance level (α): the probability of making a Type I error
  - Significance level =P(Type I error)=P(H_0×|H_0√)
- **Type II error(取伪):** do not reject a false null hypothesis
  - P(Type II error) = P(H_a×|H_a√)
  - **Power of a test**: the probability of correctly rejecting the null hypothesis when it is false.
  - Power of test = 1 − P(Type II error) = P(H_a√|H_a√)

2.32.2. 基础题

Q-119. Which of the following statements about hypothesis testing is *most accurate*?

A. A type II error is to reject the null when it is actually true.

B. The significance level equals one minus the probability of a Type I error.

C. A two-tailed test with a significance level of 5% has z-critical values of ±1.96.

Q-120. All else equal, is specifying a smaller significance level in a hypothesis test likely to increase the probability of a:

	Type I error?	Type II error?
A.	No	No
B.	No	Yes
C.	Yes	No

Q-121. All else equal, is increasing the sample size for a hypothesis test likely to decrease the probability of a:

	Type I error	Type II error
A.	Yes	No
B.	No	Yes
C.	Yes	Yes

Q-122. All else being equal, if the probability that fail to reject the null hypothesis when it's actually false increases, how about the width of confidence interval?

A. Increase

B. Decrease

C. No change

Q-123. A Type I error is best described as the probability of:

A. failing to reject a false null hypothesis.

B. rejecting a true alternative hypothesis.

C. rejecting a true null hypothesis.

Q-124. A hypothesis test fails to reject a false null hypothesis. This result is best described as a:

A. test with little power.

B. Type I error.

C. Type II error.

Q-125. When testing a hypothesis, the power of a test is best described as the:

A. probability of rejecting a true null hypothesis.

B. probability of correctly rejecting the null hypothesis.

C. same as the level of significance of the test.

2.33. 进阶题

Q-1. The table below shows three mutually exclusive $2,000,000 mortgage choices. Each of the three choices is compounded monthly.

Mortgage type	Quoted annual interest rate at initiation
32-year fixed rate	6.5%
24-year fixed rate	6.0%
32-year adjustable rate	4.5%

The adjustable-rate mortgage will reset its interest rate to 6.2% at the end of the year 4. After resetting the interest rate at the end of year 4, which mortgage will have the largest monthly payment?

A. 32-year fixed rate mortgage.

B. 24-year fixed-rate mortgage.

C. 32-year adjustable-rate mortgage.

Q-2. When rolling two six-sided dice and summing their outcomes, which of the following sums is most likely to occur?

A. Nine

B. Six

C. Five

Q-3. Independent samples drawn from normally distributed populations exhibit the following characteristics:

Sample	Size	Sample Mean	Sample Standard Deviation
A	28	210	50
B	21	195	65

Assuming that the variances of the underlying populations are equal, the pooled estimate of the common variance is 3,377.13. The t-test statistic appropriate to test the hypothesis that the two population means are equal is closest to:

A. 1.80.

B. 0.31.

C. 0.89.

Q-4. Two distributions have the same mean. One is negative skew, the other is positive skew. Which one has the larger median?

A. Distribution with negative skew

B. Distribution with positive skew

C. The same

Q-5.

Population	1	2
Sample size	$n_1 = 6$	$n_2 = 6$
Sample variance	$S_1^2 = 5$	$S_2^2 = 30$
The samples are drawn independently, and both populations are assumed to be normally distributed		

Using the above data, an analyst is trying to test the null hypothesis that the population variances are equal (H_0:$\boldsymbol{s_1^2} = \boldsymbol{s_2^2}$) against the alternative hypothesis that the variances are not equal (H_a: :$\boldsymbol{s_1^2} \neq \boldsymbol{s_2^2}$) at the 5% level of significance. The table of the F-Distribution is provided below.

Table of the F-Distribution

Panel A: Critical values for right-hand tail areas equal to 0.05

df1 (read across) **df2 (read down)**	1	2	3	4	5
1	161	200	216	225	230
2	18.5	19.0	19.2	19.2	19.3
3	10.1	9.55	9.28	9.12	9.01
4	7.71	6.94	9.59	6.39	6.26
5	6.61	5.79	5.41	5.19	5.05

Panel B: Critical values for right-hand tail areas equal to 0.025

df1 (read across) **df2 (read down)**	1	2	3	4	5
1	648	799	864	900	922
2	38.51	39.00	39.17	39.25	39.30
3	17.44	16.04	15.44	15.10	14.88
4	12.22	10.65	9.98	9.60	9.36
5	10.01	8.43	7.76	7.39	7.15

Which of the following statements is most appropriate? The critical value is:

A. 9.36 and reject the null.

B. 9.60 and do not reject the null.

C. 7.15 and do not reject the null.

Q-6. Using the following sample results drawn as 25 paired observations from their underlying distributions, test whether the mean returns of the two portfolios differ from each other at the 1% level of statistical significance. Assume the underlying distributions of returns for each portfolio are normal and that their population variances are not known.

	Portfolio 1	Portfolio 2	Difference
Mean return	15.00	20.25	5.25
Standard deviation	15.50	15.75	6.25
t-statistic for 24 degrees of freedom and at the 1% level of statistical significance = 2.807			
Null hypothesis (H_0): Mean difference of returns = 0			

Based on the paired comparisons test of the two portfolios, the most appropriate conclusion is that H0 should be:

A. accepted because the computed test statistic exceeds 2.807.

B. rejected because the computed test statistic exceeds 2.807.

C. accepted because the computed test statistic is less than 2.807.

Q-7. If the population distribution is unknown, the method that will lead to the *least* reliable estimation of a parameter is to:

A. use point estimates instead of confidence interval estimates.

B. use *t*-distribution instead of standard normal distribution to establish confidence intervals

C. draw more samples

Q-8. The table below reports the annual returns for two active portfolios in the same industry, namely, their returns are dependent with each other.

Year	Portfolio A (%)	Portfolio B (%)
2013	11	9
2014	-10	4
2015	1	-3
2016	8	12
2017	21	23
2018	2	-4

If we want to test whether the two portfolios have the same mean return at a 5% significance level, the test statistics we shall use is *closest* to:

A. 1.96.

B. 1.66.

C. 0.45.

Q-9. In a head and shoulders pattern, if the neckline is at \$23, the shoulders at \$28, and the head at \$33. The price target is closest to which of the following:

A. \$13.

B. \$19.

C. \$40.

Q-10. An analyst has established the following prior probabilities regarding a company's next quarter's earnings per share (EPS) exceeding, equaling, or being below the consensus estimate.

	Prior Prababilities
EPS exceed consensus	23%
EPS equal consensus	56%
EPS are less than consensus	21%

Several days before releasing its earnings statement, the company announces a cut in its dividend. Given this new information, the analyst revises his opinion regarding the likelihood that the company will have EPS below the consensus estimate. He estimates the likelihood the company will cut the dividend, given that EPS exceeds/meets/falls below consensus, as reported below.

	Probabilities the Company Cuts Dividends, Conditional on EPS Exceeding/Equaling/Falling below consensus
P(Cut div/EPS exceed)	3%
P(Cut div/EPS equal)	11%
P(Cut div/EPS below)	86%

The analyst thus determines that the unconditional probability for a cut in the dividend, P(Cut div), is equal to 24.75%. Using Bayes' formula, the updated (posterior) probability that the company's EPS are below the consensus is closest to:

A. 73%.

B. 84%.

C. 22%.

Q-11. Samples of size (n_1,n_2) are drawn respectively from two populations (X_1,X_2) with associated sample means and standard deviations of (X_1,X_2)and (S_1,S_2) and associated population means and standard deviations of(μ_1,μ_2) and(σ_1,σ_2) where ($\sigma_1 \neq \sigma_2$). In addition, $\bar{\mathbf{d}}$ is the sample mean of X_1-X_2 with a standard error of $\mathbf{S}_{\bar{\mathbf{d}}}$ and a population mean of $\boldsymbol{\mu}_{d_0}$ and $\mathbf{S}_{\mathbf{p}}^{\mathbf{2}}$ is a pooled estimator of the common variance.

The most appropriate test statistic to determine the equality of the two population means assuming X_1 and X_2 are independent and normally distributed is:

A. $t = \frac{\bar{d} - \mu_{d0}}{s_{\bar{d}}}$

B. $t = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{(\frac{s_p^2}{n_1} + \frac{s_p^2}{n_2})^{0.5}}$

C. $t = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2})^{0.5}}$

Q-12. Monte Carlo simulation is best described as:

A. a restrictive form of scenario analysis.

B. providing a distribution of possible solutions to complex functions.

C. an approach to backtest data.

Q-13. Which of the following most accurately describes how to standardize a random variable X?

A. Subtract the mean of X from X, and then divide that result by the standard deviation of X.

B. Subtract the mean of X from X, and then divide that result by the standard deviation of the standard normal distribution.

C. Divide X by the difference between the standard deviation of X and the standard deviation of the standard normal distribution.

Q-14. A descriptive measure of a population characteristic is best described as a:

A. parameter.

B. frequency distribution.

C. sample statistic.

Q-15. The discrepancy between a statistically significant result and an economically meaningful result is least likely the result of:

A. transaction costs.

B. sampling errors.

C. risk tolerance.

Q-16. Investors should be most attracted to return distributions that are:

A. normal.

B. negatively skewed.

C. positively skewed.

Q-17.

	Population 1	Population 2
Sample Size	n_1=6	n_2=6
Sample Variance	S_1^2=5	S_2^2=25
The samples are drawn independently and both populations are assumed to be normally distributed		

Using the above data, an analyst is trying to test the null hypothesis that the population variance are equal(H_0: $\sigma_1^2=\sigma_2^2$) against the alternative hypothesis that the variance are not equal(H_1: $\sigma_1^2 \neq \sigma_2^2$) at the 5% level of significance. The following table provides the F-distribution.

Table of the F-distribution						
Panel A: Critical values for right-hand tail area equal to 0.05						
	df1 (read across)	1	2	3	4	5
df2 (read down)	1	161	200	216	225	230
	2	18.5	19.0	19.2	19.2	19.3
	3	10.1	9.55	9.28	9.12	9.01
	4	7.71	6.94	9.59	6.39	6.26
	5	6.61	5.79	5.41	5.19	5.05
Panel B: Critical values for right-hand tail area equal to 0.025						
	df1 (read across)	1	2	3	4	5
df2 (read down)	1	648	799	864	900	922
	2	38.51	39.00	39.17	39.25	39.30
	3	17.44	16.04	15.44	15.10	14.88
	4	12.22	10.65	9.98	9.60	9.36
	5	10.01	8.43	7.76	7.39	7.15

Which of the following statements is most appropriate? The critical value is:

A. 7.15 and do not reject the null.

B. 9.60 and reject the null.

C. 6.39 and do not reject the null.

Solutions

Your life can be enhanced, and your happiness enriched, when you choose to change your perspective. Don't leave your future to chance, or wait for things to get better mysteriously on their own. You must go in the direction of your hopes and aspirations. Begin to build your confidence, and work through problems rather than avoid them. Remember that power is not necessarily control over situations, but the ability to deal with whatever comes your way.

一旦变换看问题的角度，你的生活会豁然开朗，幸福快乐会接踵而来。别交出掌握命运的主动权，也别指望局面会不可思议的好转。你必须与内心希望与热情步调一致。建立自信，敢于与困难短兵相接，而非绕道而行。记住，力量不是驾驭局势的法宝，无坚不摧的能力才是最重要的。

2. Quantitative

2.1. 基础题

Q-1. Solution: C.

The sum of the real risk-free interest rate and the inflation premium is the nominal risk-free interest rate.

Q-2. Solution: A.

The real risk free rate equals to the nominal risk-free rate minus the expected inflation rate. If the nominal risk-free rate decrease and expected inflation rate increase, the real risk-free rate should decrease.

Q-3. Solution: A.

Explain an interest rate as the sum of a real risk-free rate and premiums that compensate investors for bearing distinct types of risk.

A is correct. “The liquidity premium compensates investors for the risk of loss relative to an investment’s fair value if the investment needs to be converted to cash quickly.”

Q-4. Solution: B.

The required rate of return is the minimum rate of return an investor must receive in order to accept an investment.

Q-5. Solution: A.

An opportunity cost is the value that investors forgo by choosing a particular course of action.

Q-6. Solution: A.

All else being equal, due to the different payments, PV of option 1 will be the lowest, while PV of option 3 is the highest.

Calculation:

The present value for option 1 is $24,924. PMT=-2,000, N=20, I/Y=5, CPT: PV=24,924.

The present value for option 2 is $26,924. BGN mode,PMT=-2,000, N=20, I/Y=5, CPT: PV=26,171.

The present value for option 3 is $40,000, A=2,000, discount rate=5%.

PV=A/r=2,000/0.05=40,000

Option 1 (ordinary annuity) is the last option to choose.

Q-7. Solution: B.

Using a financial calculator, first calculate the needed funds at retirement:

N = 30, I/Y = 5, PMT =160,000, FV = 0; calculate PV to be 2,459,592.16.

Then use 2,459,592.16 as the FV of the accumulation phase annuity:

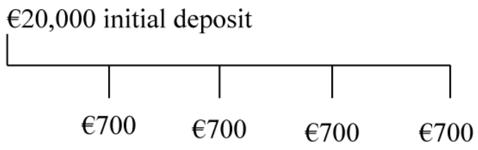
I/Y = 5, PV = 0, PMT = -11748, FV = 2,459,592.16; calculate N. N is 50.

Q-8. **Solution: C.**

Using a financial calculator: N = 48; the discount rate, I/Y = (5.5%/12) = 0.4583%; PMT = €2,400; Future value = €0; Mode = Begin; Calculate present value (PV): PV = €103,670.83.

Q-9. **Solution: B.**

As the following cash flows show:



annual interest payments (which earn 2.0%/year) + €20,000 (return of principal)

The four annual interest payments are based on the CD's 3.5% annual rate.

The first payment grows at 2.0% compounded monthly for three years (where FV is future value):

$FV_N = €700(1+\frac{0.02}{12})^{3\times12}$ FV_N= 743.25

The second payment grows at 2.0% compounded monthly for two years:

$FV_N = €700(1+\frac{0.02}{12})^{2\times12}$ FV_N= 728.54

The third payment grows at 2.0% compounded monthly for one year:

$FV_N = €700(1+\frac{0.02}{12})^{1\times12}$ FV_N= 714.13

The fourth payment is paid at the end of Year 4. Its future value is €700.

The sum of all future value payments is as follows:

€20,000.00	CD principal
€743.25	First payment's *FV*
€728.54	Second payment's *FV*
€714.13	Third payment's *FV*
€700.00	Fourth payment's *FV*
€22,885.92	Total *FV*

Or:

1+EAR (with a stated annual interest rate of 2.0% compounded monthly)= $(1+\frac{0.02}{12})^{12}$=1.02018436

PV=0, PMT=700, I/Y=2.018436, N=4, CPT FV=2,885.92. Total Future value is €22,885.925.

Q-10. Solution: C

Holding period return, HPR = $(P_1 – P_0 + D_1)/P_0$

where

P_0 = initial investment

P_1 = price received at the end of holding period

D_1 = dividend paid by the investment at the end of holding period= $2,500/10,000 shares = $0.25/shares

0.155= $(24 – P_0 + 0.25)/P_0$, and solving for P_0

P_0 = $21.00

Q-11. Solution: C.

EAR = $(1 + \text{periodic interest rate})^m – 1 = [1 + (0.09 / 365)]^{365} – 1$ = 0.094162, rounded to 9.42%.

Q-12. Solution: B.

Quarterly: EAR = $1.015^4 – 1$ = 6.1364%

Interest = $2,000,000 × 6.1364% = $122,727.1

Continuous: EAR = $e^{0.08} - 1$ = 8.33%

Interest = $2,000,000 x 8.33% = $166,574.1

Therefore, the CD2 offers the highest effective annual rate.

Q-13. Solution: B.

The effective annual rate is calculated as EAR = $(1 + r/m)^m-1$

For daily compounding, $(1 + 11\% / 365)^{365} - 1$ =11.6260%

For monthly compounding, $(1 + 11\% / 12)^{12} - 1$ = 11.5719%

For semi-annually compounding, $(1 + 11\% / 2)^2 - 1$ = 11.3025%

Therefore, the correct answer is monthly compounding.

Q-14. Solution: B.

The analyst is using an ordinal scale which involves sorting data into categories based on some characteristic, such as the firms' P/E ratios.

Q-15. Solution: A.

The relative frequency is the number of observations in an interval divided by the total number of observations. For Interval III, relative frequency = 11/55 = 20%. The cumulative relative frequency is the sum of the relative frequencies of the relevant class and all the classes before it. For Interval III, the cumulative relative frequency = (12 + 24 + 11)/55 = 85.45%.

Q-16. Solution: A.

The portfolio return is the weighted mean return and is calculated as follows:

Method two:

$$\bar{X}_1 = \sum_{i=1}^{n} w_{e1}X_{e1} + w_{b1}X_{b1} = (13\% \times 70\%) + (12\% \times 30\%) = 12.7\%$$

$$\bar{X}_2 = \sum_{i=1}^{n} w_{e2}X_{e2} + w_{b2}X_{b2} = (11\% \times 70\%) + (-5.6\% \times 30\%) = 6.02\%$$

$$\bar{X}_3 = \sum_{i=1}^{n} w_{e3}X_{e3} + w_{b3}X_{b3} = (-14.86\% \times 70\%) + (15\% \times 30\%) = -5.776\%$$

$$Geometric\ mean = \sqrt[N]{X_1X_2X_3} = \sqrt[3]{(1+12.7\%)(1+6.02\%)(1-5.776\%)} - 1 = 0.040298$$

Q-17. Solution: B.

Unless all the values of the observations in a data set have the same value, the harmonic mean is less than the corresponding geometric mean, which in turn is less than the corresponding arithmetic mean. In other words, regarding means, typically harmonic mean < geometric mean < arithmetic mean.

Q-18. Solution: B.

Add 1 to each of the given returns, then multiply them together and take the fourth root of the resulting product. 0.93 × 1.05 × 1.18 × 0.89 = 1.02552; 1.02552 raised to the 1/4 power is 1.00632. Subtracting one and multiplying by 100 gives the correct geometric mean return: $[(0.93 \times 1.05 \times 1.18 \times 0.89)^{0.25} - 1] \times 100 = 0.632\%$.

Q-19. Solution: A.

The geometric mean is always less than or equal to the arithmetic mean. The only time the two means will be equal is when there is no variability in the observations.

Q-20. Solution: A.

A is correct. The geometric mean return represents the growth rate or compound rate of return on an investment.

B is incorrect. The harmonic mean may be viewed as a special type of weighted mean in which an observation’s weight is inversely proportional to its magnitude. The harmonic mean is a relatively specialized concept of the mean that is appropriate when averaging ratios ("amount per unit") when the ratios are repeatedly applied to a fixed quantity to yield a variable number of units.

C is incorrect. The arithmetic mean return reflects the average of the single-periods performance.

Q-21. Solution: A.

The harmonic mean is appropriate for determining the average price per unit. It is calculated by summing the reciprocals of the prices; then averaging that sum by dividing by the number of prices; and finally, taking the reciprocal of the average:

4/[(1/62.00) + (1/76.00) + (1/84.00) + (1/90.00)] = €76.48.

Q-22. Solution: B.

The first quintile is the 20^{th} percentile. The first decile is the 10^{th} percentile, the first quartile is the 25^{th} percentile, and the median is the 50^{th} percentile. While it is possible that these various percentiles or some subsets of them be equal (for example the 10^{th} percentile possibly could be equal to the 20^{th} percentile), in general the order from smallest to largest would be: first decile, first quintile, first quartile, median.

Q-23. Solution: A.

First, find the position of the 75th percentile with the following formula:

$L_y = (n + 1) \times (y / 100)$,

where

y is the percentage point at which we are dividing the distribution. In our case we have y = 75, which corresponds to the 75th percentile;

n is the number of observations (funds) in the peer group. In our case we have n = 12;

L_{75} corresponds to the location of the 75th percentile.

$L_{75} = (12 + 1) \times (75/100) = 9.75$.

Therefore, the location of the 75th percentile is between the volatility of Fund 9 and Fund 10 (because they are ranked in ascending order).

Then, use linear interpolation to find the approximate value of the 75th percentile:

$P_{75} \approx X_9 + (9.75 - 9) \times (X_{10} - X_9)$,

where

X_9 is the volatility of Fund 9

X_{10} is the volatility of Fund 10

P_{75} is the approximate value of the 75th percentile

$P_{75} = 14.50\% + (9.75\text{-}9) \times (14.87\% - 14.50\%) = 14.7775\%$

Q-24. Solution: B

The arithmetic sum of the deviations around the mean will always equal zero, not one.

A is incorrect. Range does not provide information about the shape of the distribution.

C is incorrect. The mean absolute deviation will always be less than or equal to the standard deviation.

Q-25. Solution: A.

Compute the mean portfolio return = (8.5% + 11.1%+ 12.8% + 15.2% - 9.5%)/5 = 7.62% ;

MAD = (|8.5%-7.62%| + |11.1%-7.62%| + |12.8%-7.62%| + |15.2%-7.62%| + |-9.5% -7.62%|)/5 = 6.85%

Variance = $[(8.5\% - 7.62\%)^2 + (11.1\% - 7.62\%)^2 + (12.8\% - 7.62\%)^2 + (15.2\%-7.62\%)^2 + (-9.5\% - 7.62\%)^2]/5 \approx 0.78\%$

The population variance calculation is appropriate because the analyst is analyzing all the annual returns on the portfolio since its inception.

Q-26. Solution: C.

Method 1

The sample mean is: (-2-10+4-17+19+21-6+10+3-15)/10=0.7

The sample variance is: $S^2 = \sum_i^n (X_i - \overline{X})^2 / (n-1)$

The sample standard deviation is the (positive) square root of the sample variance

Value	Diff. from mean [value-0.7]	Difference Square
-2	-2.7	7.29
-10	-10.7	114.49
4	3.3	10.89
-17	-17.7	313.29
19	18.3	334.89
21	20.3	412.09
-6	-6.7	44.89
10	9.3	86.49
3	2.3	5.29
-15	-15.7	246.49
	Sum of Squared differences	1,576.1
	Divided by n-1	175.12
	Square root	13.23

Method 2（金融计算器）:

输入统计数据	
按下 2^{nd} DATA	屏幕上显示 X01 及其先前的值
按下 2^{nd} CLR WORK	清空工作表
键入 X01 的值，按下 enter 键	输入第一个变量值
按↓键，屏幕显示 Y01	默认值为 1
再按↓键，显示下一个 X 变量	重复第三至四步，直到把所有 X 变量输完为止
计算统计结果	
按下 2^{nd} STAT	选择回归模型，默认为 LIN
按↓键，屏幕显示 n	样本量
按↓键，屏幕显示 $\overline{X}$	变量 X 的均值
按↓键，屏幕显示 Sx	变量 X 的样本标准差
按↓键，屏幕显示 σx	变量 X 的总体标准差

Q-27. Solution: A.

According to Chebyshev's inequality, the proportion of the observations within k standard deviations of the arithmetic mean is at least $1-1/k^2$ for all k>1.

Firstly, to calculate the minimum probability that a monthly return falls into this range. $\mathrm{P}(\mu-k\sigma\leq X\leq\mu+k\sigma)=54\div60=90\%$

Then, to calculate the value of "k".

$1-\frac{1}{k^2}=90\%$, k=3.1623

Lastly, to calculate the lower and upper limit of the return range.

Lower limit: $\mu-k\sigma=0.80\%\ -\ 3.1623\times1.18\%=-2.9315\%$

Upper limit: $\mu+k\sigma=0.80\%+\ 3.1623\times1.18\%=4.5315\%$

Q-28. Solution: C.

$$\mathbf{P}(\boldsymbol{\mu}-\boldsymbol{k\sigma} \leq \boldsymbol{X} \leq \boldsymbol{\mu}+\boldsymbol{k\sigma}) \geq \mathbf{1}-\frac{\mathbf{1}}{\boldsymbol{k}^{\mathbf{2}}}$$

$$\mathbf{P}(\boldsymbol{\mu}-\mathbf{3.16}\boldsymbol{\sigma} \leq \boldsymbol{X} \leq \boldsymbol{\mu}+\mathbf{3.16}\boldsymbol{\sigma}) \geq \mathbf{1}-\frac{\mathbf{1}}{\mathbf{3.16^2}}=\mathbf{89.9856\%}$$

$$\mathbf{P}(\boldsymbol{X} \leq \boldsymbol{\mu}-\boldsymbol{k\sigma})=\frac{(\mathbf{1}-\mathbf{89.9856\%})}{\mathbf{2}}=\mathbf{5.0072\%}$$

Q-29. Solution: C.

According to Chebyshev's inequality, the proportion of the observations within k standard deviations of the arithmetic mean is at least $1-1/k^2$ for all k>1.

The upper limit of the range is 2.60%, which is 2.60-0.80=1.80% above the mean. The lower limit is -1.00%, which is 0.80-(-1.00)=1.80% below the mean. As a result, k=1.80/1.18=1.5254 standard deviations.

Because k=1.5254, the proportion of the observations within the interval is at least $1-1/1.5254^2$ =0.5702, or 57.02%. Thus, the number of observations in the given range is at least 60 × 57.02%, which is 34.2148.

Q-30. Solution: A.

Sharpe ratio = [expected return (mean) – risk-free rate]/standard deviation = mean/standard deviation; CV = standard deviation/expected return. The mean is less than the standard deviation, so compared with Sharpe ratio, the coefficient of variation is greater.

Q-31. Solution: B.

The Sharpe ratio is the mean excess return (mean return less risk-free rate of 4.0 percent) divided by the standard deviation of the portfolio. It is highest for portfolio 2 with a Sharpe ratio of 7 / 20= 0.35. For portfolio 1, the Sharpe ratio is 6/19 = 0.3158 and for portfolio 3 the Sharpe ratio is 9/ 34 = 0.2647.

Q-32. Solution: A.

Sharpe ratio = $[E(R_p)- r_f]/\sigma$, based on the Sharpe ratio formula,

we can get the $\sigma = [E(R_p)- r_f]$/Sharpe ratio,

σ_1 = (10%-5%)/34% = 14.71%,

σ_2 = (10%-5%)/37% = 13.51%.

CV = $\sigma/\overline{X}$, CV_1 = 14.71%/10% = 1.471, CV_2 = 13.51%/10% = 1.351.

The portfolio 1's CV is larger.

Q-33. Solution: B.

SR = $(R_p – R_F)/S_p$ where R_p is the mean return to the portfolio, R_F is the mean return to a risk-free asset, and S_p is the standard deviation of return on the portfolio. In this instance, 3.0=(21%-5%)/ S_p, solving for S_p =5.33%

Q-34. Solution: C.

As mean < median < mode, the distribution has long tail in the left and negatively skewed.

Q-35. Solution: B.

Mean=1.33; Median=(1+2)/2=1.5; Mode=2.

1.33<1.5<2; Mean<Median<Mode.

Q-36. Solution: C.

Having an excess kurtosis, the actual distribution of one year investment returns is leptokurtic return distribution. It is more peaked and has fatter tails than the normal distribution, which means more extremely large deviations from the mean than a normal distribution and an undervalued probability than extreme returns occurs.

Q-37. Solution: C.

Investors should be attracted by a positive skew (distribution skewed to the right) because the mean return falls above the median. Relative to the mean return, positive skew amounts to a limited, though frequent, downside compared with a somewhat unlimited, but less frequent, upside.

Q-38. Solution: A.

The kurtosis of a normal distribution is 3. If the kurtosis is greater than 3, the distribution is more peaked than a distribution with a kurtosis less than 3. A distribution with a positive skewness has long right tail while that with a negative skewness has a long left tail.

Q-39. Solution: C.

Sample kurtosis is measured using deviations raised to the fourth power.

$$Sample\ kurtosis = \frac{1}{n}\frac{\sum_{i=1}^{n}(X_i-\overline{X})^4}{s^4}$$

Q-40. Solution: B.

Explain measures of sample skewness and kurtosis.

B is correct. Most equity return series have been found to be leptokurtotic.

Q-41. **Solution: C.**

An empirical probability is a probability estimated from data as a relative frequency of occurrence.

A is incorrect. A subjective probability is a probability drawing on personal or subjective judgment.

B is incorrect. An a priori probability is a probability obtained based on logical analysis.

Q-42. **Solution: A.**

Properties of addition rule is that the probability that event A or event B occurs, or both occur.

Q-43. **Solution: B.**

Events are exhaustive when they cover all possible outcomes. Mutually exclusive means that only one event can occur at a time. Two events are dependent if the occurrence of one event does affect the probability of occurrence of the other event. In this situation, Event A and B are both mutually exclusive (because they cannot occur at the same time) and dependent (because if one event occurs, the probability of the other becomes zero). However, the two events are not exhaustive because they do not cover the event that the fund will earn a return above 5%.

Q-44. **Solution: B.**

Price change includes price increase.

Q-45. **Solution: A.**

The probability of underperform = 1–65% = 35%

The odds for of underperform = 35%/65% = 0.5385

Q-46. **Solution: C.**

A is incorrect. Given that X and Y are mutually exclusive events,X and Y cannot happen simutanously, so there joint probability should be zero.

B is incorrect. Given that X and Y are independent, their joint probability is equal to the product of their individual probabilities. In this problem, we calculate 0.3 × 0.6 = 0.18.

As a result, X and Y are most likely dependent events.

Q-47. **Solution: C.**

P(A or B) = P(A) + P(B) – P(AB) = 0.30 + 0.70 – 0.21 = 0.79 or 79%.

Q-48. **Solution: B.**

Because the screens are independent, the probability of passing all four simultaneously is the product of their respective probabilities: P(ABCD) = P(A) P(B) P(C) P(D), where

P(A) = 0.75 and is the probability of passing Valuation Screen 1,

P(B) = 0.55 and is the probability of passing Valuation Screen 2,

P(C) = 0.50 and is the probability of passing Valuation Screen 3,

P(D) = 0.40 and is the probability of passing Valuation Screen 4.

P(ABCD) = 0.75 × 0.55 × 0.50 × 0.40 = 0.0825.

Given 2,400 potential investments, approximately 2,400 × 0.0825 = 198 will pass the screens.

Q-49. Solution: C.

When two events are independent, the events are unrelated and the probability of occurrence of one event does not affect the other.

A is incorrect because when two events are independent, the joint probability of both events, not one event, equals the product of the individual probabilities of both events.

B is incorrect because an event is considered dependent when the probability of occurrence of one event is related to the occurrence of the other event.

Q-50. Solution: A.

A is correct. Two events, A and B, are independent if and only if P(A|B) = P(A) or, equivalently, P(B|A) = P(B). The wording of the question precludes P(A) = P(B); therefore, P(B) and P(B|A) cannot be correct.

B is incorrect. Two events A and B are independent if and only if P(A|B) = P(A) or, equivalently, P(B|A) = P(B). As P(A) ≠ P(B), B cannot be correct.

C is incorrect. Two events A and B are independent if and only if P(A|B) = P(A) or, equivalently, P(B|A) = P(B). As P(A) ≠ P(B) and given that P(B) = P(B|A), C cannot be correct.

Q-51. Solution: C.

Across two periods, there are four possibilities: an up move followed by an up move ($242.00 end value), an up move followed by a down move ($202.40 end value), a down move followed by an up move ($202.40 end value), and a down move followed by a down move ($169.28 end value). The probability of an up move followed by a down move is 0.30 times 0.70 equals 0.21. The probability of a down move followed by an up move is 0.70 times 0.30 also equals 0.21. Both of these sequences result in an end value of $202.40. Therefore, the probability of an end value of $202.40 is 42%.

Q-52. Solution: C.

When the economy recession:

E(EPS) = 20% × 4 + 80% ×8 = 7.2

Var(EPS) = 20% × $(4-7.2)^2$ + 80% × $(8 – 7.2)^2$ = 2.56

Q-53. Solution: C.

The portfolio return is the weighted mean return and is calculated as follows:

$$\bar{X}_W = \sum_{i=1}^{n} w_i X_i = (0.55 \times 18) + (0.20 \times 14) + (0.25 \times 4) = 13.7\%$$

Q-54. Correct Answer: A.

$$E(X) = \sum P_i \times X_i = 70\% \times 12\% + 30\% \times 16\% = 13.2\%$$

Q-55. Solution: A.

For an extreme case in which ρ_{XY} = –1 (that is, the two asset returns move in opposite directions), the portfolio can be made risk free.

Q-56. Solution: B.

Expected return on security A = 0.7 x 24% + 0.3 x 18% = 22.2%

Expected return on security B = 0.7 x 32% + 0.3 x 24% = 29.6%

Cov (R_A, R_B) = 0.7[(24% - 22.2%)(32% - 29.6%)] + 0.3[(18% - 22.2%)(24% - 29.6%)]

= 0.001008.

Q-57. Solution: C.

The relationship between variables A and B is perfect positive correlation (1.0) and the relationship between variables A and C is perfect negative correlation (-1.0).

Q-58. Solution: B.

Correlations near positive 1.00 exhibit strong positive linearity; correlations near negative 1.00 exhibit strong negative linearity. Correlations of zero indicate no linear relation between variables. The closer the correlation is to zero, the weaker is the linear relationship.

Q-59. Solution: B.

Calculate and interpret the mean, variance, and covariance (or correlation) of asset returns based on historical data.

Cov(A,B) = $\rho_{AB} \times \sigma_A \times \sigma_B$ = 0.85 × 0.51 × 0.435 = 0.19.

Q-60. Solution: B.

Specification of the mean and variance for a portfolio of four stocks requires estimates of the mean returns and variances for each of the four stocks and the pairwise correlations between each of the four stocks.

A is incorrect because skewness measures are not required to estimate the mean and variance of a portfolio.

C is incorrect because kurtosis measures are not required to estimate the mean and variance of a portfolio.

Q-61. Solution: B.

Correlations near +1 exhibit strong positive linearity, whereas correlations near –1 exhibit strong negative linearity. A correlation of 0 indicates an absence of any linear relationship between the variables. The closer the correlation is to 0, the weaker the linear relationship.

Q-62. Solution: C.

The correlation between two random variables R_i and R_j is defined as $\rho(R_i,R_j) = Cov(R_i,R_j)/[\sigma(R_i)\sigma(R_j)]$. Using the subscript i to represent hedge funds and the subscript j to represent the market index, the standard deviations are $\sigma(R_i) = 256^{1/2} = 16$ and $\sigma(R_j) = 81^{1/2} = 9$. Thus, $\rho(R_i,R_j) = Cov(R_i,R_j)/[\sigma(R_i)\sigma(R_j)] = 110/(16X9) = 0.764$.

Q-63. Solution: A.

As the correlation between two assets approaches +1, diversification benefits decrease. In other words, an increasingly positive correlation indicates an increasingly strong positive linear relationship and fewer diversification benefits.

Q-64. Solution: C.

Event A: the firm releases an increasing net income

Event $\overline{A}$: the firm releases an decreasing net income

Event B: the firm's stock increases

Event $\overline{B}$: the firm's stock increases

$P(B)=P(B|A)\times P(A)+P(B|\bar{A})\times P(\bar{A})=0.5\times 0.7+0.5\times 0.4=0.55$

Q-65. Solution: C.

P(CFA I|FRM) =50%, P(FRM) = 40%

P(CFA I and FRM) = P(CFA I|FRM) × P(FRM) = 50% × 40% = 20%

P(FRM| CFA I)= P(CFA I and FRM)/ P(CFA I)=20%/30%=0.67

Q-66. Solution: A.

In probability natation, Bayes' formula can be writtrn concisely as:

$$\mathrm{P}(Event|Information) = \frac{P(Information|Event)}{P(Information)}\mathrm{P(Event)}$$

Q-67. Solution: B.

Because the order of the sales is important, the permutation formula is appropriate, which is 5!/(5-3)!=60

Or,

Using the BAII Plus financial calculator (5+2ND+-+3+=), to compute the anwser (60).

Q-68. Solution: C.

The independent variables of cumulative probability function range from negative infinity to positive infinity.

Q-69. Solution: A.

A discrete random variable can take on at most a countable number of possible values. Stocks traded on the stock exchange are quoted in ticks of $0.01. Quoted stock price is thus a discrete random variable with possible values $0, $0.01, $0.02, ……

Q-70. Solution: C.

The discrete uniform distribution is known as the simplest of all probability distributions. It is made up of a finite number of specified outcomes and each outcome has equal probability.

Q-71. Solution: C.

The problem deals with the discrete uniform distribution. This means that the five outcomes are all equally likely: P(x) = 1/5 = 0.2. There are two ways to find P(1 ≤ X ≤ 4):

1.The sum of four probabilities is calculated: P(1), P(2), P(3) and P(4), 0.2 + 0.2 + 0.2 + 0.2 = 0.8, or

2.The probability is calculated as the difference between two values of the cumulative distribution function. In this case, F(4) = P(X ≤ 4) = 1.0 and F(0) = P(X = 0) = 0.2. Therefore, P(1 ≤ X ≤ 4) = F(4) – F(0) = 1.0 – 0.2 = 0.8.

A is incorrect because 0.4 is the probability of a profit less than or equal to $1.

B is incorrect because 0.6 is the probability of a profit less than or equal to $2.

Q-72. Solution: C.

The probability that the performance is at or below the expectation is calculated by finding F(3) =

p(3) + p(2) + p(1)+ p(0) using the formula:

$$P(x)=P(X=x)=C_n^x p^x (1-p)^{n-x} = \frac{n!}{(n-x)!x!} p^x (1-p)^{n-x}$$

Using this formula,

$$P(3)=\frac{4!}{(4-3)!3!}0.75^3(1-0.75)^{4-3}=\frac{24}{6}(0.42)(0.25)=0.42$$

$$P(2)=\frac{4!}{(4-2)!2!}0.75^2(1-0.75)^{4-2}=\frac{24}{4}(0.56)(0.06)=0.20$$

$$P(1)=\frac{4!}{(4-1)!1!}0.75^1(1-0.75)^{4-1}=\frac{24}{6}(0.75)(0.02)=0.06$$

$$P(0)=\frac{4!}{(4-0)!0!}0.75^0(1-0.75)^{4-0}=\frac{24}{24}(1)(0.004)=0.004$$

Therefore,

F(3) = p(3) + p(2) + p(1)+ p(0)=0.42+0.20+0.06+0.004=0.684.

Or:

The probability that the performance is at or below the expectation also can be calculated by finding F(3) = 1-p(4) using the formula:

$$P(4)=\frac{4!}{(4-\ 4)!4!}0.75^4(1-0.75)^{4-4}=0.75^4=0.316$$

Therefore,

F(3) =1- p(4)=1-0.316=0.684.

Q-73. Solution: B.

Because the price follows a continuous uniform distribution that ranges from $150 to $210, the probability that the price will be less than $160 is P(X < 160) = (160 - 150)/(210 - 150) = 16.7%

Q-74. Solution: A.

Under same level of significant level, the critical value of one-tailed test is smaller than two-tailed test.

Q-75. Solution: C.

Standardize the value of return for the given normal distribution:

$$P(X<10\%)=P\left(\frac{X-\mu}{\sigma}<\frac{10\%-\mu}{\sigma}\right)=P\left(\frac{X-\mu}{\sigma}<\frac{10\%-20\%}{10\%}\right)=P(Z<-1)$$

Q-76. Solution: B.

First standardize the value of return for the given normal distribution:

$$P(7\% < X < 19\%) = P(\frac{7\%-\mu}{\sigma} < \frac{X-\mu}{\sigma} < \frac{19\%-\mu}{\sigma})$$
$$= P(\frac{7\%-13\%}{5\%} < \frac{X-\mu}{\sigma} < \frac{19\%-13\%}{5\%})$$
$$= P(-1.2 < z < 1.2)$$

Using the property of standard normal distribution,

P(-1.2 < z < 1.2) = 1 – 2 × P(z > 1.2)=1 – 2 × [1 – P(z ≤ 1.2)] = 1 – 2 × [1 – N(1.2)] = 2 × N(1.2) - 1

Given the z-table, N(1.2) = 0.8849, so P(-1.2 < z < 1.2) = 2 × N(1.2) – 1 = 76.98%

Q-77. Solution: A.

For a standard normal distribution, the probability that a random variable lies within 1 standard of the mean is about 68%.

$$P(\mu-\sigma \le X \le \mu+\sigma)=68\%$$

The probability that a random variable lies within 1.96 standard of the mean is about 95%.

$$P(\mu-2\sigma \le X \le \mu+2\sigma)=95\%$$

The probability that a random variable lies within 1 standard deviation to 2 standard deviation is about 13.5%.

$$P(\sigma \le X \le 2\sigma)=\frac{(95\%-68\%)}{2}=13.5\%$$

Q-78. Solution: C.

Explain the key properties of the normal distribution.

C is correct. A normal distribution is more suitable as a model for returns than for asset prices.

Q-79. Solution: A.

Roy's safety-first criterion states that the optimal portfolio minimizes the probability that the return of the portfolio falls below some minimum acceptable level. This minimum acceptable level is called the "threshold" level. Symbolically, Roy's safety-first criterion can be stated as: Maximize the SFR where SFR = [E(R_p) - R_L] / σ_p

Where: R_p = portfolio return; R_L = threshold level return

R_L=10,000/90,000=11.11%, SFR = (14%-11.11%)/($0.0225^{1/2}$) =2.89% / 0.15=19.27%

Q-80. Solution: B.

Define shortfall risk, calculate the safety-first ratio, and select an optimal portfolio using Roy’s safety-first criterion.

B is correct. The portfolio with the highest SFRatio is preferred. The SFRatio is calculated by subtracting the target return from the expected return and dividing by the standard deviation.

For the choices given:

Portfolio 1= 0.45

Portfolio 2= 0.74

Portfolio 3 = (24 – 6)/42 = 0.4286

B has the highest SF Ratio, so it is the most appropriate choice.

Q-81. Solution: A.

A normal distribution is suitable for describing asset returns. However, the normal distribution is not suitable for asset prices because asset prices cannot be negative. The lognormal distribution is bounded by zero (skewed to the right) and is suitable for describing distributions of asset prices.

Q-82. Solution: B.

Lognormal distributions are right/positively skewed with unknown kurtosis. Lognormal distributions can be used to describe prices of an investment asset rather than its returns.

Q-83. Solution: B.

If a stock's continuously compounded return is normally distributed, then the future stock price is necessarily lognormally distributed.

Q-84. Solution: C.

Monte Carlo simulation is a complement to analytical methods. Monte Carlo simulation provides statistical estimates and not exact results. Analytical methods, when available, provide more insight into cause- and- effect relationships

Q-85. Solution: C.

Data on some characteristics of companies at a single point in time are cross-sectional data.

Q-86. Solution: B.

The standard deviation of a sample statistic is known as the standard error of the statistic.

Q-87. Solution: A.

According to the central limit theorem, if the sample size is large, the distribution of sample means will be approximately normal,with a mean equal to the population mean, and with a variance equal to the population variance divided by the sample size.

Q-88. Solution: B.

The central limit theorem holds without regard for the distribution of the underlying population.

Q-89. Solution: B.

When the population variance is unknown, the standard error of the sample mean is calculated as: $\text{Standard error} = \frac{s}{\sqrt{n}}$

Deviation from Mean	Squared Deviation
(11-4.5) = 6.5	42.25
(21-4.5) = 16.5	272.25
(–7 -4.5) = –11.5	132.25
(3-4.5) = –1.5	2.25
(–8 -4.5) = –12.5	156.25
(6-4.5) = 1.5	2.25
(0-4.5) = –4.5	20.25
(-7-4.5) = –11.5	132.25
(4-4.5) = –0.5	0.25
(22-4.5) = 17.5	306.25
Total	1066.5
Variance	1066.5/9 = 118.5
Standard deviation (s):	√118.5= 10.89

The standard error of the sample mean is: $10.89/10^{0.5}=3.44$

Q-90. Solution: B.

Stratified random sampling (known as proportional random sampling or quota random sampling) involves the division of a population into smaller sub-groups known as strata. The strata are formed based on members' shared attributes or characteristics such as income or educational attainment.

Sample members of systematic sampling are selected according to a random starting point but with a fixed, periodic interval. For example, to select a random group of 1,000 people from a population of 50,000, all the potential participants must be placed in a list and a starting point would be selected. If the selected starting point was 20, the 70^{th} person on the list would be chosen followed by the 120^{th}, and so on.

Random sampling is to take all the samples at random, and each sample has the same probability of being selected. For example, for a population (1,2,3…100), each data has equal probability of being drawn.

Q-91. Solution: A.

The standard error of the sample mean, when the sample standard deviation is known, is:

$s_{\overline{X}} = \frac{s}{\sqrt{n}}$. In this case, $s_{\overline{X}} = \frac{15}{\sqrt{64}}$ =1.875.

The reliability factor for a 95% confidence interval with unknown population variance and sample size greater than 30 is $Z_{0.025}$ =1.96.

The confidence interval estimate is:

$\overline{X} \pm Z_{0.025}\left(s/\sqrt{n} \right)$.

With sample standard error of 1.875, the estimated confidence interval is:

$8 \pm 1.96 \times 1.875 = 8 \pm 3.675$

Q-92. Solution: A.

A is correct. As the degree of confidence is increased, the confidence interval becomes wider. A larger sample size decreases the width of a confidence interval.

B is incorrect. As the degree of confidence is increased, the confidence interval becomes wider. A larger sample size decreases the width of a confidence interval.

C is incorrect. As the degree of confidence is increased, the confidence interval becomes wider. A larger sample size decreases the width of a confidence interval.

Q-93. Solution: A.

The sampling distribution of a statistic (like a sample mean) is defined as the probability distribution of a given sample statistic when samples of the same size are randomly drawn from the same population.

Q-94. Solution: B.

A consistent estimator is one for which the accuracy of the parameter estimate increases as the sample size increases.

Efficiency represents that the variance of its sampling distribution is smaller than all the other unbiased estimators of the parameter you are trying to estimate.

Unbiasedness indicates that the expected value of the estimator is equal to the parameter that are trying to estimate.

Q-95. Solution: A.

All else equal, a larger sample size will decrease both the standard error and the width of the confidence interval. In other words, the precision of the estimate of the population parameter is increased.

Q-96. Solution: C.

With a sample size of 12, there are 11 degrees of freedom. The confidence interval concept is based on a two-tailed approach. For a 95% confidence interval, 2.5% of the distribution will be in each tail. Thus, the correct t-statistic to use is 2.201. The confidence interval is calculated as:

$\overline{\mathrm{X}} \pm \mathrm{t}_{0.025} \frac{s}{\sqrt{n}}$.

Where $\bar{X}$ is the sample mean, s is the sample standard deviation, and n is the sample size. In this case:

5.76 ± 2.201 × 14/√12 = 5.76 ± 8.8952 or –3.14 to 14.66.

Q-97. Solution: B.

A confidence interval for a parameter = Point estimate ± Reliability factor × Standard error. For example, the reliability factors for confidence intervals based on the standard normal distribution are 1.65 for 90% confidence intervals and 1.96 for 95% confidence intervals. For a given point estimate and standard error, the confidence interval will be narrower with a lower reliability factor.

Q-98. Solution: C.

Sample selection bias often results when a lack of data availability leads to certain data being excluded from the analysis. Survivorship bias is an example of sample selection bias.

Q-99. Solution: B.

With a sample size of 10, there are 9 degrees of freedom. The confidence interval concept is based on a two-tailed approach. For a 95% confidence interval, 2.5% of the distribution will be in each tail. Thus, the correct t-statistic to use is 2.262. The confidence interval is calculated as:

$\overline{\mathbf{X}} \pm \mathbf{t}_{\mathbf{0.025}} \frac{\boldsymbol{S}}{\sqrt{\boldsymbol{n}}}$

Where $\overline{\mathbf{X}}$ is the sample mean, s is the sample standard deviation, and n is the sample size. In this case: 6.25 ± 2.262 × 12/$\sqrt{\mathbf{10}}$ = 6.25± 8.58369 or –2.33 to 14.83.

Q-100. Solution: B.

If the t-distribution and the normal distribution have a same significance level, the tails of the t-distribution are fatter than the tails of normal distribution. As the degrees of freedom increase, the t-distribution approaches the standard normal.

Q-101. Solution: C.

As degrees of freedom increase, the t-distribution will more closely resemble a normal distribution, becoming more peaked and having less fat tails.

Q-102. Solution: B.

For testing a sample mean with a small sample size and known population variance, Z distribution should be used.

Q-103. Solution: B.

The t-statistic for the given information (normally distributed populations, population variances assumed equal) is calculated as:

$$t = \frac{\left(\overline{X}_1 - \overline{X}_2\right) - \left(\overline{\mu}_1 - \overline{\mu}_2\right)}{\left(\frac{s_p^2}{n_1} + \frac{s_p^2}{n_2}\right)^{0.5}}$$

In this case, we have:

$$s_p^2 = 2678.05$$

$$t = \frac{(200 - 185) - (0)}{\left(\frac{2678.05}{25} + \frac{2678.05}{18}\right)^{0.5}} = 0.93768$$

Q-104. Solution: B.

The t-test is based on $\mathrm{t} = \frac{\mathrm{X} - \mu_0}{\mathrm{s} / \sqrt{n}}$.

For this test, we have $t = \frac{0.06 - 0}{0.20 / \sqrt{100}} = 3$

Q-105. Solution: C.

The sample size was over 90, which was more than 30, so z-test is appropriate. Using a 5% significant level, the critical value of a two-tailed test is 1.96. The z-statistic is 1.30, which is less than 1.96, so the analyst fail to reject null hypothesis.

Q-106. Solution: C.

Test the selected samples are random or not, nonparametric test should be used.

Q-107. Solution: A.

Define a hypothesis, describe the steps of hypothesis testing, describe and interpret the choice of the null and alternative hypotheses, and distinguish between one-tailed and two-tailed tests of hypotheses.

A is correct. When the null and alternative hypotheses are of the form: H_0: $\theta = \theta_0$ versus H_a: $\theta \neq \theta_0$, the correct approach is to use a two-tailed test.

Q-108. Solution: C.

The appropriate test statistic is a z-statistic because the sample comes from a normal distributed population with known variance. A z-test does not use degrees of freedom. This test is two-sided at the 0.05 significance level, and the rejection point conditions are z > 1.960 and z < –1.960.

Q-109. Solution: A.

A is correct. This is a one-tailed hypothesis testing with a "greater than" alternative hypothesis. A squared standard deviation is being used to obtain a test of variance.

The hypotheses are $H_0: \sigma^2 \leq 0.25\%$ versus $H_a: \sigma^2 > 0.25\%$

B and C are incorrect as explained in choice A.

Q-110. Solution: B.

This is a two-tailed hypothesis testing because it concerns whether the population mean is zero.

$H_0: \mu = 0$ versus $H_a: \mu \neq 0$

With degrees of freedom (df) = n – 1 = 24 – 1 = 23, the rejection points are as follows:

Significance level	Rejection points for t-test
0.10	t < –1.714 and t > 1.714
0.05	t < –2.069 and t > 2.069
0.01	t < –2.807 and t > 2.807

Because the calculated test statistic is 2.41, the null hypothesis is thus rejected at the 0.05 and 0.10 levels of significance but not at 0.01.

Q-111. Solution: B.

A test statistic is determined by the following formula:

$$t = \frac{\bar{x} - \mu_0}{s / \sqrt{n}}$$

Q-112. Solution: C.

Describe the properties of Student's t-distribution and calculate and interpret its degrees of freedom.

C is correct. When the sample size is small, the Student's t-distribution is preferred if the variance is unknown.

Q-113. Solution: B.

The calculated test statistic is:

$$\mathrm{t} = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}} = \frac{-0.1452\sqrt{248-2}}{\sqrt{1-(-0.1452)^2}} = -2.30177$$

Because the absolute value of t = −2.30177 is greater than 1.96, the correlation coefficient is statistically significant.

Q-114. Solution: A.

The p-value is the smallest level of significance at which the null hypothesis can be rejected. The smaller the p-value, the stronger the evidence against the null hypothesis. P-values close to zero strongly suggest that the null hypothesis should be rejected.

Q-115. Solution: C.

If the p-value is less than the specified level of significance, the null hypothesis is rejected.

Q-116. Solution: C.

If the p-value is less than the specified level of significance, the null hypothesis is rejected. Definetion of p-value: the smallest level of significance at which the null hypothesis can be reject.

Q-117. Solution: A.

Because the p-value (0.0567) exceeds the stated level of significance (0.05), the null hypothesis cannot be rejected. Therefore, A is correct and C is incorrect.

B is incorrect. A 5% confidence level does not allow the significance level to be increased beyond 5%.

Q-118. Solution: A.

By the definition of p-value, 0.04 is the smallest level of significance at which the null hypothesis can be rejected. An analyst cannot reject the null hypothesis at the 0.01 significance level.

Q-119. Solution: C.

Type I error is the rejection of the null hypothesis when it’s actually true, while Type II error is the failure to reject the null hypothesis when it’s actually false. Significance level (α) is the probability of making a Type I error. Power of a test is the probability of correctly rejecting the null hypothesis when it is false

Q-120. Solution: B.

Decrease the significance level can increase type II error and decrease type I error.

Q-121. Solution: C.

The only way to avoid the trade-off between the two types of errors is to increase the sample size; increasing sample size (all else equal) reduces the probability of both types of errors. From the reading on sampling and estimations, all else equal, a larger sample size will decrease both the standard error and the width of the confidence interval. In other words, the precision of the estimate of the population parameter is increased.

Q-122. Solution: A.

When the probability of Type II error increase, the probability of Type I error will decrease, which means that the significance level (α) will decrease. So the width of confidence interval will increase.

Q-123. Solution: C.

A Type I error is the mistake of rejecting the null hypothesis when it is, in fact, true.

Q-124. Solution: C.

Failure to reject a false null hypothesis is a Type II error.

Q-125. Solution: B.

The power of a test is the probability of correctly rejecting the null hypothesis-that is, the probability of rejecting the null when it is false.

2.2. 进阶题

Q-1. Solution: B.

After year 4, the 24-year fixed-rate mortgage has the largest payment.

The loan payments are summarized in the table below.

Mortgage type	Initial Payment ($)	Payment after adjustment($)
32-year fixed	12,389.92	12,389.92
24-year fixed	13,119.56	13,119.56
32-year adjustable	9,836.93	11,785.90

Payment on the 32-year fixed is calculated as:

N = 12×32= 384, I/Y = 6.5/12, PV = -2,000,000, FV = 0; CPT PMT = 12,389.92

Payment on the 24-year fixed is calculated as:

N = 12×24 = 288, I/Y = 6/12, PV = -2,000,000, FV = 0; CPT PMT = 13,119.56

Payment on the 32-year adjustable is calculated as:

Initial payment

N = 12×32 = 384, I/Y = 4.5/12, PV = -2,000,000; FV = 0; CPT PMT = 9,836.93

Balance at end of year 4:

N = 12×28 = 336, I/Y = 4.5/12, FV = 0, PMT = 9,836.93; CPT PV =-1,877,349.82

Payment after the end of year 4:

N = 336, I/Y = 6.2/12, PV = -1,877,349.82; FV = 0; CPT PMT =11,785.90

Q-2. Solution: B.

This scenario provides an example of a discrete random variable. The paired outcomes for the dice are indicated in the following table. The outcome of the dice summing to six is the most likely to occur of the three choices because it can occur in five different ways, whereas the summation to five and nine can occur in only four different ways.

Summed Outcome Paired Outcomes (Die 1, Die 2) Possible Combinations

5 (1, 4), (2, 3), (3, 2), and (4, 1) 4

6 (1, 5), (2, 4), (3, 3), (4, 2), and (5, 1) 5

9 (3, 6), (4, 5), (5, 4), and (6, 3) 4

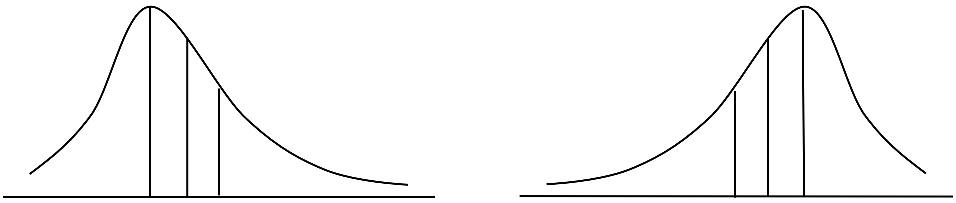
Q-3. Solution: C.

The t-statistic for the given information (normally distributed populations, population variances assumed equal) is calculated as:

$$t = \frac{(210-195)-0}{\left(\frac{3377.13}{28}+\frac{3377.13}{21}\right)^{0.5}} = 0.89$$

Q-4. Solution: A.

As shown in the following figure, the median is smaller than the mean for the positive skew. In contrast, the median is larger than the mean for the negative skew.



Mode < Median < Mean
Positive (right) skew

Mean < Median < Mode
Negative (left) skew

Therefore, if the two means equal, the median of the negative skew is larger than that of positive skew.

Q-5. Solution: C.

Identify the appropriate test statistic and interpret the results for a hypothesis test concerning 1) the variance of a normally distributed population, and 2) the equality of the variances of two normally distributed populations based on two independent random samples.

C is correct. The test statistic is the ratio of the variances, with the larger variance in the numerator. Here, the test statistic is 30 ÷ 5 = 6. The degrees of freedom are 5 by 5. Because it is a two-tailed test, the correct critical value at α = 5% is 7.15. And because the test statistic is less than the critical value, we cannot reject the null hypothesis.

Q-6. Solution: B.

The test statistic is : $\frac{d-\bar{\mu}_{d0}}{S_d/\sqrt{n}}$ where d is the mean difference, $\bar{\mu}_{d_0}$ is the hypothesized difference in the means, s_d is the sample standard deviation of differences, and n is the sample size. In this case, the test statistic equals : ${(5.25-0)}\big/{(6.25/\sqrt{25})} = 4.20$. Because 4.20 > 2.807, the null hypothesis that the mean difference is zero is rejected.

Q-7. Solution: A.

Point estimates are less reliable than confidence interval estimates.

Using the *t*-distribution rather than the normal distribution is a more conservative approach to construct confidence intervals, and thus increase the reliability of the confidence interval.

Increasing the sample size can also increase the reliability of the confidence interval.

Q-8. Solution: C.

First, calculate the return difference each year:

Year	Portfolio A (%)	Portfolio B (%)	Differences (%)
2013	11	9	-2
2014	-10	4	14
2015	1	-3	-4
2016	8	12	4
2017	21	23	2
2018	2	-4	-6

And calculate the mean difference of returns using a financial calculator: $\bar{d} = \frac{1}{n}\sum d_i = 1.33\%$

Then, calculate the sample standard deviation and the standard error of the mean difference using a financial calculator:

$$S_d = \sqrt{\frac{\sum (d_i - \bar{d})^2}{n-1}} = 7.23\%$$

$$S_{\bar{d}} = \frac{S_d}{\sqrt{n}} = \frac{7.23\%}{\sqrt{6}} = 2.95\%$$

Finally, calculate the *t*-statistic: $t = \frac{\bar{d} - 0}{S_{\bar{d}}} = 0.45$

Q-9. Solution: A.

Head and shoulders pattern: Price target = neckline – (head – neckline) = 23 – (33 – 23) = 13.

Q-10. Solution: A.

Bayes' formula: $P(A|B) = \frac{P(B|A)}{P(B)} \times P(A)$

Updated probability of event given the new information:

where

Updated probability of event given the new information: P(EPS below|Cut div);

Probability of the new information given event: P(Cut div|EPS below) = 86%;

Unconditional probability of the new information: P(Cut div) = 24.75%;

Prior probability of event: P(EPS below) = 21%.

Therefore, the probability of EPS falling below the consensus is updated as:

P(EPS below | Cut div) = [P(Cut div | EPS below)/P(Cut div)] × P(EPS below)

= (0.86/0.2475) × 0.21 = 0.73

Q-11. Solution: C.

The most appropriate test statistic for the difference between two population means (unequal and unknown population variances) is $t = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{(\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2})^{0.5}}$.

Q-12. Solution: B.

Monte Carlo simulation provides a distribution of possible solutions to complex functions. The central tendency and the variance of the distribution of solutions give important clues to decision makers regarding expected results and risk.

Q-13. Solution: A.

There are two steps in standardizing a random variable X: Subtract the mean of X from X, and then divide that result by the standard deviation of X. This is represented by the following formula: $Z = (X - \mu)/\sigma$.

Q-14. Solution: A.

Any descriptive measure of a population characteristic is called a parameter.

Q-15. Solution: B.

Sampling errors will result in statistical error. A statistically significant result might not be economically meaningful after an analyst accounts for the risk, transaction costs, and applicable taxes.

Q-16. Solution: C.

Investors should be attracted by a positive skew (distribution skewed to the right) because the mean return falls above the median. Relative to the mean return, positive skew amounts to a limited, though frequent, downside compared with a somewhat unlimited, but less frequent, upside.

Q-17. Solution: A.

The test statistic makes use of the F-distribution and is the ratio of the variances, with the larger variance in the numerator. The test statistic is $F = s_2^2 / s_1^2 = 25/5 = 5$. The degrees of freedom are 5 by 5. Because it is a two-tailed test, the correct critical value at α = 5% is 7.15 (Panel B). Because the test statistic is less than the critical value (i.e., 5 < 7.15), the null hypothesis cannot be rejected.