FRM Part I Exam

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Questions - Quantitative Analysis

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Reading 12: Fundamentals of Probability

Q.315 The probability of an increase in the annual dividend paid out to shareholders of ABC Limited is 0.4. The probability of an increase in share price given an increase in dividends is 0.7. Determine the joint probability of an increase in dividends and an increase in the share price.

A. 0.28

B. 0.14

C. 0.72

D. 0.3

Q.316 Two events are said to be independent if:

A. They cannot occur at the same time.

B. The occurrence of one of the events affects the probability of occurrence of the other event.

C. The occurrence of one of the events does not affect the probability of occurrence of the other event .

D. The occurrence of one of the events means the second event is certain to occur.

Q.317 A financial risk manager exam candidate is asked two questions. The probability that she gets the first question correct is 0.4 and the probability that she gets the second question correct is 0.5. Given that the probability that she gets both questions correct is 0.2, determine the probability that she gets either the first or the second question correct.

A. 0.9

B. 0.7

C. 0.1

D. 0.4

Q.318 An empirical study of ABC stock listed on the New York Exchange reveals that the stock has closed higher on one-third of all days in the past few months. Given that up and down days are independent, determine the probability of ABC stock closing higher for six consecutive days.

A. 0.17

B. 0.0137

C. 0.03704

D. 0.00137

Q.319 A fruit juice shop allows customers to choose apple juice, mango juice or passion juice. The probability of a customer ordering passion juice is 0.45, mango juice and apple juice 0.19, passion juice and mango juice 0.15, passion juice and apple juice 0.25, passion juice or mango juice 0.6, passion juice or apple juice 0.84, and 0.9 for at least one of them.
Find the probability that a customer orders all the three juices.

A. 0.64

B. 0.1

C. 0.3

D. 0.25

Q.321 During a lottery, 400 names are fed into a computer program. Five of the names are identical. If a name is drawn from the program at random, what is the probability that one of these 5 names will be drawn?

A. 0.0125

B. 0.25

C. 0.0025

D. 0.0625

Q.322 If two events are not independent, the joint probability of A and B, $P(A \cap B)$ is equal to:

A. $\frac{P(A|B)}{P(B)}$

B. P(A | B) * P(B)

C. P(A) * P(B)

D. None of the above

Q.323 Use the following incomplete probability matrix to compute the joint probability of a poor economy and an increase in interest rate:

Economy	Interest Rate-Increase	Interest Rate-No Increase
Good	20%	10%
Normal	30%	20%
Poor	X	10%

A. 0.2

B. 0.3

C. 0.1

D. 0.05

Q.324 Calculate the probability that a stock return is either below -5% or above 5%, given:
P(R < -5%) = 16%
P(R > +5%) = 18%

A. 0.02

B. 0.32

C. 0.34

D. 0.16

Q.356 A financial risk manager has three routes to get to the office. The probability that she gets to the office on time using routes X, Y, and Z are 60%, 65%, and 70%. She does not have a preferred route and is therefore equally likely to choose any of the three routes. Calculate the probability that she chose route Z given that she arrives to work on time.

A. 0.359

B. 0.233

C. 0.216

D. 0.2

Q.357
A life assurance company insures individuals of all ages. A manager compiled the following statistics of the company's insured persons:

Age of insured	Mortality (Probability of death) [arbitrary]	Portion of company's insured persons
16-20	0.04	0.10
21-30	0.05	0.29
31-65	0.10	0.49
66-99	0.14	0.12

If a randomly selected individual insured by the company dies, calculate the probability that the dead client was age 16-20.

A. 0.9525

B. 0.0593

C. 0.0630

D. 0.0475

Q.358
A life assurance company insures individuals of all ages. A manager compiled the following statistics of the company's insured persons:

Age of insured	Mortality (Probability of death) [arbitrary]	Portion of company's insured persons
16 – 20	0.04	0.10
21 – 30	0.05	0.29
31 – 65	0.10	0.49
66 – 99	0.14	0.12

If a randomly selected individual insured by the company dies, calculate the probability that the dead client was in age range 21-30.

A. 0.172

B. 0.04

C. 0.168

D. 0.145

Q.359
A life assurance company insures individuals of all ages. A manager compiled the following statistics of the company's insured persons:

Age of insured	Mortality (Probability of death) [arbitrary]	Portion of company's insured persons
16-20	0.04	0.10
21-30	0.05	0.29
31-65	0.10	0.49
66-99	0.14	0.12

Compute the probability that the dead client was in the age range 31-65.

A. 0.58

B. 0.172

C. 0.168

D. 0.047

Q.360 A life assurance company insures individuals of all ages. A manager compiled the following statistics of the company's insured persons:

Age of insured	Mortality (Probability of death) [arbitrary]	Portion of company's insured persons
16-20	0.04	0.10
21-30	0.05	0.29
31-65	0.10	0.49
66-99	0.14	0.12

Calculate the probability that the dead client was between 66 and 99 years.

A. 0.047

B. 0.172

C. 0.12

D. 0.201

Q.361 An investment firm classifies capital projects into three different categories, depending on risk level: Standard, Preferred, and Ultra-preferred. Of the firm's projects, 60% are standard, 30% are preferred, and 10% are ultra-preferred. The probabilities of a project making a loss are 0.01, 0.005, and 0.001 for categories standard, preferred, and ultra-preferred respectively.
If a capital project makes a loss in the next year, then what is the probability that the project was standard (correct to 2 decimal places)?

A. 0.79

B. 0.73

C. 0.22

D. 0.15

Q.363 Upon arrival at a cancer treatment center, patients are categorized into one of four stages, namely: stage 1, stage 2, stage 3, and stage 4. In the past year,
i. 10% of patients arriving were in stage 1
ii. 40% of patients arriving were in stage 2
iii. 30% of patients arriving were in stage 3
iv. The rest of the patients were in stage 4
v. 10% of stage 1 patients died
vi. 20% of stage 2 patients died
vii. 30% of stage 3 patients died
viii. 50% of stage 4 patient died

Given that the patient died, what is the probability that the patient was in stage 4 cancer?

A. 0.86

B. 0.1

C. 0.36

D. 0.5

Q.364 You are an analyst at a large mutual fund. After examining historical data, you establish that all fund managers fall into two categories: superstars (S) and ordinaries (O).
Superstars are by far the best managers. The probability that a superstar will beat the market in any given year stands at 70%. Ordinaries, on the other hand, are just as likely to beat the market as they are to underperform it. Regardless of the category in which a manager falls, the probability of beating the market is independent from year to year. Superstars are rare diamonds because only a meager 16% of all recruits turn out to be superstars.

During the analysis, you stumble upon the profile of a manager recruited three years ago, who has since gone on to beat the market every year.

Determine the probability that the manager was a superstar when he was recruited into the fund.

A. 0.5

B. 0.86

C. 0.7

D. 0.16

Q.365 You are an analyst at a large mutual fund. After examining historical data, you establish that all fund managers fall into 2 categories: superstars (S) and ordinaries (O).
Superstars are by far the best managers. The probability that a superstar will beat the market in any given year stands at 70%. Ordinaries, on the other hand, are just as likely to beat the market as they are to underperform it. Regardless of the category in which a manager falls, the probability of beating the market is independent of year to year. Superstars are rare diamonds because only a meager 16% of all recruits turn out to be superstars.

During the analysis, you stumble upon the profile of a manager recruited 3 years ago, who has since gone on to beat the market every year.

What is the probability that the manager is a superstar as at present?

A. 0.46

B. 0.34

C. 0.84

D. 0.16

Q.366 You are an analyst at a large mutual fund. After examining historical data, you establish that all fund managers fall into two categories: superstars (S) and ordinaries (O).
Superstars are by far the best managers. The probability that a superstar will beat the market in any given year stands at 70%. Ordinaries, on the other hand, are just as likely to beat the market as they are to underperform it. Regardless of the category in which a manager falls, the probability of beating the market is independent of year to year. Superstars are rare diamonds because only a meager 16% of all recruits turn out to be superstars.

During the analysis, you stumble upon the profile of a manager recruited three years ago, who has since gone on to beat the market every year.

What is the conditional probability for a non-superstar manager given that he/she has beaten the market for 3 years?

A. 0.66

B. 0.7

C. 0.45

D. 0.64

Q.367 A human health organization tracked a group of individuals for five years. At the commencement of the study, 25% were categorized as heavy smokers, 40% as light smokers, and the remaining as nonsmokers. Results revealed that light smokers were twice as likely as nonsmokers to die during the half-decade study, but only half as likely as heavy smokers. During the period, a randomly selected group member passed on.
Compute the probability that the individual who died was a heavy smoker.

A. 19%

B. 53%

C. 47%

D. 18%

Q.369 Peter selects a coin from a pair of coins and tosses it. While coin 1 is double-headed, coin 2 is a normal unbiased coin. After the toss, the result is a head. Calculate the probability that it was coin 1 which was tossed.

A. $\frac{1}{3}$

B. $\frac{2}{3}$

C. 0.5

D. 0.75

Q.3251 The probability that the Eurozone economy will grow this year is 18%, and the probability that the European Central Bank (ECB) will loosen its monetary policy is 26%. Assuming that the joint probability that the Eurozone economy will grow and the ECB will loosen its monetary policy is 12%, then the probability that either the Eurozone economy will grow or the ECB will loosen its the monetary policy is *closest to*:

A. 14%

B. 32%

C. 44%

D. 6%

Q.3252 A mathematician has given you the following conditional probabilities:

$p(O\|T) = 0.62$	Conditional probability of reaching the office if the train arrives on time
$p(O\|T^c) = 0.47$	Conditional probability of reaching the office if the train does not arrive on time
$p(T) = 0.65$	Unconditional probability of the train arriving on time
$p(O) = ?$	Unconditional probability of reaching the office

What is the unconditional probability of reaching the office, p(O)?

A. 0.5675

B. 0.4325

C. 0.3265

D. 0.3333

Q.3254 An investor owns shares of both Apple and Microsoft. The two companies operate independently. The investor assumes that the probability of Apple's share price declining by more than 5% this year is 0.4 while the probability of Microsoft's share price declining by more than 5% is 0.3. What is the probability that either Apple or Microsoft share prices will decline in price by more than 5% this year?

A. 0.58

B. 0.12

C. 0.7

D. 0.67

Q.3255 The probabilities that Bond A and Bond X will default in the next two years are 10% and 8%, respectively. The probability that both bonds will default simultaneously in the next two years is 5%. The probability that Bond A will default given that Bond X has already defaulted is *closest to*:

A. 62.50%.

B. 50%.

C. 80%.

D. 37.50%

Q.3256 There is a 40% chance that ABX will announce negative quarterly results tomorrow. On any given day, there is a 55% chance that the company's stock price will decrease. If negative quarterly results are announced, the probability that the stock price will decline is 85%. Tomorrow, the probability that ABX will announce negative quarterly results or that the stock will decrease in price is *closest to*:

A. 0.72

B. 0.95

C. 0.85

D. 0.61

Q.3257 The probability that a portfolio manager reads Business News weekly is 0.50, while the probability that a portfolio manager reads BloomField News is 0.40. If the probability that a portfolio manager reads both Business News and BloomField News is 0.30, then the probability that a portfolio manager does not read any of the two newspapers is *closest* to:

A. 0.30.

B. 0.40.

C. 0.50.

D. 0.6

Q.3590 An athlete takes part in two different events. The probability that she wins the first event is 0.3 and the probability that she wins the second event is 0.4. Given that the probability that she wins the first and the second event is 0.1, calculate the probability that she wins either the first or the second event.

A. 0.2

B. 0.5

C. 0.6

D. 0.1

Q.3591 A homeowners insurer offers a discount for homeowners that either have a sprinkler system or live within 5 miles of a fire station. 60% of homeowners qualify for the discount. Only 15% of homeowners have a sprinkler system, and none of those homeowners live within 5 miles of a fire station. If the events are mutually exclusive, what is the probability a randomly selected homeowner lives within 5 miles of a fire station?

A. 15%

B. 25%

C. 30%

D. 45%

Q.3592 A patient is considered high risk for a heart attack if they either have high cholesterol or high blood pressure. What percentage of patients are NOT considered high risk for a heart attack if 25% have high cholesterol, 30% have high blood pressure and 10% have both high cholesterol and high blood pressure?

A. 45%

B. 50%

C. 55%

D. 60%

Q.3596 55% of an insurer's policyholders are male and 45% are female. The chances of a male having a claim stand at 10% while the chances of a female having a claim stand at 7%. What is the probability that NO ONE will have a claim?

A. 83%

B. 90%

C. 91%

D. 93%

Q.3599 Which two events are NOT considered independent?

A. Rolling a die; rolling another die

B. Flipping a coin; flipping a coin

C. Rolling a die; flipping a coin

D. Drawing a card; drawing another card from the same deck

Q.3600 Events A and B are mutually exclusive events and P(A)= .3 while P(B) = .5. Calculate P(A u B).

A. 0.2

B. 0.35

C. 0.5

D. 0.80

Q.3601 A company insures both male and female drivers. At the moment, the company has insured an equal number of male and female drivers. Males have a 0.15 chance of having a claim during a policy period while females have a 0.10 chance of having a claim. If a driver is randomly selected from the population, what is the probability that the driver has no claim during the policy period?

A. 73.5%

B. 76.5%

C. 77.5%

D. 87.5%

Q.3602 For a certain insured, the probability of making no claim during a policy period is .60. The probability of making 1 claim is .25. What is the probability that this insured makes no more than 1 claim during the policy period?

A. 0.15

B. 0.25

C. 0.35

D. 0.85

Q.3603 For a certain insured, the probability of making no claim during a policy period is .60. The probability of making 1 claim is .25. What is the probability that this insured makes more than 1 claim during the policy period?

A. 0.15

B. 0.25

C. 0.35

D. 0.6

Q.3606 60% of an insurer's policyholders are male and 40% are female. The chance of a female having a claim is twice the chance of a male having a claim. Given a randomly selected policyholder has a claim, what's the probability that the policyholder is a male?

A. 35%

B. 65%

C. 57%

D. 43%

Q.3607 55% of an insurer's policyholders are male and 45% are female. The chance of a male having a claim is 10% and the chance of a female having a claim is 7%. Given a randomly selected policyholder has a claim, what's the probability she is a female?

A. 25%

B. 33%

C. 36%

D. 38%

Q.3609 A company insures red and black cars, male and female drivers and writes policies in 2 territories (A and B). There are 300 male drivers and 200 female drivers in total. There are 150 males who drive red cars and 100 females who drive red cars. 100 male and 100 female drivers live in territory A and 50 of each, males and females, drive red cars in territory A. Given that a randomly selected policyholder drives a black car, what is the probability that they are female and live in territory B?

A. 20%

B. 25%

C. 33%

D. 40%

Q.3610 A patient is considered high risk for a heart attack if they either have high cholesterol or high blood pressure and the two events are independent. In a given population, 25% have high cholesterol and 30% have high blood pressure. If a randomly selected person has high blood pressure, what is the probability they also have high cholesterol?

A. 15%

B. 20%

C. 25%

D. 33%

Q.3611 A patient is considered high risk for a heart attack if they either have high cholesterol or high blood pressure. In a given population, 45% of people are considered high risk for a heart attack, (25% have high cholesterol, 30% have high blood pressure). If a randomly selected person has high blood pressure, what is the probability they also have high cholesterol?

A. 15%

B. 20%

C. 25%

D. 33%

Q.3613 Given the following chart describing the claims of an auto insurer during a policy period, calculate P (C|M). (Assume that the number of male and female claims are independent of each other.)

	Male (M)	Female (F)	Total
Claim (C)	100	200	300
No Claim (X)	400	600	1000
Total	500	800	1300

A. 8%

B. 10%

C. 20%

D. 23%

Q.3615 An insurance company classifies its policyholders into three tiers – standard, preferred, and ultra preferred. 40% of standard tier policyholders are male, 50% of preferred tier policyholders are male and 75% of ultra preferred tier policyholders are male. There is an equal number of policyholders in each tier. If a policyholder is selected at random, what is the chance she is female?

A. 25%

B. 30%

C. 33%

D. 45%

Q.3616 An insurance company classifies its policyholders into three tiers – standard, preferred, and ultra preferred. 40% of standard tier policyholders are male, 50% of preferred tier policyholders are male and 75% of ultra preferred tier policyholders are male. There is an equal number of policyholders in each tier. If a male policyholder is selected at random, what is the chance he is classified as a standard tier?

A. 15%

B. 24%

C. 30%

D. 33%

Q.3617 An insurance company classifies its policyholders into three tiers – standard, preferred and ultra preferred with a 25%/50%/25% distribution. The chance of a policyholder in the standard tier having a claim is 10%, in the preferred tier it is 5% and in the ultra preferred tier it is 2%. Given a policyholder has a claim, what is the probability they came from the ultra preferred tier?

A. 5%

B. 7%

C. 9%

D. 11%

Q.3618 There are three different bags. The first bag contains 3 square blocks and 2 round blocks. The second bag contains 2 square blocks and 3 round blocks. The third bag contains 5 round blocks. In an experiment, a bag is randomly chosen, and then a block is chosen from the bag. What is the probability that a round block is chosen?

A. 1/5

B. 1/3

C. 2/5

D. 2/3

Q.3619 There are three different bags. The first bag contains 3 square blocks and 2 round blocks. The second bag contains 2 square blocks and 3 round blocks. The third bag contains 5 round blocks. In an experiment, a bag is randomly chosen and then a block picked. Given a round block was selected, what is the probability it came from the second bag?

A. 1/5

B. 3/10

C. 1/3

D. 2/5

Q.3620 There are two bags with red and white balls. The first bag has 5 red and 5 white balls. The second bag has 3 red and 2 white balls. A bag is randomly selected and a ball is drawn. If the ball is red, another ball is selected from the same bag. If the ball is white, another ball is selected from the other bag. What is the probability that the second ball drawn is red?

A. 40%

B. 50%

C. 51%

D. 53%

Q.3621 In a game, a coin is flipped. If the coin is heads, the player rolls one die. If the coin turns up tails, the player rolls two dice and the player moves their playing piece the number of spots shown on the die or dice. Given that on a player's turn, he moves 5 spaces, what is the probability he flipped tails on the coin?

A. 1/10

B. 1/5

C. 2/5

D. 1/3

Q.3624 An insurance company writes business in three territories: A, B and C. They have 150 policyholders in territory A, 250 in territory B and 300 in territory C. A person is twice as likely to have a claim in territory B than territory A and 3 times as likely to have a claim in territory C than territory A. On average, 50 people have a claim every policy period. Given a claim occurs, what is the probability it was a policyholder in territory C?

A. 21%

B. 33%

C. 43%

D. 58%

Q.3625 A test for heart disease results in a correct positive diagnosis 95% of the time and a correct negative diagnosis 99% of the time. 25% of the population has heart disease. What is the probability of a positive test?

A. 0.275

B. 0.150

C. 0.245

D. 0.950

Q.3626 A test for heart disease results in a false positive 5% of the time. 25% of the population has heart disease and 20% test positive. What is the probability of a negative test given that the patient has no heart disease. ?

A. 0.67

B. 0.07

C. 0.0533

D. 0.9467

Q.3643 A company insures red and black cars, male and female drivers and writes policies in 2 territories A and B. There are 300 male drivers and 200 female drivers in total. There are 150 males who drive red cars and 100 females who drive red cars. 100 male and 100 female drivers live in territory A and 50 of each, males and females, drive red cars in territory A. What is the probability that a randomly selected driver is either female or lives in territory B?

A. $\frac{2}{5}$

B. $\frac{7}{10}$

C. $\frac{4}{5}$

D. $\frac{9}{10}$

Reading 13: Random Variables

Q.311 Which of the following can be categorized as continuous random variables?
I. Stock returns on a given day
II. The weight of 20 FRM candidates (in pounds)
III. The total amount of Biannual share dividends received over a 10-year period
IV. The number of holidays in a given year
V. The annual number of FRM exam candidates in the last 10 years

A. I, III, and V

B. I, II, and III

C. I, II, III, and V

D. All the above

Q.312 Consider the following probability function for a discrete random variable X:

$$P(x) = \frac{x}{100}, X = 10, 20, 30, Y, ; \text{ otherwise } P(x) = 0$$

Find the value of Y.

A. 4

B. 40

C. 50

D. 5

Q.314 The following is the probability mass function for a discrete random variable X,

$$P(x) = \frac{x}{100}; X = 10, 20, 30, 40$$

Determine the CDF at X =30, i.e., F(30)

A. 0.2

B. 0.3

C. 0.7

D. 0.6

Q.327 The following table presents the probability distribution of the earnings per share (EPS) for a certain company:

Probability	EPS	Interest Rates	Beta
20%	$1.5	21%	1.15
10%	$2.0	20%	10%
30%	$1.3	20%	1.25
40%	$1.2	10%	

Compute the expected earnings per share.

A. 2

B. 1.5

C. 1.37

D. 1.2

Q.330 A discrete random variable Y has probability function given by:

Y	0	1	2
P(Y = y)	0.3	0.6	0.1

Calculate Var(Y).

A. 0.2

B. 0.36

C. 0.8

D. 1

Q.334 Which of the following best describes the concept of skewness in statistics?

A. The degree to which a distribution is symmetric about its mean.

B. The degree to which a distribution is nonsymmetric about its median.

C. The degree to which a distribution is nonsymmetric about its mean.

D. The degree to which a random variable spreads around its mean.

Q.335 Which of the following is *incorrect* about kurtosis?

A. Excess kurtosis is a measure relative to the uniform distribution, which has a kurtosis of 3.

B. Excess kurtosis that's negative indicates a platykurtic distribution.

C. Excess kurtosis that's positive indicates a leptokurtic distribution.

D. The normal distribution has a kurtosis equal to 3.

Q.336 Mary Noel, FRM, is tasked with analyzing the returns of two different assets – A and B. She finds that the two assets have the same mean, variance, and skewness, but A has a higher kurtosis than B. Which of the following statements is most likely true?

A. Asset A is riskier than asset B.

B. Asset B is riskier than asset A.

C. Both assets are highly profitable.

D. Assets A and B will earn negative returns in the long term.

Q.337 The following are measures of variability, EXCEPT:

A. Variance

B. Standard deviation

C. Range

D. Median

Q.3260 Which of the following statements is *most* accurate?
Skewness refers to the extent a distribution is:

A. Symmetrical. In negatively-skewed distributions, the mean is to the left of the peak.

B. Asymmetrical. In negatively-skewed distributions, the mean is to the right of the peak.

C. Asymmetrical. In positively-skewed distributions, the mean is to the right of the peak.

D. Asymmetrical. In left-skewed distribution, the mean coincides with the peak.

Q.3262 Assume you're a financial risk manager at an investment management firm where you're given the task to estimate the dispersion of a specific equity price around its forecasted value. As a financial risk manager, calculate the variance of equity value using the data provided in the following table.

Probability	Equity Value
0.33	$62.15
0.39	$60.75
0.28	$63

A. 0.87

B. 0.93

C. 0.75

D. 0.78

Q.3268 An equity research analyst forecasts the share price of Equidor Inc.'s stock and the probability of achieving the price target. The forecast made by the analyst is given in the following exhibit.

Exhibit 1: Share Price Forecast

Probability	Share Price
20%	$32.00
25%	$28.00
40%	$34.00
15%	$38.00

What is the variance of Equidor's stock price?

A. 12.450

B. 10.51

C. 16.324

D. 12.213

Q.3269 Which of the following is an example of a continuous random variable?

A. The number of defective TV sets in a container.

B. The number of visits recorded at a risk management consultancy office on a given day.

C. The amount of time required to run a mile.

D. None of the above.

Q.3739 Let X have the following probability density function:

$$f_X(x) = \begin{cases} 0.15 & x = 1 \\ 0.25 & x = 2 \\ 0.35 & x = 3 \\ C & x = 4 \end{cases}$$

Calculate the mode of the distribution.

A. 1.5

B. 2.0

C. 2.5

D. 3.0

Q.3836 The average salary for an employee at Capital Asset Managers is $50,000 per year. This year, the management has decided to award bonuses to every employee:

- A Christmas bonus of $1,000
- An incentive bonus equal to 15% of the employee's salary

Determine the mean bonus received by employees.

A. $8,500

B. $4,250

C. $500

D. $10,500

Q.3837 At Capital Bank, the average salary among sales employees is $30,000 per year, and they are also entitled to a bonus of $0.05 for every dollar of sales brought in. Average sales amount to $300,000 per year. Determine the mean compensation received by employees.

A. $165,000

B. $45,000

C. $22,500

D. $330,000

Q.3838 The average salary for an employee at Capital Asset Managers is $50,000 per year, with a variance of 6,000,000. This year, the management has decided to award bonuses to every employee:

- A Christmas bonus of $1,000
- An incentive bonus equal to 15% of the employee's salary

Calculate the standard deviation of employee bonuses.

A. $8,500

B. $250

C. $367

D. $10,500

Q.3839 At Capital Bank, the compensation framework is made up of a basic salary plus bonuses. The average salary among sales employees is $30,000 per year, and they are also entitled to a bonus of $0.05 for every dollar of sales brought in. Average sales amount to $300,000 per year with a variance of 5,000,000. Determine the standard deviation of compensation received by employees.

A. $165

B. $450

C. $222

D. $112

Reading 14: Common Univariate Random Variables

Q.340 During a disease outbreak, the probability of surviving after an infection is 60%. Determine the probability that at least 8 out of a group of 9 infected persons will survive.

A. 0.7

B. 0.07

C. 0.007

D. 0.06

Q.341 June Barrow, FRM, runs a consultancy firm that offers investment advice to clients in Canada. The number of clients the firm receives in a month follows a Poisson distribution with a mean of 4. What is the probability that the firm receives exactly 44 new clients in a year, assuming every client is independent?

A. 0.025

B. 0.0506

C. 0.24

D. 0.00363

Q.342 Which of the following is NOT true regarding the normal distribution?

A. It's completely described by its mean, μ, and variance, σ^2.

B. Its skewness = 3 and kurtosis = 0.

C. A linear combination of two normally distributed variables also has a normal distribution.

D. The probabilities of extreme events (those further above and below the mean) continually get smaller but extend infinitely without going to zero.

Q.343 Consider the following events:
I. Throwing a fair, six-sided die
II. The rate at which customers walk into a banking hall per day
III. The score of 50 FRM exam candidates in a mock test
IV. Tossing a coin
V. Picking an orange from a basket containing 10 equally sized oranges

Which of the events above exhibit uniform distributions?

A. I, IV and V

B. I and II only

C. II and III only

D. None of the above

Q.344 The probability that a patient suffering from typhoid will be treated successfully is 0.8. Forty patients are subjected to treatment. Determine the expected value of the number of patients who are treated successfully.

A. 7

B. 28

C. 8

D. 32

Q.345 The rate of registration for the FRM exam by candidates takes on a Poisson distribution with mean λ. Which of the following statements is correct?

A. Mean equals the standard deviation.

B. Mean equals the variance.

C. Median equals the variance.

D. Median, mean and variance are all equal.

Q.347 In the standard normal distribution, what do z-scores represent?

A. Scores below the mean in units of the standard deviation of the distribution.

B. Scores below and above the variance in units of the standard deviation of the distribution.

C. Scores above the mean in units of the standard deviation of the distribution from the mean.

D. Scores below and above the mean in units of the standard deviation of the distribution.

Q.351 The normal distribution and the lognormal distribution are related in such a way that:

A. If a random variable X follows a lognormal distribution, ln X is normally distributed.

B. If a random variable X follows a normal distribution, ln X is said to have a lognormal distribution.

C. The mean and variance of a lognormal distribution are twice that of the normal distribution, provided the value of n is the same.

D. The mean and variance of the normal distribution are twice that of the lognormal distribution, provided the value of n is the same.

Q.352 A motor vehicle production company based in California is assembling its first batch of fully electric cars. After inspecting about 100 newly assembled units, engineers establish that there are a total of 40 defects. While some units have no defects, others have one, two, or more defects. Assume that the distribution of mechanical defects follows a Poisson distribution. Drawing on the first 100 units produced, how many cars, out of every 10,000 units assembled, would we expect to have at least one defect?

A. About 330

B. About 0.330

C. About 3,300

D. About 1250

Q.353 The F-distribution and the Chi-square distribution have glaring similarities. Which of the following is not accurate?

A. Both are asymmetrical.

B. Both have a bound equal to zero on the left.

C. Their means are always less than their standard deviations.

D. They are defined by the number of degrees of freedom.

Q.354 Insurance claims in a certain class of business are modeled using a normal distribution with mean $3,000 and a standard deviation of $400. Calculate the probability that the next claim received will exceed $3,500.

A. 0.8944

B. 0.25

C. 0.75

D. 0.1056

Q.3264 As a portfolio analyst, you're directed to label a fund consisting of 9 stocks out of which 4 stocks should be small-cap stocks, 3 stocks should be blue-chips and 2 stocks should be from emerging markets. Determine how many ways these 9 stocks can be labeled.

A. 1260

B. 362880

C. 60480

D. 112840

Q.3265 A teacher wants to select groups of 3 students out of 15 for group work. How many different groups of 3 are possible?

A. 25

B. 45

C. 225

D. 455

Q.3270 A trader purchases one single stock every day during five working days. His risk manager believes that the probability of selecting an underpriced stock at any given time is 52%. Assuming a binomial distribution, what is the probability of selecting exactly two underpriced stocks during the week out of the universe of underpriced and overpriced stocks?

A. 0.395

B. 0.208

C. 0.327

D. 0.299

Q.3271 As an investment analyst, your job is to determine how many companies will announce IPOs out of 50 virtual reality startup companies operating in Palo Alto. The annual IPO rate in high-tech industries in all other states of the U.S. is 7.85%. Using a binomial model, what is the standard deviation of the number of virtual reality company IPOs in Palo Alto?

A. 3.616

B. 1.902

C. 1.38

D. 2.125

Q.3272 As a research analyst, you're analyzing the probability that the prices of copper will be set below $44/kg after the upcoming government elections. Suppose that the prices of copper are uniformly distributed with a floor at $38/kg and a ceiling at $54/kg imposed by the government, then what is the probability that the prices of copper will be set below $44/kg?

A. 0.815

B. 0.625

C. 0.375

D. 0.429

Q.3273 Which of the following are the most appropriate properties of normal distribution?

I. The mean, mode, and median are equal in a normal distribution.
II. The linear combination of two or more normally distributed random variables is not necessarily normally distributed.
III. The normal distribution has a skewness of 0 and excess kurtosis of 3.

A. II and III only.

B. I only.

C. II only.

D. All the above.

Q.3274 In Toronto, Canada, there is a 90% chance of having a sunny day. What is the probability that there will be exactly 3 sunny days in the next 7 days?

A. 0.9

B. 0.00255

C. 0.0625

D. 0.00125

Q.3275 A portfolio has an expected return of 9% with a standard deviation of 7%. If the returns are normally distributed, then what is the probability that the return will be greater than 16%?
Click here to view the normal distribution table.

A. 0.1052

B. 0.2241

C. 0.1228

D. 0.1587

Q.3276 The population living in Calgary, Canada has a mean income of CAD 55,000 with a standard deviation of CAD 10,000. If the distribution is assumed to be normal, what is the percentage of the population that makes between CAD 45,000 and CAD 50,000?
Click here to view the normal distribution table.

A. 0.1498

B. 0.1511

C. 0.1624

D. 0.2014

Q.3277 A portfolio's expected return is 17% and its standard deviation is 4%. If the returns are normally distributed, then what is the probability that the returns will be greater than 29%? Use the following standard normal table:

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9999							

A. 0.0013

B. 0.01

C. 0.13

D. 0.0525

Q.3278 A portfolio manager's bonus depends on the return generated by the fund. The different bonus bands are listed below:

Band	Bonus %
Return > 5%	2%
Return > 8%	4%
Return > 12%	10%
Return > 20%	14%
Return > 25%	20%

The mean return and the standard deviation of the fund managed by the portfolio manager stood at 8% and 2%, respectively. Assuming that mutual fund returns are normally distributed, what is the probability that the portfolio manager earns a bonus of 4% this year? Click here to view the normal distribution table.

A. 0.6737

B. 0.5

C. 0.4226

D. 0.4772

Q.3286 Which statistic should you use to compare 2 population's variances, with a sample size smaller than 30?

A. z-test

B. Chi-square test

C. t-test

D. F-test

Q.3294 Which of the following is the most common hypothesis test concerning the difference between the variance of a normally distributed population?

A. Chi-squared test

B. F-test

C. Z-test

D. t-test

Q.3628 If the rate at which accidents occur in a U.S. city is, on average, three every day, calculate the probability that more than 5 accidents occur on a single day.

A. 0.15

B. 0.06

C. 0.05

D. 0.084

Q.3629 Given a binomial random variable with $P(X=0) = .20$ and $P(X=1) = .35$ and $E(X) = 1.5$ calculate $Var(X)$.

A. 0.4

B. 0.6

C. 1

D. 1.3

Q.3630 Given a binomial random variable with $E(X) = 2$ and $Var(X) = 1.5$, calculate $P(X=5)$.

A. 0.015

B. 0.023

C. 0.039

D. 0.047

Q.3631 Given a Poisson random variable with $E(X) = .25$, calculate $P(X=1)$

A. 0.1

B. 0.15

C. 0.19

D. 0.25

Q.3632 Given a Poisson random variable with $P(X=1) = .09$ and $P(X=2) = .0045$, calculate $Var(X)$.

A. 0.009

B. 0.01

C. 0.05

D. 0.1

Q.3737 The supermarket sells discounted items for an excellent price; this price is modeled uniformly on the interval [0,500].
Calculate the difference between the median and the 10th percentile.

A. 250

B. 200

C. 240

D. 50

Reading 15: Multivariate Random Variables

Q.329 Which of the following statements is NOT true regarding the correlation coefficient?

A. The correlation coefficient measures the strength of the linear relationship between two random variables.

B. The correlation coefficient has no units.

C. The correlation coefficient ranges from 0 to +1.

D. Random variables with a correlation of +1 are said to be perfectly correlated.

Q.332 Two random variables X and Y are such that V[X] = 4V[Y] and Cov[X,Y] = V[Y]
Let E = X + Y and F = X – Y

Find Cov[E, F].

A. V[Y] – V[X]

B. Cov[X,Y]

C. V[Y]

D. 3V[Y]

Q.338 Two stocks, X and Y, have a correlation of 0.50. Stock Y's return has a standard deviation of 0.26. Given that the covariance between X and Y is 0.005, determine the variance of returns for stock X.

A. 0.13

B. 0.00148

C. 0.0385

D. 0.0148

Q.349 Which of the following *best describes* the central limit theorem?

A. When the sample size is large, the sum of independent and identically distributed (i.i.d.) random variables are normally distributed.

B. The sum of *n* independent and identically distributed random variables approaches the normal distribution as *n* becomes large.

C. For simple random samples of size *n* from a population with mean μ and finite variance σ^2, the sampling distribution approaches the normal distribution with mean μ and variance $\frac{\sigma^2}{n}$, as the sample size becomes large.

D. For simple random samples of size *n* from a population with mean μ and finite variance σ^2, the sampling distribution of the sample mean approaches the normal distribution with mean μ and variance $\frac{\sigma^2}{n}$, as the sample size becomes large.

Q.3263 Assuming that the covariance of returns of Stock X and Stock Y is $Cov(R_X, R_Y) = 0.093$, the variance of $R_X = 0.69$, and the variance of $R_Y = 0.36$, the correlation of returns of Stock X and Stock Y is *closest to*:

A. 0.155.

B. 0.1865.

C. 0.1119.

D. 0.2133

Q.3266 The covariance matrix of two stocks is given in the following exhibit.

Exhibit: Covariance Matrix

Stock	X	Y
X	650	120
Y	120	450

What is the correlation of returns for stocks X and Y?

A. 0.45

B. 0.22.

C. 0.37.

D. 0.33

Q.3267 A portfolio consists of two funds A and B. The weights of the two funds in the portfolio and the covariance matrix of the two funds are given in the following two exhibits.

Exhibit 1: Weight of the Funds in the Portfolio

Fund	A	B
Weight	60%	40%

Exhibit 2: Covariance Matrix

Fund	A	B
A	700	200
B	200	500

What is the portfolio variance?

A. 428

B. 500

C. 324

D. 328

Q.3627 Living in a certain city is really expensive. The mean spent by a citizen monthly is $3,000 with a variance of $500. Nonetheless, the city mayor decided to put a tax in order to make people regulate their monthly expenses adding 20% to all daily living articles. Find the new variance of this city.

A. 520

B. 580

C. 600

D. 720

Q.3742 The two random variables X_1 and X_2 have well-defined variances, and they are independent. What is the correlation of these random variables?

A. 0

B. 1

C. -1

D. 0.5

Q.3743 The yearly profits of the two firms A and B can be summarized in the following probability matrix.

		Company A (X_1) Profits			
		-1 Million	0 Million	2 Million	4 Million
Company B (X_2) Profits	-50 Million	0.0197	0.0395	0.010	0.002
	0 Million	0.0390	0.230	0.124	0.0298
	10 Million	0.011	0.127	0.144	0.0662
	100 Million	0	0.0309	0.0656	0.0618

What is the marginal distribution of company A?

Table A: Marginal Distribution of Company A

Company A(X_1) Profits	-1 Million	0 Million	2 Million	4 Million
$P(X_1 = x_1)$	0.0697	0.4274	0.3436	0.1598

Table B: Marginal Distribution of Company A

Company A(X_1) Profits	-1 Million	0 Million	2 Million	4 Million
$P(X_1 = x_1)$	0.0697	0.5274	0.3436	0.0593

Table C: Marginal Distribution of Company A

Company A(X_1) Profits	-1 Million	0 Million	2 Million	4 Million
$P(X_1 = x_1)$	0.0593	0.5274	0.3436	0.0697

Table D: Marginal Distribution of Company A

Company A(X_1) Profits	-1 Million	0 Million	2 Million	4 Million
$P(X_1 = x_1)$	0.0697	0.5274	0.1235	0.2794

A. Table A

B. Table B

C. Table C

D. Table D

Q.3744 The yearly profits of the two firms A and B can be summarized in the following probability matrix.

		Company A (X_1) Profits			
		-1 Million	0 Million	2 Million	4 Million
Company B (X_2) Profits	-50 Million	0.0197	0.0395	0.010	0.002
	0 Million	0.0390	0.230	0.124	0.0298
	10 Million	0.011	0.127	0.144	0.0662
	100 Million	0	0.0309	0.0656	0.0618

What is the marginal distribution of company B?

A.

Company B(X_2) Profits	-50 Million	0 Million	10 Million	100 Million
$P(X_2 = x_2)$	0.1325	0.4244	0.3599	0.0832

B.

Company B(X_2) Profits	-50 Million	0 Million	10 Million	100 Million
$P(X_2 = x_2)$	0.0235	0.4856	0.3254	0.1655

C.

Company B(X_2) Profits	-50 Million	0 Million	10 Million	100 Million
$P(X_2 = x_2)$	0.0712	0.4228	0.3482	0.1583

D.

Company B(X_2) Profits	-50 Million	0 Million	10 Million	100 Million
$P(X_2 = x_2)$	0.0633	0.4423	0.3658	0.1286

A. Table A

B. Table B

C. Table C

D. Table D

Q.3745 The yearly profits of the two firms A and B can be summarized in the following probability matrix.

		Company A (X_1) Profits			
		-1 Million	0 Million	2 Million	4 Million
Company B (X_2) Profits	-50 Million	0.0197	0.0395	0.010	0.002
	0 Million	0.0390	0.230	0.124	0.0298
	10 Million	0.011	0.127	0.144	0.0662
	100 Million	0	0.0309	0.0656	0.0618

What is the conditional distribution of company A given that company B made a profit of 100 Million?

A.

Company A(X_1) Profits	-1 Million	0 Million	2 Million	4 Million
$P(X_1 \mid X_2 = 100)$	0.0697	0.4274	0.3436	0.1598

B.

Company A(X_1) Profits	-1 Million	0 Million	2 Million	4 Million
$P(X_1 \mid X_2 = 100)$	0.0697	0.5274	0.6436	0.1598

C.

Company A(X_1) Profits	-1 Million	0 Million	2 Million	4 Million
$P(X_1 \mid X_2 = 100)$	0.0697	0.5274	0.3436	0.2598

D.

Company A(X_1) Profits	-1 Million	0 Million	2 Million	4 Million
$P(X_1 \mid X_2 = 100)$	0	0.1952	0.4144	0.3904

A. Table A

B. Table B

C. Table C

D. Table D

Q.3746 The yearly profits of the two firms A and B can be summarized in the following probability matrix.

		Company A (X_1) Profits			
		-1 Million	0 Million	2 Million	4 Million
Company B (X_2) Profits	-50 Million	0.0197	0.0395	0.010	0.002
	0 Million	0.0390	0.230	0.124	0.0298
	10 Million	0.011	0.127	0.144	0.0662
	100 Million	0	0.0309	0.0656	0.0618

Looking at the marginal distribution of companies A and B, which of the following of the statements is true?

A. The marginal distributions are independent.

B. The marginal distributions are not independent.

C. The distributions are not ideal probability distributions.

D. None of the above.

Q.3747 The yearly profits of the two firms A and B can be summarized in the following probability matrix.

		Company A (X_1) Profits			
		-1 Million	0 Million	2 Million	4 Million
Company B (X_2) Profits	-50 Million	0.0197	0.0395	0.010	0.002
	0 Million	0.0390	0.230	0.124	0.0298
	10 Million	0.011	0.127	0.144	0.0662
	100 Million	0	0.0309	0.0656	0.0618

What is the covariance of company A and B given that $E(X_1X_2) = 43.23$?

A. 24.56

B. 23.43

C. 21.45

D. 22.45

Q.3748 The yearly profits of the two firms A and B can be summarized in the following probability matrix.

		Company A Profits (X_1)			
		-1 Million	0 Million	2 Million	4 Million
Company B (X_2) Profits	-50 Million	0.0197	0.0395	0.010	0.002
	0 Million	0.0390	0.230	0.124	0.0298
	10 Million	0.011	0.127	0.144	0.0662
	100 Million	0	0.0309	0.0656	0.0618

What is the correlation coefficient between the two companies A and B if Cov(A, B) = 23.43 ?

A. 0.4553

B. 0.3827

C. 0.4562

D. 0.5651

Q.3749 An investor invests 30% of his assets in security A and 70% in security B. The variance of returns for security in security A is 1234.56, and that of B is 243.56. The covariance between securities A and B is 25.56. What is the standard deviation of the combined returns from these securities?

A. 18.89

B. 14.78

C. 15.53

D. 13.45

Q.3750 The resulting probability matrix displays the amount of returns of two income-generating sections of bank: Loans and Stock Market

Loans Return	Returns(X_1) Probability	−20% 30%	0% 55%	20% 15%
Stock Market Returns	Returns(X_2) Probability	−5% 40%	0% 31%	9% 29%

Assuming that the two income-generating avenues are independent of each other, what is the joint probability distribution (matrix)?

A.

	Loan	Return	(X_1)	
		−20%	0%	20%
Stock	−5%	12%	22%	6%
Market	0%	9.3%	17.05%	4.65%
Returns(X_2)	9%	8.7%	15.95%	4.35%

B.

	Loan	Return	(X_1)	
		−20%	0%	20%
Stock	−5%	12%	12%	7%
Market	0%	10.3%	17.05%	4.65%
Returns(X_2)	9%	8.7%	15.95%	4.35%

C.

	Loan	Return	(X_1)	
		−20%	0%	20%
Stock	−5%	12%	12%	6%
Market	0%	9.3%	27.05%	5.65%
Returns(X_2)	9%	8.7%	25.95%	4.35%

D.

	Loan	Return	(X_1)	
		−20%	0%	20%
Stock	−5%	12%	22%	6%
Market	0%	9.3%	14.05%	4.65%
Returns(X_2)	9%	7.7%	55.95%	4.35%

A. Table A

B. Table B

C. Table C

D. Table D

Q.3751 The resulting probability matrix displays the amount of returns of two independent income-generating sections of bank: Loans and Stock Market

Loans Return	Returns(X_1) Probability	20% 30%	0% 55%	20% 15%
Stock Market Returns	Returns(X_2) Probability	−5% 40%	0% 31%	9% 29%

What is the conditional distribution of loan returns given that the return from the stock market is 9%?

A.

Loans Return(X_1)	−20%	0%	20%
$P(X_1 \mid X_2 = 9\%)$	40%	31%	29%

B.

Loans Return(X_1)	−20%	0%	20%
$P(X_1 \mid X_2 = 9\%)$	9.3%	17.05%	4.65%

C.

Loans Return(X_1)	−20%	0%	20%
$P(X_1 \mid X_2 = 9\%)$	30%	55%	15%

D.

Loans Return(X_1)	−20%	0%	20%
$P(X_1 \mid X_2 = 9\%)$	8.7%	15.95%	4.35%

A. Table A

B. Table B

C. Table C

D. Table D

Q.3752 Three random variables X, Y, and Z have the equal variance of $\sigma^2 = 2$. X is independent of both Y and Z, and that Y and Z are correlated with a correlation coefficient of 0.8. What is the covariance between X and K given that K=Y+Z?

A. 0

B. 2

C. 3

D. 4

Q.3753 Three random variables X, Y , and Z have equal variance of $\sigma^2 = 2$. X is independent of both Y and Z, and that Y and Z are correlated with a correlation coefficient of 0.8. What is the covariance between Z and V given that $V = 3X - 2Y$.

A. 4.1

B. -4.3

C. 3.2

D. -3.2

Q.3754 The amount of profit (X) for a sales company is continuously distributed uniformly with the parameters 0 and 1,500. However, a financial analyst believes that the actual profit (Y) is a minimum of X. What is the conditional distribution of X given X<1,300?

A. Continuous uniform with parameters 0 and 1,300.

B. Continuous uniform with parameters 0 and 1,500.

C. Continuous uniform with parameters 0 and 1,000.

D. Continuous uniform with parameters 0 and 2,800.

Q.3755 Which one of these correlation coefficients shows the weakest linear relationship?

A. -0.8

B. 0.65

C. 0.30

D. 0.56

Q.3756 The random variables X and Y have a discrete joint distribution with joint probability function:

$$P(X = x, Y = y) = c(x + 2y); x = 0, 1, 2; y = 0, 1, 2$$

Determine the value of c.

A. $\frac{1}{10}$

B. $\frac{1}{27}$

C. 1

D. $\frac{1}{8}$

Q.3758 Let X represent the age of an insured automobile involved in an accident. Let Y denote the length of time the insurance contract has been in place at the time of the accident. X and Y have joint probability density function

$$f(x, y) = \begin{cases} \frac{1}{64}(10 - xy^2), & 2 < x < 10, 0 < y < 1 \\ 0, & \text{elsewhere} \end{cases}$$

What is the expected length of time the contract has been in place for an insured automobile involved in an accident?

A. 0.4563

B. 0.5500

C. 0.4375

D. 0.2010

Q.3759 What is the correlation of returns between these two portfolios?

- Portfolio A's variance of returns: 52.5%
- Portfolio B's variance of returns: 63%
- The covariance of return between the two portfolios: 0.315

A. 0.8257

B. 0.0011

C. 0.5477

D. 0.9524

Q.3760 Given the following joint probability density function of two random variables:

$$f(x_1, x_2) = \begin{cases} 8x_1x_2, & 0 < x_1 < 1, 0 < x_2 < 1 \\ 0, & \text{elsewhere} \end{cases}$$

Find $E(X_1|X_2 = 0.5)$

A. 0.01

B. 0.54

C. 0.33

D. 0.67

Q.3761 A financial risk manager believes that the prevailing interests rate (X_1) and the return in a stock market (X_2) can be modeled using the following joint probability function:

$$f(x_1, x_2) = \begin{cases} \frac{1}{8}x_1x_2, & 0 \le x_1 \le 1, 0 \le x_2 \le 2 \\ 0, & \text{elsewhere} \end{cases}$$

What is the covariance between the interest rate and the return in the stock market?

A. 0.0972

B. 0.0444

C. 0.2222

D. 0.0555

Reading 16: Sample Moments

Q.325 Compute the sample standard deviation given the following sample data: $\sum x = 31,353 n = 100$ $\sum x^2 = 10,687,041$

A. 86

B. 93

C. 71

D. 75

Q.326 On Tuesday, an insurance company receives a total of 10 claims for automobile policies. After the first-round assessment, it's found that the mean claim amount of the 10 claims is $426 while the standard deviation is 112. On Tuesday, the chief claims analyst authorizes the removal of one of the claims for $545 from the list on grounds that it's fraught with fraud. Compute the standard deviation for the remaining set of 9 claims.

A. 110.2

B. 12145.2

C. 421.8

D. 420

Q.328 A renowned economist has calculated that the Canadian economy will be in one of 3 possible states in the coming year: Boom, Normal, or Slow. The following table gives the returns of stocks A and B under each economic state.

State	Probability State	Return for Stock A	Return for Stock B
Boom	40%	12%	18%
Normal	35%	10%	15%
Slow	25%	8%	12%

Which of the following is closest to the covariance of the returns for stocks A and B?

A. 0.103

B. 0.0001734

C. 0.1545

D. 0.0003765

Q.331 The mean height of female FRM exam candidates over the years is 1.671m while that of male candidates is 1.757. Given that the mean height of ALL of the exam candidates is 1.712m, calculate the percentage of the candidates who are female:

A. 0.523

B. 0.46

C. 0.087

D. 0.477

Q.339 Which of the following best describes the concept of an unbiased estimator?

A. One for which the accuracy of the parameter estimate increases as the sample size increases.

B. One that has the least variance compared to all other estimators.

C. One for which the accuracy of the parameter estimate increases as the sample size decreases.

D. One for which the expected value of the estimator is equal to the value of the parameter being estimated.

Q.370 At a certain investment firm, each of the firm's 5 managers is tasked with overseeing a project. During a given one-year period, the managers reported the following individual returns from their projects:
[24%, 26%, 30%, 18%, 20%]

Calculate the population variance of these returns.

A. 0.1824%

B. 18.24%

C. 22.8%

D. 0.228%

Q.3258 The returns generated by a sample of five stocks from the Karachi Stock Exchange are given in the exhibit below.

Stock	Return
A	12%
B	13%
C	5%
D	4%
E	20%

What is the standard deviation of this sample?

A. 6.53%.

B. 5.84%.

C. 7.53%.

D. 8.34%

Q.3261 Which of the following statements is the *most* accurate? Lognormal Distributions are:

A. Skewed to the left and rarely used to model asset prices.

B. Skewed to the left and often used to model asset prices.

C. Skewed to the right and often used to model asset prices.

D. Skewed to the right and rarely used to model asset prices.

Q.3279 What is the correlation of returns between these two portfolios?

- Portfolio A's variance of returns: 52.5%
- Portfolio B's variance of returns: 63%
- Covariance of return between the two portfolios: 0.315

A. 0.8257

B. 0.0011

C. 0.5477

D. 0.9524

Q.3762 The following are the data on the financial analysis of a sales company's income over the last 200 months:

$$n = 200, \sum_{i=1}^{n} (x_i - \hat{\mu})^2 = 774,759.90 \text{ and } \sum_{i=1}^{n} (x_i - \hat{\mu})^3 = -13,476.784$$

What is the value of skewness?

A. --0.0002795

B. -0.00051738

C. -0.00031736

D. -0.00021733

Q.3763 A sample of 100 monthly profits gave out the following data:

$$\sum_{i=1}^{100} x_i = 3,453 \text{ and } \sum_{i=1}^{100} x_i^2 = 800,536$$

What is the sample mean and standard deviation of the monthly profits?

A. Sample Mean=33.53, Standard deviation=85.99

B. Sample Mean=34.53, Standard deviation=82.96

C. Sample Mean=43.53, Standard deviation=89.99

D. Sample Mean=33.63, Standard deviation=65.99

Q.3764 The following contains the amounts of monthly profits for a certain company for the year 2019:

$$1576, 1595, 1754, 1464, 1850, 1698, 1614, 1524, 4320, 1650, 1440, 1602$$

What is the mean?

A. 1840.58

B. 2007.91

C. 1564.33

D. 1785.44

Q.3766 The following data represents a sample of daily profit of a sales company for six weeks in a particular year.

Week	Amount of the Profit($)
1	3,800
2	2,800
3	2,700
4	9,900
5	2,600
6	4,300

What is the median of the profit?

A. 3,000

B. 5,000

C. 3,300

D. 3,700

Q.3767 The following data represents a sample of daily profit of a sales company for six weeks in a particular year.

Week	Amount of the Profit($)
1	3,800
2	2,800
3	2,700
4	9,900
5	2,600
6	4,300

What is the 25% quantile of the profits?

A. 2750

B. 2,700

C. 2,650

D. 2,725

Q.3768 The following data represents a sample of daily profit of a sales company for six weeks in a particular year.

Week	Amount of the Profit($)
1	3,800
2	2,800
3	2,700
4	9,900
5	2,600
6	4,300

What is the 75% quantile profit?

A. 4,175

B. 4,234

C. 4,050

D. 4,654

Q.3769 The following data represents a sample of daily profit of a sales company for six weeks in a particular year.

Week	Amount of the Profit($)
1	3,800
2	2,800
3	2,700
4	9,900
5	2,600
6	4,300

What is the interquartile range?

A. 1,600

B. 1,542

C. 1,475

D. 1,400

Q.3770 What are the conventional values of skewness and kurtosis of a normal random variable?

A. Skewness=0, kurtosis=3

B. Skewness=1, kurtosis=3

C. Skewness=0, kurtosis=2

D. Skewness=0, kurtosis=4

Q.3771 A sample amount of profit for a certain company for the first 15 weeks of the year is given below:

Weeks	Amount of the Profit($)
1	0
2	7,000
3	13,000
4	13,000
5	20,000
6	23,000
7	25,000
8	27,000
9	34,000
10	41,000
11	60,000
12	66,000
13	76,000
14	77,000
15	96,000

What is the difference between the biased and an unbiased estimator of the sample mean?

A. 0

B. 1.0

C. 3.2

D. 4.6

Q.3772 A sample amount of profit for a certain company for the first 15 weeks of the year is given below:

Weeks	Amount of the Profit($)
1	0
2	70
3	130
4	130
5	200
6	230
7	250
8	270
9	340
10	410
11	600
12	660
13	760
14	770
15	960

What is the difference between the biased and unbiased estimators of the variance?

A. 5,867.50

B. 5,503.90

C. 5,767.49

D. 5,867.87

Q.3773 The following are the two series of data X and Y.

X	Y
700	318
130	304
140	317
200	305
230	309
250	307
270	316
340	309
400	315
620	327
620	450
760	324
650	500
750	699

Assuming the Central limit theorem, what is the correct representation of the sample means distributions of the random variables above?

A.

$$\begin{bmatrix} 432.86 \\ 264.29 \end{bmatrix} \sim N\left(\begin{bmatrix} \mu_x \\ \mu_y \end{bmatrix}, \begin{bmatrix} 4058.71 & 1106.37 \\ 3106.37 & 914.81 \end{bmatrix}\right)$$

B.

$$\begin{bmatrix} 432.86 \\ 464.29 \end{bmatrix} \sim N\left(\begin{bmatrix} \mu_x \\ \mu_y \end{bmatrix}, \begin{bmatrix} 4058.71 & 1106.37 \\ 2106.37 & 914.81 \end{bmatrix}\right)$$

C.

$$\begin{bmatrix} 432.86 \\ 364.29 \end{bmatrix} \sim N\left(\begin{bmatrix} \mu_x \\ \mu_y \end{bmatrix}, \begin{bmatrix} 4058.71 & 1106.37 \\ 1106.37 & 914.81 \end{bmatrix}\right)$$

D.

$$\begin{bmatrix} 432.86 \\ 324.29 \end{bmatrix} \sim N\left(\begin{bmatrix} \mu_x \\ \mu_y \end{bmatrix}, \begin{bmatrix} 4458.71 & 1146.37 \\ 1406.37 & 914.81 \end{bmatrix}\right)$$

Q.3774 What is the difference between the skewness and the kurtosis?

A. Skewness measures the tendency of a larger amount of values moving in a given direction or with respect to the mean while the kurtosis is the peakedness of a distribution with respect to the normal distribution.

B. Skewness ranges from 0 and 1, while kurtosis ranges from 0 and 3.

C. Skewness is always positive relative to the kurtosis.

D. None of the above

Q.3775 Which of the following statements describes the Central Limit Theorem (CLT)?

A. If $X_1, X_2, \ldots, X_n$ is a sequence of iid random variables with a finite mean μ and finite non-zero variance σ^2 then the distribution of $\frac{\hat{\mu} - \mu}{\frac{\sigma}{\sqrt{n}}}$ tends to a standard normal distribution as $n \to \infty$.

B. If $X_1, X_2, \ldots, X_n$ is a sequence of iid random variables with a finite mean μ and finite non-zero variance σ^2 then the distribution of $\frac{\hat{\mu} - \mu}{\frac{\sigma}{\sqrt{n}}}$ tends to a standard normal distribution as $n \to 0$.

C. that If $X_1, X_2, \ldots, X_n$ is a sequence of iid random variables with a finite mean μ and finite non-zero variance σ^2 then the distribution of $\frac{\hat{\mu} - \mu}{\frac{\sigma}{\sqrt{n}}}$ tends to a standard normal distribution as $n \to 1$.

D. None of the above

Q.3776 All of the following statements are true, except:

A. If the return distributions of two investments have the same mean and standard deviation, the one which has a more negatively skewed distribution will be considered to be riskier.

B. Distributions with positive excess kurtosis are known as leptokurtic.

C. If two investments have the same mean, standard deviation and skewness, then the one with the lower kurtosis will be considered riskier.

D. The normal distribution has a kurtosis of 3.

Q.3777 An analyst gathers monthly data about the returns of a stock for the past five years. If the mean monthly return is 6% and the standard deviation of the series of returns is 1.8%, then what is the standard deviation of the mean over the period?

A. 6.24%

B. 0.23%

C. 13.94%

D. 4.02%

Q.3778 Assume we have equally invested in two different companies; ABC and XYZ. We anticipate that there is a 15% chance that next year's stock returns for ABC Corp will be 6%, a 60% probability that they will be 8% and a 25% probability that they will be 10%. In addition, we already know the expected value of returns is 8.2%, and the standard deviation is 1.249%. We also anticipate that the same probabilities and states are associated with a 4% return for XYZ Corp, a 5% return, and a 5.5% return. The expected value of returns is then 4.975, and the standard deviation is 0.46%. Calculate the portfolio standard deviation:

A. 0.0000561

B. 0

C. 0.00849

D. 0.00897

Q.3779 A sample of 36 working days was analyzed; for the amount of income of a company. If the income has a standard deviation of 7, what is the approximate probability that the mean of this sample is greater than 44.50 and that the mean of the yearly income (population) is $\mu=42$?

A. 0.045

B. 0.016

C. 0.065

D. 0.042

Q.3797 A portfolio is composed of 60% equities and 40% bonds. The variance of equities is 320, the variance of bonds is 110, and the covariance is 90. What is the portfolio's variance?

A. 154.4

B. 176

C. 192

D. 279.2

Q.3798 Alan West, a portfolio manager, created the following portfolio:

Security	Security Weight (%)	Expected Standard deviation(%)
A	20	4
B	80	10

If the correlation of returns between the two securities is 0.60, then what is the expected standard deviation of the portfolio?

A. 9.50%

B. 8.10%

C. 9.15%.

D. 8.50%.

Q.3799 Raul Perez, a portfolio manager, created the following portfolio:

Security	Security Weight (%)	Expected Standard deviation(%)
A	40	7
B	60	12

If the covariance of returns between the two securities is -0.004, then what is the expected standard deviation of the portfolio?

A. 6.36%

B. 6.56%

C. 8.14%

D. 6.10%

Q.3800 Tina Fer, a portfolio manager, created the following portfolio:

Security	Security Weight (%)	Expected Standard deviation(%)
A	10	6
B	90	15

If the standard deviation of the portfolio is 14.1%, then what is the covariance between the two securities?

A. 0.009

B. 0.090

C. 0.008

D. -0.011

Q.3801 Carla Mayes, a portfolio manager created the following portfolio:

Security	Expected Return (%)	Expected Standard Deviation(%)
A	5	8
B	10	14

If the correlation of returns between the two securities is -0.20, then what is the standard deviation of a portfolio invested 75% in Security A and 25% in Security B?

A. 0.51%

B. 0.81%

C. 5.12%

D. 6.31%

Q.3802 Which of the following statements is *most* accurate regarding a negative covariance between two assets?

A. The returns of two assets move together in the negative direction.

B. The returns of two assets move in opposite directions.

C. The returns of two assets move in the positive direction.

D. None of the above.

Q.3803 Which of the following properties of covariance is INCORRECT?

A. Covariance measures how one random variable moves with another random variable.

B. Covariance of (R,R) = Variance of R

C. Covariance ranges from -1 to +1.

D. None of the above.

Q.3804 Which of the following is the most appropriate explanation of a -1 correlation between two random variables?

A. There is no correlation between two random variables.

B. Both variables move together in a negative direction.

C. The movement in one variable will result in the exact opposite proportional movement in the other variable.

D. None of the above.

Q.3805 Assuming that the covariance of returns of Stock X and Stock Y is $Cov(R_X, R_Y) = 0.093$, the variance of $R_X = 0.69$, and the variance of $R_Y = 0.36$, what is the correlation of returns of Stock X and Stock Y?

A. 0.155

B. 0.1865

C. 0.1713

D. 0.1119

Q.3806 Which of the following is an INCORRECT interpretation of the correlation coefficient?

A. A correlation coefficient of +1 means that the mean returns of two assets move proportionately in the same direction.

B. A correlation coefficient of -1 means that the mean returns of two assets move proportionately in a negative direction.

C. A correlation coefficient of 0 means that the mean returns of two assets move proportionately in a negative direction.

D. None of the above.

Q.3807 A junior fund manager at Dapper Assets Management is constructing a portfolio consisting of two large-cap stocks that trade on the London stock exchange. In a meeting with the investment committee, the manager was asked to present the covariance of both stocks. Using the data given in the following table, calculate the covariance if the population mean is unknown.

Year	Stock A Return	Stock B Return
1	17%	45%
2	21%	20%
3	-8%	-2%
4	-1%	2%
5	4%	-19%
6	19%	2%
7	-7%	13%

A. 0.0113

B. 0.1010

C. 0.1156

D. 0.00907

Q.3808 A fund manager is constructing a portfolio consisting of two stocks. Which of the following equations can the manager use to calculate the correlation coefficient if the covariance is 0.0168, the standards deviation of stock A is 0.125 and the standard deviation of stock B is 0.2?

A. $0.0168/(0.125*0.2)^2$

B. $0.0168/(0.125*0.2)$

C. $0.0168/(0.125*0.2)^{1/2}$

D. $0.0168/(0.125^2*0.2^2)$

Q.3809 Hakim Ahmed has recently joined Lampard Investment Inc. He was given the data related to the assets of a portfolio provided in the following table. If the weight of Asset X is 35% and the weight of Asset Z is 65%, then what is the variance of the portfolio?

Variance Asset X	0.1225
Variance Asset Z	0.4225
Covariance	0.19

A. 0.2800

B. 0.1156

C. 0.2245

D. 0.2587

Q.3810 Hakim Ahmed has recently joined Lampard Investment Inc. He has been given data related to the assets of a client's portfolio provided in the following table:

Variance Asset X	0.1225
Variance Asset Z	0.3721
Covariance	0.19

If the weight of Asset X is 35% and the weight of Asset Z is 65%, then what is the correlation coefficient between Assets X and Z?

A. 0.8899

B. 0.0469

C. 0.4412

D. 0.4168

Q.3811 The covariance matrix of two stocks is given in the following exhibit.

Exhibit: Covariance Matrix

Stock	X	Y
X	650	120
Y	120	450

What is the correlation of returns for stocks X and Y?

A. 0.45

B. 0.22

C. 0.28

D. 0.37

Q.3812 A portfolio consists of two funds A and B. The weights of the two funds in the portfolio and the covariance matrix of the two funds are given in the following two exhibits.

Exhibit 1: Weight of the Funds in the Portfolio

Fund	A	B
Weight	60%	40%

Exhibit 2: Covariance Matrix

Fund	A	B
A	700	200
B	200	500

What is the portfolio variance?

A. 428.04

B. 500.00

C. 512

D. 324.80

Q.3813 Which of the following statements is INCORRECT regarding the correlation coefficient?

A. The correlation coefficient measures the strength of the linear relationship between two random variables

B. The correlation coefficient has no units

C. The correlation coefficient ranges from -1 to +1

D. None of the above.

Q.371 The mean hourly wage for coal workers in the U.S. is $15.5 with a population standard deviation of $3.2. Calculate the standard error of the sample mean if the sample size is 30.

A. 3.2

B. 0.3413

C. 0.1067

D. 0.5842

Q.373 An auto insurance company intends to establish the mean claim amount demanded by policyholders who own SUVs. After extensive analysis of its records, the company believes the standard deviation of such claims is about $200.
The company wishes to construct a 95% confidence interval for the mean claim amount such that the interval is of width "±$50". Determine the value of n, the sample size that would be required to achieve this.

A. 62

B. 100

C. 30

D. 124

Q.374 After 72 FRM Part 1 students took a mock exam, the mean score was 75. Assuming that the population standard deviation is 10, construct a 99% confidence interval for the mean score on the mock exam.

A. (75, 85)

B. (65, 75)

C. (71.96, 78.04)

D. (75, 78.04)

Q.375 Which of the following best defines the term “hypothesis” as used in statistics?

A. An assumption about a problem.

B. The current state of knowledge or belief about the value of a population parameter.

C. A test that divides the sample space into a region of acceptance and the critical region.

D. A statement about the value of a population parameter developed to test a theory or belief.

Q.376 An investment firm intends to carry out a test to determine whether bonuses have any significant effect on job performance. The head of the human resource department develops the following sets of possible hypotheses.

I. H_0: Bonuses do not have any effect on job performance H_1: Bonuses improve job performance
II. H_0: Bonuses do not have any effect on job performance H_1: Bonuses reduce job performance
III. H_0: Bonuses do not have any effect on job performance H_1: Bonuses affect job performance
IV. H_0: Bonuses have no effect on job performance H_1: Bonuses improve job performance

Which of the above pairs of hypotheses implies a two-sided test?

A. I

B. II

C. III

D. IV

Q.377 Which of the following choices correctly defines type I error, type II error, and p-value?

	Type I error	Type II error	P-value
I.	The probability of rejecting H_0 when it is in fact true	The probability of accepting H_0 when it is in fact false	The highest level at which H_0 can be rejected
II.	The probability of accepting H_0 when it is in fact false	The probability of rejecting H_0 when it is in fact true	The highest level at which H_0 can be rejected
III.	The probability of rejecting H_0 when it is in fact true	The probability of accepting H_0 when it is in fact false	The lowest level at which H_0 can be rejected
IV.	The probability of rejecting H_0 when it is in fact true	The lowest level at which H_0 can be rejected	The probability of accepting H_0 when it is in fact false

A. I

B. II

C. III

D. IV

Q.378 A random sample of 50 FRM exam candidates was found to have an average IQ of 125. The standard deviation among candidates is known (approximately 20). Assuming that IQs follow a normal distribution, carry out a statistical test (5% significance level) to determine whether the average IQ of FRM candidates is greater than 120. Compute the test statistic and give a conclusion.

A. Test statistic: 1.768; Reject H_0

B. Test statistic: 2.828; Reject H_0

C. Test statistic: 1.768; Fail to reject H_0

D. Test statistic: 1.0606; Fail to reject H_0

Q.379 A stock has an initial market price of $80. Exactly one year from now, its price will be given by:
P = 80 * exp(i) where *i* is the rate of return.

i is normally distributed with mean 0.2 and standard deviation 0.3. Construct a 95% confidence interval for the price of the stock after one year.

A. ($54.27, $80)

B. ($80, $175.91)

C. ($54.27, $175.91)

D. ($54.27, $140)

Q.380 A manager conducts a hypothesis test at the 1% significance level. What does this mean?

A. P(reject H_0 | H_0 is false) = 0.01

B. P(reject H_0 | H_0 is true) = 0.01

C. P(not reject H_0 | H_0 is false) = 0.01

D. P(not reject H_0 | H_0 is true) = 0.01

Q.381 Suppose you conducted a hypothesis test. What would happen if you decrease the level of significance of the test?

A. The likelihood of committing a type II error decreases

B. The likelihood of a type I error increases

C. The likelihood of rejecting the null hypothesis when it's in fact true decreases

D. The likelihood of frequently committing a type I error increases, even when it's in fact true

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Q.383 At a 95% confidence interval, the value at risk (VaR) of a portfolio is approximately $10 million. During 100 days, the VaR was exceeded on 9 different occasions. Based on this information:

A. This model is overestimating risk.

B. This model is underestimating risk.

C. This model is appropriate for estimating the risk.

D. The model is accurate.

Q.384 A population has a known mean of 100. Suppose 36 samples are randomly drawn from this population with replacement. The observed mean is 97.8 and the standard deviation is 10. Calculate the standard error of the sample mean.

A. 0.8165

B. 1.667

C. 1.8165

D. 16.67

Q.3280 Which of the following statement(s) are accurate?
I. The t-distribution is similar but not identical to the normal distribution in shape. It has fatter tails compared to the normal distribution.
II. Degrees of freedom for the t-distribution are equal to n. Students' t-distribution is closer to a normal distribution when the degrees of freedom are lower.

A. Statement I is correct and Statement II is incorrect.

B. Statement I and Statement II are both correct.

C. Statement I and Statement II are both are incorrect.

D. Statement I is incorrect and Statement II is correct.

Q.3281 A sample of 121 applicants received the Canadian travel visa in 45 days on average. Suppose the population is normally distributed, and the standard deviation of the sample is 19, then what is the 95% confidence interval for the population mean?

A. [44.7 days; 45.3 days]

B. [41.6 days; 48.4 days]

C. [42.2 days; 47.8 days]

D. [40.1 days; 49.8 days]

Q.3282 A sample of 100 students is currently renting rooms in the mean distance of 18 miles from a small U.S. College. Assuming that the population is normally distributed and the standard deviation of the sample is 14 miles, what is the 99% confidence interval for the population mean?

A. [15.26 miles; 20.74 miles]

B. [16.6 miles; 19.4 miles]

C. [14.4 miles; 21.6 miles]

D. [12.8 miles; 23.6 miles]

Q.3283 The mean return of a sample of 28 BB+ corporate bonds is 7.5%, and the sample's standard deviation is 14%. Assuming that the population is normally distributed and the population variance is unknown, what is the 95% confidence interval for the population mean?

A. [2.77%; 12.23%]

B. [2.07%; 12.93%]

C. [2.93%; 11.43%]

D. [4.12%; 13.3%]

Q.3284 Which of the following is INCORRECT regarding the t-statistic?

A. As the degree of freedom increases, the t-statistic decreases.

B. A 90% confidence interval with n-1 degrees of freedom will be calculated at $\frac{\alpha}{2}$ or $t_{0.05}$.

C. The t-statistic is used for sample sizes smaller than 30 observations.

D. The t-statistic has thinner tails than the normal distribution.

Q.3285 From a population of 10,000 observations, a researcher chooses a sample of 1,000. If the population's standard deviation is 100, then what is the standard error of the mean?

A. 0.1

B. 3.16

C. 27.6

D. 0.01

Q.3287 Which of the following best represents a 99 percent confidence interval if the mean score from 40 students in an exam is 85 and the population's standard deviation is 18?

A. [77.658; 92.342]

B. [73.658; 92.342]

C. [77.658; 90.342]

D. [80.212; 93.526]

Q.3288 While performing a hypothesis test, Albert Khan is told that his analysis suffers from a Type I error. We can therefore conclude that:

A. Khan rejected the null hypothesis when it was actually false.

B. Khan failed to reject the null hypothesis when it was actually false.

C. Khan failed to reject the null hypothesis when it was actually true.

D. Khan rejected the null hypothesis when it was actually true.

Q.3289 A two-tailed hypothesis test at the 95% confidence level has a p-value of 2.14%. This means that:

A. At a 5% significance level, we cannot reject the null hypothesis.

B. At a 2% significance level, we can reject the null hypothesis.

C. At a 5% significance level, we can reject the null hypothesis.

D. We have insufficient information to provide any kind of conclusion.

Q.3290 Which of the following statement(s) is/are correct?

I. Decreasing the significance level will decrease the probability of rejecting a true null
II. Increasing the significance level will increase the power of the test.

A. Both statements are correct.

B. Only Statement I is correct.

C. Only Statement II is correct.

D. Both statements are incorrect.

Q.3291 A survey is conducted to determine if the average starting salary of investment bankers is equal to or greater than $57,000 per year. Given a sample of 115 newly employed investment bankers with a mean starting salary of $65,000 and a standard deviation of $4,500, and assuming a normal distribution, what is the test statistic?

A. 204.44

B. 19.06

C. 1.78.

D. 746

Q.3292 Hilda believes that the average return on equity in the consumer durables industry is greater than 80%. What are the null (H_0) and the alternative (H_1) hypotheses for this study?

A. $H_0 : M = 0.8$ versus $H_1 : M \neq 0.8$

B. $H_0 : M \geq 0.8$ versus $H_1 : M < 0.8$

C. $H_0 : M \leq 0.8$ versus $H_1 : M > 0.8$

D. $H_0 : M < 0.8$ versus $H_1 : M \geq 0.8$

Q.3293 The average return on the Dow Jones Industrial Average for 121 quarterly observations is 1.5%. If the standard deviation of the returns can be assumed to be 8%, what is the 99% confidence interval for the quarterly returns of the Dow Jones?

A. [-0.4%; 3.4%]

B. [0.1%; 2.9%]

C. [-6.5%; 9.5%]

D. [-0.1%; 2.9%]

Q.3295 If a researcher wants to test that the mean return of 50 small-cap stocks from the Singapore Exchange is greater than 14%, which of the following would be the alternative hypothesis for the test?

A. $H_1 : \mu \neq 14\%$

B. $H_1 : \mu > 14\%$

C. $H_1 : \mu < 14\%$

D. $H_0 : \mu < 14\%$

Q.3298 A portfolio manager observes that the weekly return generated by a portfolio of high-beta stocks stood at 5%. The standard deviation of the portfolio return stood at 1.50%. However, the manager observes that the standard deviation of the portfolio return for the past 15 weeks stood at 2.00%. The portfolio manager wants to determine whether the standard deviation of the portfolio return has increased from 1.50% to 2.00%.
What is the test statistic to test the above hypothesis?

A. 34.89

B. 25.89

C. 31.55

D. 24.89

Q.3299 A portfolio manager believes that returns on pharmaceutical stocks are more volatile than the returns generated on e-commerce stocks. To check this hypothesis, the portfolio manager collects the data summarized in exhibit 1.

Exhibit 1: Volatility in Pharmaceutical vs. e-Commerce Stocks

	Pharma Stock	e-Commerce Stocks
Standard Deviation	1.50%	2.10%
Sample Size	20	25

What is the value of the test statistic?

A. 1.51

B. 1.96

C. 1.70

D. 2.14

Q.3300 An investor is planning to invest in mutual funds. He intends to maximize his chances of earning a return in excess of 20%. The list of mutual funds available to the investor is listed in exhibit 1.

Exhibit 1: Potential List of Mutual Funds

Fund	Mean Return	Std. Dev. of Return
X	15%	2.%
Y	15.20%	3%
Z	14%	4%

Assuming that mutual fund returns are normally distributed and using a z-table, what is the correct probability of earning a return in excess of 20%?

A. 1.60% for Fund Y.

B. 5.78% for Fund Z.

C. 0.62% for Fund X.

D. 11.6% for Fund Y.

Q.3330 For a sample of the past 28 monthly stock returns for Bidco Inc., the mean return is 5% and the sample standard deviation is 15%. Assume that the population variance is unknown.
The related t-table values are given below, where (t_{ij}) denotes the $(100-j)^{th}$ percentile of t-distribution value with i degrees of freedom):

$t_{27,0.025}$	2.05
$t_{27,0.05}$	1.70
$t_{26,0.025}$	2.06
$t_{26,0.05}$	1.71

What is the 95% confidence interval for the mean monthly return?

A. [0.00181, 0.0989]

B. [-0.0084, 0.1084]

C. [-0.00811, 0.10811]

D. [0.02135, 0.07835]

Q.3331 Using returns observed over the past 18 monthly, an analyst has estimated the mean monthly return of stock A to be 2.85% with a standard deviation of 1.6%.

One-tailed t-distribution table

Degrees of Freedom		a	
	0.1	0.05	0.025
14	1.35	1.78	2.15
15	1.34	1.75	2.13
16	1.34	1.75	2.12
17	1.33	1.74	2.11
18	1.33	1.73	2.10

Using the t-table above, the 95% confidence interval for the mean return is between:

A. [0.02031, 0.03688]

B. [0.02051, 0.03650]

C. [0.02194, 0.03506]

D. [0.02054, 0.03646]

Q.3332 A risk analyst wishes to establish the VaR of a hedge fund. She has gathered return data spanning 24 weeks. From her analysis, the mean and standard deviation of weekly returns are 10% and 12%, respectively. Assuming that weekly returns are independent and identically distributed, what is the standard error of the mean of the weekly returns?

A. 10%

B. 2%

C. 2.45%

D. 12%

Reading 18: Linear Regression

Q.386 The relationship between two variables can be explained by the following regression function: $Y_i = B_0 + B_1 \times X_i + \varepsilon_i$

What does ε_i represent?

A. The difference between total variation and the unexplained variation.

B. The effects of independent variables not included in the model.

C. The slope coefficient.

D. The intercept coefficient.

Q.387 What is the difference between regression analysis and correlation analysis?

A. Regression enables us to measure the association between two or more variables in specified units of the dependent variable.

B. Regression enables us to establish a line of best fit through the data.

C. With regression, we can predict the values of the dependent variable.

D. All of the above.

Q.388 A hospital uses ultrasound technology to measure the weight of unborn babies as follows:

Gestation period in weeks	30	32	34	36	38	40
Estimated weight of foetus	1.6	1.7	2.5	2.8	3.2	3.5

Further information: $S_{XX} = 70, S_{YY} = 3.015, S_{XY} = 14.3$Calculate the least square estimator of the slope and the Y-intercept (in that order).

A. Least square estimator: 0.2043; Y-intercept: -4.6

B. Least square estimator: 0.20; Y-intercept: -4

C. Least square estimator: 2.55; Y-intercept: 35

D. Least square estimator: 0.2043; Y-intercept: 35

Q.389 Given a regression equation is of the form: $y_i = \alpha + \beta x_i$ where Y is the dependent variable (foetal weight), X is the independent variable (gestation period, in weeks), α = the y-intercept, and β = the slope.
If $\alpha = -4.60$ and $\beta = 0.2043$, then estimate the weight of the foetus at exactly 31 weeks.

A. 1.533kg

B. 1.733kg

C. 1.722kg

D. 1.8kg

Q.391 A limited liability company uses the ordinary least squares method to estimate a linear relationship between total monthly revenue and the total promotional expenditure. The linear function is found to have a positive slope that's significantly different from zero. Assuming that other variables, like product price and supply region, remain constant during the period covered by the data set, this implies that:

A. The company should significantly increase promotional expenditure.

B. The company should significantly reduce promotional expenditure.

C. Promotional expenditures have no effect on demand.

D. Promotional expenditures have a significant influence on demand.

Q.392 Ordinary least squares is used to estimate the relationship between foetal weight and the number of weeks of gestation in a group of women. The exercise gives the following results:

- Total sum of squares, $ST_{TT} = 3.125$
- Regression sum of squares, $SS_{REG} = 2.925$
- Residual sum of squares, $SS_{RES} = 0.2$

This implies that:

A. The variability explained by the model is 0.2

B. The variability unexplained by the model is 3.125

C. The variability explained by the model is 2.925

D. The variability explained by the model is 3.125

Q.394 The annual returns of two stocks, X and Y, are jointly normally distributed. Each stock has a marginal distribution with mean = 2%, standard deviation = 10%. The correlation coefficient between X and Y is 0.9. If the annual return on stock X is 4%, what is the expected annual return on stock Y?

A. 0.038

B. 0.029

C. 0.0038

D. 0.4

Q.395 If the value of the independent variable = 0, what would be the expected value of the dependent variable?

A. The slope coefficient

B. The residual value

C. The intercept coefficient

D. 0

Q.396 A graduate school constructs a linear regression model to estimate the effect of increased study hours on the average performance of students in a test. The slope coefficient is found to be equal to 2. What does this mean?

A. The average score when the number of study hours is zero is 2.

B. The predicted score when the number of study hours is zero is 2%.

C. For every one unit change in the number of study hours, the model predicts that the average score will change by 2 units.

D. For every one unit change in the number of study hours, the model predicts that the average score will change by 2%.

Q.397 The estimated slope coefficient (β_1) for a certain stock is 0.8823 with a standard error equal to 0.0931. Assuming that the sample had 10 observations, carry out a statistical test to determine if the slope coefficient is statistically different than zero. Quote the test statistic and the decision rule using a 5% level of significance.

A. 9.477, reject H_0

B. 9.477, do not reject H_0

C. 2.307, reject H_0

D. 2.307, do not reject H_0

Q.398 An analyst obtained the following linear regression relationship between 2 variables, X and Y :

$$Y = \alpha + \beta_1 X$$

where $\alpha = 0.45$ and $\beta = 0.8823$He proceeded to construct a 2-sided 95% confidence interval for the slope coefficient (β_1) and obtained the following interval:

$$\beta = 0.8823 \pm 0.2147$$

Suppose the analyst decided to test the hypothesis $H_0 : \beta_1 = 1$ vs $H_a : \beta_1 \neq 1$ at 5% significance, what would be the inference?

A. Reject H_0

B. Do not reject H_0

C. The slope coefficient is statistically different than "1"

D. Cannot tell from the information provided

Q.399 Two variables have a linear relationship of the form:

$$Y = -4.6 + 0.2043X$$

The slope coefficient has a standard error equal to 0.01828. Carry out a test of $H_0 : \beta_1 = 0$ vs $H_a : \beta_1 > 0$ at 0.5% significance, quoting the test statistic and the conclusion if the number of observations, n, is 6.

A. $11.2, \beta > 0$

B. $11.2, \beta = 0$

C. $0.01828, \beta \neq 0$

D. $11.2, \beta \neq 0$

Q.400 During a statistical test to determine if the mean return on an asset is different from zero, an FRM Part 1 candidate obtains a p-value of 1.4%. With a significance level of 1%, she would:

A. Reject the null hypothesis.

B. Fail to reject the null hypothesis.

C. Conclude that the mean return is different from zero.

D. Conclude that the mean return is negative (loss).

Q.402 An organization estimates that the effect of increasing the number of qualified Financial Risk Managers hired by 1 will improve the stock's annual return by 2.8% with a standard error of 0.52%. Construct a 90% 2-sided confidence interval for the size of the slope coefficient, assuming the stock's returns are normally distributed.

A. (1.9%, 2.8%)

B. (1.4%, 3.1%)

C. (1.9%, 3.5%)

D. (1.9%, 3.7%)

Q.404 A linear regression model gave the following results:

$$S_{yy} = 10.6; S_{xx} = 12.0; S_{xy} = 8.0; n = 18$$

Test (at 1% significance) whether β is significantly different from zero, given that its standard error = 0.16 and give the value of the test statistic and the conclusion.

A. 0.667, β is not significantly different from zero

B. 0.4169, β is not significantly different from zero

C. 0.667, β is significantly different from zero

D. 4.169, β is significantly different from zero

Q.406 A 95% confidence interval for β_1 is determined to be (20, 25). This means that:

A. We can be 95% confident that the mean value of Y lies between 20 and 25 units.

B. We can be 95% confident that the value of X will increase by between 20 and 25 units for every one unit increase in Y.

C. We can be 95% confident that the value of Y will increase by between 20 and 25 units for every one unit increase in X.

D. At the 5% level of significance, we would not find evidence of a linear relationship between X and Y.

Q.408 You have been given the following regression equation:

$$\overline{WPO} = -3.2\% + 0.49(\overline{S\&P\ 500})$$

Calculate the predicted value of WPO excess returns if forecasted S&P 500 excess returns are 10%.

A. 0.017

B. 0.12

C. 0.17

D. 0.0017

Q.409 Use the regression equation " $\overline{WPO}$ = -3.2% + 0.49($\overline{S\&P\ 500}$) " to calculate a 95% confidence interval on the predicted value of WPO. You have been given that n = 30, the standard error of the forecast is 3.76%, and the forecasted value of S&P 500 excess return is 10%.

A. (1.7%, 9.37%)

B. (-5.97%, 1.7%)

C. (4.9%, 9.37%)

D. (-5.97%, 9.37%)

Q.410 Sometimes the explanatory power of regression analysis can be overstated. Under which of the following scenarios would that most likely happen?

A. If the residual term is normally distributed.

B. If the explanatory variables are not correlated with one another.

C. The omission of a crucial explanatory variable, which has significant influence on the explanatory variables included as well as the dependent variable..

D. If there are only two explanatory variables.

Q.3333 An analyst is trying to establish the relationship between the return on stock X(R_X) and the return on stock S(R_s). Stock X is listed on the Bombay Stock Exchange (BSE). The analyst has assumed a linear relationship as follows.

$$R_X = a + b \times R_S + \epsilon_t$$

Furthermore, the analyst has gathered the following historical data.

Expected return on stock X	15%
Expected return on S	10%
Standard deviation of return on stock X	20%
Standard deviation of return on stock S	15%
Correlation between returns on stock X and S	0.3

Which of the following is the correct model that can be deduced using the ordinary least squares technique?

A. $E(R_X) = 0.40 + 0.40 \times E(R_S)$

B. $E(R_X) = 0.11 + 0.40 \times E(R_S)$

C. $E(R_X) = 0.40 + 0.11 \times E(R_S)$

D. None of the above

Q.3335 Which of the following is/are correct regarding the assumption(s) required in OLS to draw a valid conclusion?

A. The expected value of the error term, conditional on the independent variable, $E(\epsilon_i|X_i)$, is zero.

B. The error term, ϵ, is uncorrelated across observations.

C. The error term, ϵ, is normally distributed.

D. All of the above

Q.3336 The return on a stock (R) exhibits the following relationship with the market return (MR).

$$R = -1.15 \times MR + 2\%; R^2 = 81\%$$

Assuming all coefficients are significant, which of the following interpretations is correct?

A. A 1% increase in MR results into a 1.15% increase in R.

B. A 1% increase in MR results into 2% increase in R.

C. The correlation between the return on the stock and the return on the market is 0.81.

D. The correlation between the return on the stock and the return on the market is -0.90.

Q.3337 The return on a stock (R) exhibits the following relationship with the market return (MR).

$$R = -1.15 \times MR + 2\%; R^2 = 81\%$$

Compute the ratio of the standard deviation of stock return to standard deviation of the market return.

A. 1.15

B. 1.28

C. 0.81

D. 0.90

Q.3338 An analyst has attempted to get some insight into the relationship between the return on stock A($R_{A,t}$) and the return on the Nasdaq Composite index ($R_{NC,t}$). The analyst gathers historical data and comes up with the following estimates:

Expected mean return for A	10%
Annual mean return for Nasdaq Composite	6%
Annual volatility for Nasdaq Composite	15%
Covariance between the returns of A and Nasdaq Composite	5%

The analyst goes ahead and formulates the following regression model using the data:

$$R_{A,t} = \alpha + \beta R_{NC,t} + \epsilon_t$$

Using the ordinary least squares technique, which of the following models will the analyst obtain?

A. $R_{A,t} = -0.03333 + 2.2222 R_{NC,t} + \epsilon_t$

B. $R_{A,t} = -0.05 + 2.2222 R_{NC,t} + \epsilon_t$

C. $R_{A,t} = 2.2222 + 0.06 R_{NC,t} + \epsilon_t$

D. $R_{A,t} = 1.80 - 0.05 R_{NC,t} + \epsilon_t$

Q.3339 The return on a stock (R) exhibits the following relationship with the market return (MR).

$$R = \hat{a} + \hat{b} \times MR$$

Where $\hat{b}$ is the slope coefficient and $\hat{a}$ is the intercept. After gathering 36 observations, an analyst computed the estimated slope coefficient as 0.6 with a standard error of 0.2. Compute a 95% confidence interval for the slope coefficient, b.

A. $0.208 < b < 0.992$

B. $0.194 < b < 1.006$

C. $0.6 < b < 0.95$

D. $0.2 < b < 0.95$

Q.3340 The return on a stock R exhibits the following relationship with the market return (MR).

$$R = \hat{a} + \hat{b} \times MR$$

Where $\hat{b}$ is the slope coefficient and $\hat{a}$ is the intercept. After gathering 36 observations, an analyst computed the estimated slope coefficient as 0.6 with a standard error of 0.2. Determine whether the estimated slope coefficient is different from 0 at a 95% confidence level with reference to the critical t-value.

A. The slope coefficient is not significant.

B. The slope coefficient is statistically significant with a t-statistic of 2.03.

C. The slope coefficient is statistically significant with a t-statistic of 3.

D. The slope coefficient is statistically significant with a t-statistic of 1.015.

Q.3341 An analyst has regressed the annual return on a stock (R_{stock}) against the annual return on the NIFTY 50(R_{index}) for 30 years. The NIFTY is the National Stock Exchange (NSE) index in India.The results are as shown below. Regression equation:

$$R_{index,\,t} = \hat{a} + \hat{b} \times R_{stock,\,t} + \varepsilon_t$$

Coefficient	Coefficient Estimate	Standard Error
a	0.002	0.001
b	1.223	0.063

Interpret whether the regression coefficients are statistically different from zero at a 95% confidence level?

A. Intercept term (a): Yes; Slope coefficient (b): Yes

B. Intercept term (a): No; Slope coefficient (b): No

C. Intercept term (a): No; Slope coefficient (b): Yes

D. Intercept term (a): Yes; Slope coefficient (b): No

Q.3342 An analyst has regressed the annual return on a stock (R_{stock}) against the annual return on the NIFTY 50 (R_{index}) for 36 years. The NIFTY is the index of the National Stock Exchange (NSE), India. Results are shown below. Regression equation:

$$R_{index,\,t} = \hat{a} + \hat{b} \times R_{stock,\,t} + \varepsilon_t$$

Coefficient	Coefficient Estimate	Standard Error
a	0.002	0.001
b	1.223	0.063

What is the 90% confidence interval for the slope coefficient?

A. [1.1165; 1.3295]

B. [1.223; 1.3295]

C. [0.002; 1.223]

D. [0.063; 1.223]

Q.3343 An analyst has regressed the annual return on a stock (R_{stock}) against the annual return on the NIFTY 50(R_{index}) for 36 years. The NIFTY is the National Stock Exchange (NSE) index in India. Results are shown below. Regression equation:

$$R_{index,\,t} = \hat{a} + \hat{b} \times R_{stock,\,t} + \varepsilon_t$$

Coefficient	Coefficient Estimate	Standard Error
a	0.002	0.001
b	1.223	0.063

An analyst wants to test the hypothesis given below at 5% significance level: $H_0 : b \leq 1$ $H_a : b > 1$ Which of the following statement is correct about slope coefficient?

A. Estimated t-statistic: 1.223; Hypothesis: Fail to reject H_0

B. Estimated t-statistic: 3.54; Hypothesis: Reject H_0

C. Estimated t-statistic: 3.54; Hypothesis: Fail to reject H_0

D. Estimated t-statistic: 1.223; Hypothesis: Reject H_0

Q.3344 An analyst wishes to establish the relationship between corporate revenue (Y_t) and the average years of experience per employee (X_t) and comes up with the following model.

$$Y_t = 0.45 + 0.78X_t$$

The analyst also observes that the standard error of the coefficient of the average years of experience per employee is 0.65. In order to test the null hypothesis that the average years of experience per employee have no effect on corporate revenue, what is the correct statistic to calculate?

A. F-test

B. t-test

C. Chi-square test

D. Durbin Watson test

Q.3966 A financial analyst develops a Capital Pricing Model that regresses the expected monthly return of a company on the prevailing interest rates. The coefficients are $\beta_0 = 0.064$ and $\beta = 0.65$ where β_0 is the intercept. What is the value of the monthly expected return for the company if the interest rate at a particular month is 5%?

A. 0.0965

B. 0.0856

C. 0.0778

D. 0.0567

Q.3968 A regression analysis of monthly returns of a sales company on the market return over ten years gives an intercept of $\hat{\beta}_0 = 0.65$, the slope $\hat{\beta} = 1.65$. Other quantities include: $s^2 = 20.45$, $\hat{\sigma}_X^2 = 18.65$ and $\hat{\mu}_X = 0.61$. What is the standard error estimate of $\hat{\beta}_0$?

A. 0.5463

B. 0.56435

C. 0.4552

D. 0.4169

Q.3969 A regression analysis of monthly returns of a sales company on the market return over ten years gives an intercept of $\hat{\beta}_0 = 0.65$, the slope $\hat{\beta} = 1.65$. Other quantities include:$s^2 = 20.45$, $\hat{\sigma}_X^2 = 18.65$ and $\hat{\mu}_X = 0.61$. The analyst wishes to test whether the slope coefficient is different from 0. What is the test statistic of $\hat{\beta}$?

A. 17.2594

B. 10.1891

C. 24.3234

D. 20.3232

Q.3970 A regression analysis of monthly returns of a sales company on the market return over ten years gives an intercept of $\hat{\beta}_0 = 0.65$, the slope $\hat{\beta} = 1.65$. Other quantities include:$s^2 = 20.45$, $\hat{\sigma}_X^2 = 18.65$ and $\hat{\mu}_X = 0.61$. The analyst wishes to test whether the slope coefficient is different from 0. What is 99% confidence interval for $\hat{\beta}$?

A. [1.6034,1.8906]

B. [1.3034,1.8966]

C. [1.3997,1.9002]

D. [1.5034,1.6976]

Q.3971 You want to develop a model that regresses the number of options on the number of underlying stocks. You estimate the following regression equation.

$$\text{Number of Options} = \hat{\alpha} + \hat{\beta}(\text{amount of underlying stock})$$

The statistical software you used returns a 90% confidence interval of [0.30,1.60] for the slope coefficient. If the 10% critical value for the t-test is 1.70, what is the likely value of the p-value corresponding to your slope coefficient if you wanted to test whether the slope is different from 0?

A. 0.0132

B. 0.0164

C. 0.0192

D. 0.0186

Q.3972 Which of the following is the correct sequence of steps in hypothesis testing?

A. State the hypothesis, select the level of significance, compute the test statistic, formulate the decision rule, and make a decision.

B. State the hypothesis, select the level of significance, formulate the decision rule, compute the test statistic, and make a decision.

C. State the hypothesis, formulate the decision rule, select the level of significance, compute the test statistic, and make a decision.

D. Formulate the decision rule, state the hypothesis, select the level of significance, compute the test statistic, and make a decision.

Q.3973 The covariance between the 10-year money supply growth rates and the inflation rate is 0.007668, and the variance of the money supply growth rates is 0.02320. An investment analyst wants to explain the inflation rates using the money supply growth rates and predict the inflation rate when the money supply rate is 25%. The 10-year means for the money supply growth rate and inflation rate are 9% and 3%, respectively. The predicted inflation rate is *closest* to:

A. 7.234%

B. 8.289%

C. 6.345%

D. 8.756%

Reading 19: Regression with Multiple Explanatory Variables

Q.385 Which of the following is NOT true regarding a scatter plot?

A. It's a visual representation of the relationship between the explained variable and the independent/explanatory variable.

B. It's a standard two-dimensional graph where the values of the explained variable are plotted on the Y-axis while those of the explanatory variable are plotted on the X-axis.

C. It reveals the kind of relationship between the explained variable and the explanatory variable – linear or non-linear which may be positive or negative. .

D. None of the above.

Q.393 Which of the following is true regarding the coefficient of determination?

A. Can take values between 0% and 100% inclusive

B. Will generally increase when additional independent variables are added to the regression model

C. It is maximized by ordinary least squares.

D. All of the above are correct

Q.407 The following table represents the return of a portfolio over the return of its benchmark.

Portfolio Parameter	Value
Alpha	0.25
Coefficient of Determination	0.77
Standard Deviation of Error	2.40
Beta	1.20

Which of the following statements are correct?
I. The correlation is 0.69
II. The dependent variable is the portfolio
III. About 23% of the variation noted in the portfolio return is explained by variation in benchmark return
IV. For an estimated portfolio return of 10%, the 95% confidence interval is (5.296%, 14.704%)

A. I and II

B. II and III

C. II only

D. II and IV

Q.436 Which of the following best explains why multiple linear regression analysis may be preferred to single linear regression?

A. It is simpler to model using modern software and computer programming.

B. It reduces the omitted variable bias.

C. It's easier to model and establishes the relationship between the dependent variable and important independent variables.

D. None of the above.

Q.439 Under multiple linear regression, a residual is defined as:

A. A type 1 error

B. The error sum of squares

C. The regression sum of squared deviations from the mean value of the dependent variable

D. $Y - \hat{Y}$

Q.440 Assume we have the following multiple regression model:

$$Y = b_0 + 0.25X_1 + 0.14X_2 + \epsilon$$

It would be correct to say that:

A. If the independent variable X_1 increases by 1 unit, we would expect Y to increase by 0.25 units.

B. If the independent variable X_1 increases by 1 unit, we would expect Y to increase by 0.25/0.14 units.

C. If independent variable X_1 increases by 1 unit, we would expect Y to increase by 0.25 units, holding X_2 constant.

D. If independent variable X_2 increases by 1 unit, we would expect Y to increase by 0.25 + 0.14 units.

Q.441 Which of the following best describes how OLS estimators are derived in multiple regression models?

A. By minimizing the absolute difference of the residuals.

B. By minimizing the sum of squared prediction mistakes.

C. Minimizing the distance between the actual and fitted values.

D. By equating the sum of squared errors to zero.

Q.443 In a problem involving three independent variables and one dependent variable, assume that the computed coefficient of determination is 0.59. This result means that:

A. 59% of the total variation is explained by the dependent variable.

B. The correlation coefficient is 0.59 as well.

C. At least two of the three independent variables are highly correlated.

D. 59% of the total variation in the dependent variable is explained by the independent variables.

Q.444 Under multiple linear regression models, there's always the risk of overestimating the impact of additional variables on the explanatory power of the resulting model, which is why most researchers recommend using the adjusted R^2, $\overline{R^2}$, instead of R^2 itself. This adjusted R^2:

A. Is always positive.

B. Will never be greater than the regression R-Squared.

C. Cannot increase when an additional independent variable is incorporated into the model.

D. Is always negative.

Q.445 When an important variable is omitted from a regression model, the assumption that $E(\epsilon_i|X_i = 0)$ is violated. This implies that:

A. The OLS estimator is biased.

B. The product of the residuals and any of the independent variables is no longer zero.

C. The sum of the residuals is no longer equal to zero.

D. The coefficient of determination is zero.

Q.446 Study the following table:

Source	Sum of squares
Explained	825
Residual	625

The total sum of squares is closest to:

A. 1.32

B. 200

C. 1450

D. 0.7576

Q.447 An analyst uses the following regression model to explain stock returns:
Dependent variable:
ASR = Annual stock returns (%)

Independent variables:
MCP = Market capitalization (divided by $1million to simplify modeling)
SEF = Stock exchange firm, where SEF = 1 if the stock is that of a firm listed on the New York Stock Exchange and SEF = 0 if not listed
FMR = Forbes magazine ranking (FMR = 4 is the highest ranking)

The following table presents the regression results:

	Coefficient	Standard Error
Intercept	0.6330	1.11
MCP	0.0840	0.0130
SEF	0.5101	0.1235
FMR	0.7000	0.3241

Based on the results in the table above, which of the following is the correct regression equation?

A. 0.0840(MCP) + 0.5101(SEF) + 0.7(FMR)

B. 0.6330 + 0.0840(MCP) + 0.5101(SEF) + 0.7(FMR)

C. 1.11 + 0.0840(MCP) + 0.5101(SEF) + 0.7(FMR)

D. 1.11 + 0.0130(MCP) + 0.1235(SEF) + 0.3241(FMR)

Q.448 An analyst uses the following regression model to explain stock returns:
Dependent variable:
ASR = Annual stock returns (%)

Independent variables:
MCP = Market capitalization (divided by $1million to simplify modeling)
SEF = Stock exchange firm, where SEF = 1 if the stock is that of a firm listed on the New York Stock Exchange and SEF = 0 if not listed
FMR = Forbes magazine ranking (FMR = 4 is the highest ranking)

If the regression equation is 0.6330 + 0.0840(MCP) + 0.5101(SEF) + 0.7(FMR), then what is the expected amount of stock return that would be attributed to it being a listed stock?

A. 1.11 + 0.5101

B. 0.1235

C. 0.5101

D. 1.11 + 0.1235

Q.449 The following are assumptions of the multiple linear regression model EXCEPT:

A. The independent variables are random, and there is an exact linear relationship between any two or more independent variables.

B. The error term has an expected value equal to zero and is normally distributed.

C. A linear relationship exists between the dependent and independent variables.

D. The error for one observation is uncorrelated with that of a different observation.

Q.450 To construct a confidence interval for a regression coefficient, we need the estimated regression coefficient, the appropriate test statistic, and:

A. The F-statistic

B. The standard error of the regression coefficient

C. The coefficient of determination

D. The adjusted R-squared

Q.451 An analyst believes that future 15-year real earnings of the S&P 500 are a function of the trailing dividend payout ratio of the stocks in the index (DB) and the yield curve slope (YC). She collects data and obtains the following multiple regression results:

	Coefficient	Standard Error
Intercept	−10.8%	1.567%
DB	0.27	0.029
YC	0.12	0.210

Test the statistical significance of the independent variable DB at the 5% level of significance, quoting the value of the test statistic and the conclusion. (Number of observations = 43)

A. Test statistic = 2.021; DB regression coefficient is statistically different from zero

B. Test statistic = 9.310; DB regression coefficient is statistically different from zero

C. Test statistic = 0.018; DB regression coefficient is not statistically different from zero

D. Test statistic = 9.310; DB regression coefficient has little effect on the returns of S&P 500

Q.453 The following table presents regression results for a linear regression model with 3 independent random variables:

Variable	Coefficient	Standard Error	t-statistic	p-value
Intercept	2.0	2.0	1.0	0.3215
X	−1.8	0.56	−3.2	0.0022
Y	16.4	4.10	4.0	0.0002
Z	0.12	0.54	0.22	0.0319

Determine the regression parameters that are significantly different from zero at the 1% level of significance, assuming n = 60.

A. X and Y

B. X only

C. Y and Z

D. All of X, Y, and Z

Q.454 A multiple regression model has 4 independent variables such that:

$$Y_i = b_0 + b_1X_1 + b_2X_2 + b_3X_3$$

An analyst carries out a joint hypothesis test to determine the statistical significance of the independent variable coefficients, incorporating all the 3 variables. The null hypothesis is such that each variable coefficient is equated to zero. The results reveal that the F-statistic is greater than the one-tailed critical F-value. This implies that:

A. At least one of the coefficients is statistically significantly different from zero.

B. Each of the independent variable coefficients is statistically significantly different from zero.

C. None of the coefficients is statistically different from zero.

D. Only one of the independent variable coefficients is statistically different from zero.

Q.455 Peter Bridge, FRM, runs a regression of monthly stock returns on four independent variables over 65 months. The total sum of squares is 540, and the sum of squared residuals is 250. Carry out a statistical test at the 5% significance level with the null hypothesis that all four of the independent variables are equal to zero. Quote the F-statistic and the conclusion.

A. F-statistic = 17.40; At least one of the 4 independent variables is significantly different from zero.

B. F-statistic = 2.525; At least one of the 4 independent variables is significantly different from zero.

C. F-statistic = 72.5; All the 4 independent variables are significantly different from zero.

D. F-statistic = 17.40; None of the independent variables is significantly different from zero.

Q.456 Which of the following statements is INCORRECT regarding the use if R^2 and $\overline{R^2}$ in multiple regression analysis?

A. An increase in the R^2 or $\overline{R^2}$ always means that an added variable is statistically significant

B. A high R^2 or $\overline{R^2}$ does not mean that the regressors are the true cause of the dependent variable

C. A high R^2 or $\overline{R^2}$ does not necessarily indicate that you have the most relevant set of regressors, nor does a low R^2 or $\overline{R^2}$ necessarily indicate the presence of inappropriate regressors

D. A high R^2 or $\overline{R^2}$ does not mean that we do not have omitted variable bias

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Q.459 Elizabeth Graham, FRM, runs a regression of monthly stock returns on five independent variables over 66 months. The explained sum of squares is 270, and the sum of squared residuals is 250. Graham then performs a statistical test at the 10% significance level with the null hypothesis that all five of the independent variables are equal to zero. Quote the F-statistic and the conclusion.

A. F-statistic = 12.96; At least one of the 5 independent variables is significantly different from zero.

B. F-statistic = 1.946; At least one of the 5 independent variables is significantly different from zero.

C. F-statistic = 72.5; All the 5 independent variables are significantly different from zero.

D. F-statistic = 17.40; None of the independent variables is significantly different from zero.

Q.460 An analyst runs a regression of monthly value-stock returns on 8 independent variables . Given the following information: Explained Sum of Squares=1435 Residual sum of Squares=1335 Number of obsrvations=28 R^2 and the F-statistic, respectively, are closest to:

A. 53%, 4

B. 51%, 3.8

C. 52%, 2.6

D. 50%, 4

Q.461 A Financial Risk Manager exam candidate conducts a hypothesis test using a 10% significance level. Which of the following statements are correct?

A. The significance level is equal to the size of the test.

B. 5% of the total distribution will be in each tail rejection region if the test is 2-sided.

C. 10% of the whole distribution will be in the rejection region if the test is 2-sided.

D. All the above.

Q.462 Under multiple linear regression, if an estimator is said to be consistent, what does this imply?

A. On average, the estimated values of the coefficients will be equal to the true values.

B. The coefficient estimates will be as close to their true values as possible, regardless of the sample size.

C. The estimates will converge upon the true values as the sample size, n, increases.

D. The OLS estimator will also be unbiased and efficient.

Q.463 Assume that after constructing a multiple linear regression model, you find that $R^2 = 0.97$. How confident would you be in using the line of best fit for the purposes of prediction?

A. Not confident.

B. Very confident.

C. The relationship would be too weak at predicting using a linear function.

D. The relationship would be random and hence impossible to predict.

Q.480 A multiple regression model with three variables has the following formula:

$$Y_i = b_0 + b_1X_{1i} + b_2X_{2i} + b_3X_{3i}$$

A FRM exam candidate performs a joint hypothesis test where:

$$H_0 : b_1 = b_2 = b_3 = 0$$

If the computed *F*-statistic is less than the tabulated one-tailed F-value, this implies that:

A. All the three coefficients of the independent variables are statistically different from zero.

B. Only b_1 is statistically different from zero.

C. The effects of the independent variables on Y are statistically significant.

D. None of the coefficients are statistically significantly different from zero.

Q.481 Suppose you performed the F-test on a multiple regression model and established that a significant amount of variation in the Y variable is explained by the set of X variables; then:

A. You should transform the Y variable.

B. You could perform another test with an indicator variable so as to establish the significance level of the test.

C. You should discard the initial model in favor of a different one with more X variables.

D. You should perform t-tests on each X variable to establish whether there's any of them whose effect on Y is not statistically significant.

Q.482 A market analyst has established that future 10-year growth of earnings in the S&P 500 can be explained by a combination of two factors: the slope of the yield curve (YCS) and the preceding dividend payout ratio (PR) of stocks that have been featured in the index. The analyst carries out a regression and obtains the following results:

	Coefficient	Standard error
Intercept	−10.6%	1.525%
YCS	0.20	0.024
PR	0.12	0.230

Test the statistical significance of YCS at the 10% level of significance, quoting the t-statistic and the conclusion if n = 46.

A. 16.60; The YCS coefficient is statistically significantly different from zero.

B. 16.60; The PR coefficient is statistically significantly different from zero.

C. 8.333; The YCS coefficient is statistically significantly different from zero.

D. 1.68; The YCS coefficient is not statistically significantly different from zero.

Q.483 The following statements regarding R^2 and the adjusted R^2 are correct EXCEPT:

A. If R^2 improves after the addition of an independent variable, that does not necessarily mean that the variable is statistically significant

B. A high R^2 means that the independent variables are the definite causes of the movement seen in the dependent variable

C. Even with a high value of R^2, it's incorrect to assume that all the relevant independent variables have been found

D. The R^2 cannot and does not give evidence that the most or least statistically significant variables have been selected

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Q.484 Which of the following best defines the omitted variable bias under multiple regression?

A. The bias that emerges whenever an omitted determinant of the dependent variable is correlated with at least one of the included regressors.

B. The bias that emerges whenever two or more included regressors are correlated with an omitted variable.

C. The bias that emerges whenever one or more included regressors are uncorrelated with an omitted variable.

D. The bias that emerges whenever one or more included regressors are positively correlated with an omitted variable.

Q.3334 Tom Well, FRM, works for a trading company. Using historical data, he has computed the following variables considering one independent and one dependent variable.

- Explained Sum of Squares (ESS) = 60
- Sum of Squared Residuals (SSR) = 15

If we are dealing with a sample size of 62 observations, what is the coefficient of determination and the standard error of the estimate, respectively.

A. Coefficient of Determination = 0.50, Standard Error of the Estimate = 0.50

B. Coefficient of Determination = 0.80, Standard Error of the Estimate = 0.80

C. Coefficient of Determination = 0.80, Standard Error of the Estimate = 0.50

D. Coefficient of Determination = 0.25, Standard Error of the Estimate = 0.25

Q.3345 During the course of building a model using multiple linear regression, an analyst tried to judge the model based on its coefficient of determination (R^2) and adjusted R^2. Which of the following interpretation is correct?

A. The adjusted R^2 is always greater than the R^2

B. Both the adjusted R^2 and the R^2 always have positive values

C. The adjusted R^2 is always less than the R^2

D. The adjusted R^2 always increases with an increase in the number of independent

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Q.3346 An analyst performed a regression of monthly returns on a stock with 4 independent variables over a 50 month period. The analyst calculated the total sum of squares (TSS) and the sum of square residuals or error (SSR) as 500 and 100, respectively.
What is the adjusted R^2?

A. 0.80

B. 0.78

C. 0.20

D. 0.75

Q.3350 In a hypothetical world, GDP is regressed against interest rate and inflation, and regression results are shown below.

$$\text{GDP} = a + b\,(\text{Interest rate}) + c\,(\text{Inflation}) + \text{Error term}$$

	Coefficient	p-Value
a	9	0.042
b	2	0.035
c	1.5	0.012

ANOVA	df	SS	
Regression	2	240	
Residual	37	1070	
Total	39	1300	
Total	0.428		
R2	0.183		
Observation	40		

Which of the test is relevant to determine whether the regression model as a whole is significant?

A. $F-\text{test}; H_0$: All slope coefficients $= 0$; H_a: At least one slope coefficient $\neq 0$

B. $F-\text{test}; H_0$: All slope coefficients ≥ 0; H_a: At least one slope coefficient < 0

C. $t-\text{test}; H_0$: All slope coefficients $= 0$; H_a: At least one slope coefficient $\neq 0$

D. $t-\text{test}; H_0$: All slope coefficients ≥ 0; H_a: At least one slope coefficient < 0

Q.3352 In a hypothetical world, GDP is regressed against interest rate, and inflation and regression results are shown below.

$$GDP = a + b\ (\text{Interest Rate}) + c\ (\text{Inflation}) + \text{Error Term}$$

	Coefficient	p-Value
a	9	0.042
b	2	0.035
c	1.5	0.012

ANOVA	df	SS
Regression	2	240
Residual	37	1070
Total	39	1310
Total	0.428	
R2	0.183	
Observation	40	

Assume that on a certain significance level, the critical value of the F-statistic is 4. Which of the following is correct?

A. The value of F-statistic is less than its critical value.

B. We fail to reject the null hypothesis: H_0: All slope coefficients = 0.

C. The model as a whole is statistically significant.

D. The model as whole is not statistically significant.

Q.3353 Suppose that the following regression is estimated using 25 quarterly observations:

$$y_t = \beta_1 + \beta_2 x_{2t} + \beta_3 x_{3t} + u_t$$

What is the appropriate critical value for a 2-sided 5% size of test of $H_0 : \beta_3 = 1$?

A. 1.72

B. 2.06

C. 2.07

D. 1.64

Q.3354 Consider the following 2 regression models built to estimate a common phenomenon:

Model	R^2	Adjusted R^2
Model 1	0.75	0.73
Model 2	0.81	0.72

If a variable x_4 is introduced in model 2 and that the coefficient estimate β_4 was zero, which one of the following is most likely correct?

A. The researcher must have made a mistake because the adjusted R^2 for model 2 must be greater than the adjusted R^2 for model 1.

B. Variable x_4 is statistically significant.

C. The coefficient estimate β_4 is non-zero but not significant.

D. None of the above.

Q.3355 Consider the following 2 regression models:

$$\text{Model 1}: y_t = \beta_1 + \beta_2 x_{2t} + u_t$$
$$\text{Model 2}: y_t = \beta_1 + \beta_2 x_{2t} + \beta_3 x_{3t} + u_t$$

A researcher determines that the two models have identical R-squared values. This most likely implies that:

A. Model 2 must have a lower value of adjusted R-squared.

B. Model 2 must have a higher value of adjusted R-squared.

C. Model 1 and 2 will also have identical values of adjusted R-squared.

D. Variable x_3 is statistically significant.

Q.3356 For a sample of 40 years, the relationship between GDP growth (Y_i), inflation (X_1) and interest rates (X_2) is modeled as follows:

$$y_t = \beta_1 + \beta_2 x_{1t} + \beta_3 x_{2t} + u_t$$

An economist wishes to test the joint hypothesis that $\beta_1 = 0$, $\beta_2 = 0$, and $\beta_3 = 0$ at the 90% confidence level.
The p-value for the t-statistic for β_1 is 0.11, and the p-value for the t-statistic for β_2 is 0.12. The p-value for the F-statistic for the regression is 0.09. Which of the following statements is correct?

A. We cannot reject the null hypothesis because none of the β_s is different from zero at 90% confidence.

B. We can reject the null hypothesis because each of the β_s is different from zero at 90% confidence.

C. We cannot reject the null hypothesis because the F-statistic is not significant at 90% confidence.

D. We can reject the null hypothesis because the F-statistic is significant at 90% confidence.

Reading 20: Regression Diagnostics

Q.401 What is the implication of having heteroskedastic regression?

A. The variance of the error terms is constant.

B. The variance of the error terms is not constant.

C. Subsamples are equally spread out.

D. The independent variable has no linear relationship with the dependent variable.

Q.403 Which of the following statements regarding linear regression is incorrect?

A. Homoskedasticity occurs when the variance of the residuals is constant across all observations.

B. Heteroskedasticity occurs when the variance of the residuals, commonly known as error terms, is not the same across all observations in the sample.

C. If residual terms are correlated with each other, this can lead to serial correlation.

D. Heteroskedasticity does not lead to problems with inference and estimation.

Q.437 One of the following assumptions is applied in the multiple least squares regression model. Which one?

A. The independent variables included in the model are homoskedastic.

B. The residual terms are heteroskedastic.

C. The dependent variable is unique and stationary.

D. There is no perfect multi-collinearity..

Q.442 Jessica Pearson, FRM, builds a model to study the annual salaries of individuals in a certain developed country. The model incorporates just 2 independent variables – age and experience. She is surprised for ending up with a negative value for the coefficient of experience, which seems to be somewhat counterintuitive. Furthermore, the coefficients have low t-statistics but otherwise the model has a high R^2. Which of the following is the most likely cause of such results?

A. Heteroskedasticity

B. Multicollinearity

C. Homoskedasticity

D. Serial correlation

Q.457 Which of the following conditions must be met for omitted variable bias to occur under multiple linear regression?
I. The value of $\overline{R^2}$ must be less than that of R^2
II. At least one of the included regressors must be correlated with the omitted variable
III. The omitted variable must be a determinant of the dependent variable
IV. The residuals must be homoskedastic
V. The number of included regressors must be less than or equal to 5

A. I and II

B. II and III only

C. I, III, and V

D. All the above

Q.3347 What will be the properties of the OLS estimator in the presence of near multicollinearity?

A. It will be consistent, unbiased, and efficient.

B. It will not be consistent.

C. It will be consistent, unbiased, but not efficient.

D. It will be consistent but not unbiased.

Q.3349 Which of the following statements is/are correct?

I. Homoskedasticity means that the variance of the error terms is constant across all observations in the sample
II. Heteroskedasticity means that the variance of error terms varies over the sample
III. The presence of conditional heteroskedasticity leads to biased standard error estimates

A. Only I is correct.

B. Only II and III are correct.

C. All statements are correct.

D. None of the statements is correct.

Q.3780 When is a set of data termed as homoscedastic? When:

A. the variance of the error terms is the same across all the observations.

B. the observations are i.i.d. random variables.

C. the variance of the errors varies with the independent variables.

D. None of the above.

Q.3782 Assume that you want to test for heteroskedasticity in a model with one explanatory variable, using a sample size of 100. What is the value of R^2 at which the null hypothesis will be rejected at a 5% level of significance?

A. 0.0399

B. 0.0112

C. 0.0563

D. 0.0599

Q.3783 A regression model is estimated as:

$$Y_i = 3 + 1.5X_{1i} - 2X_{2i} + \epsilon_i$$

What is the value of $\hat{\beta}_1$ if the model is reduced to $Y_i = \alpha + \hat{\beta}_1 X_1 + \epsilon_i$ given that $\rho_{X_1X_2} = 0.7$,$\sigma^2_{X_1} = 25$ and $\sigma^2_{X_2} = 36$?

A. -0.45

B. 0.67

C. -0.18

D. 0.23

Q.3785 Given a model with two independent variables: $Y_i = Y_i = \alpha + \beta_1 X_1 i + \beta_2 X_2 i + \epsilon_i$, what is the value of the correlation coefficient between X_1 and X_2 so that the value of the variance inflation factor is 15?

A. 0.9595

B. 0.9654

C. 0.9661

D. 0.4563

Q.3786 Consider the following data sets (We are using a small sample size for illustration purposes. In an exam situation, it might involve large sample sizes)

Y	X_1	X_2
−2	−0.41	−0.01
−0.11	0.40	−1.2
−1.68	−0.86	−0.91
−0.36	1.69	0.37
−0.08	0.46	−0.64
−0.74	1.40	−1.09

What are the estimated values of the parameters ($\hat{\alpha}$ and $\hat{\beta}_1$) in the model:

$$Y = \alpha + \beta_1 X_1$$

A. $\hat{\alpha}$=-1.080 ,$\hat{\beta}_1$=0.5633

B. $\hat{\alpha}$=-1.280 ,$\hat{\beta}_1$=0.3433

C. $\hat{\alpha}$=-1.5797 ,$\hat{\beta}_1$=0.6633

D. $\hat{\alpha}$=-1.780 ,$\hat{\beta}_1$=0.9933

Q.3787 Consider the following data sets (We are using a small sample size for illustration purposes. In an exam situation, it might involve large sample sizes)

Y	X_1	X_2
−2	−0.41	−0.01
−0.11	0.40	−1.2
−1.68	−0.86	−0.91
−0.36	1.69	0.37
−0.08	0.46	−0.64
−0.74	1.40	−1.09

What is the estimated regression equation

$$\hat{Y} = \hat{\alpha} + \hat{\beta}_1 X_1$$

A. $\hat{Y}=0.8967+0.9633X_1$

B. $\hat{Y}=-1.0799+0.5633X_1$

C. $\hat{Y}=-1.8967+0.7633X_1$

D. $\hat{Y}=-1.5745+0.6633X_1$

Q.3788 Assume that you have estimated two regression equations: $\hat{Y} = 0.5767 + 0.5633X_1$ and $\hat{Y} = 0.6767 - 0.7633X_2$ and that covariance between explanatory variables X_1 and X_2 is 0.603 ($Cov(X_1, X_2) = 0.603$) and $Var(X_1) = 0.874$ and $Var(X_2) = 0.75$ What is the estimated expression the intercept ($\hat{\alpha}$) for $Y_i = \alpha + \beta_1 X_1 + \beta_2 X_2 + \epsilon_i$?

A. $\hat{\alpha} = \hat{Y}_i - 4.875X_1i + 1.627X_2i$

B. $\hat{\alpha} = \hat{Y}_i - 3.585X_1i + 1.907X_2i$

C. $\hat{\alpha} = \hat{Y}_i - 2.585X_1i + 3.827X_2i$

D. $\hat{\alpha} = \hat{Y}_i - 2.4476X_1i + 2.7312X_2i$

Q.3789 A financial analyst wishes to come up with Ordinary Least Squares Estimation (OLS) regression model to analyze the financial performance of a company. However, the analyst is aware that some of the explanatory variables might be excluded (and hence omitted variable bias). What is the cause of omitted variables bias?

A. Omitted variable bias happens when the omitted variable is independent of the included independent variables but is not a determinant of the dependent variable.

B. Omitted variable bias occurs when the omitted variable is correlated with all of the included independent variables and is a determinant of the dependent variable.

C. Omitted variable bias occurs when the omitted variable is independent of the included independent variables and is a determinant of the dependent variable.

D. Omitted variable bias occurs when the omitted variable is correlated with at least one of the included independent variables and is a determinant of the dependent variable.

Q.3790 Consider the following data sets:

Observation	Y	X
1	3.67	1.85
2	1.88	0.65
3	1.35	0.63
4	0.34	1.24
5	0.89	2.45

The regression analysis was done on the entire data set, and the regression equation was estimated as:

$$\hat{Y} = 1.4110 + 0.1512X_1$$

Additionally, first four observations were used, leading to the following estimated regression equation:

$$\hat{Y} = 0.3169 + 1.3667X_1$$

What is Cook's distance for the 5^{th} observation?

A. 3.3923

B. 1.6268

C. 0.6458

D. 1.3667

Q.3791 What is the extraneous variable in regression diagnostics?

A. It is a variable which is eliminated to increase the effectiveness of a model.

B. It is one that is unnecessarily included in the model, whose actual coefficient and consistently approximated value is 0 in large sample sizes. If we add these variables is costly.

C. It is a variable that is included in a model in case the sample size is not appropriate.

D. None of the above.

Q.3792 Which of the following is least likely to be the method of handling data with heteroscedastic data?

A. Use of weighted least squares (WLS).

B. Ignoring the heteroskedasticity when approximating the parameters and then utilize the White covariance estimator in hypothesis tests.

C. Transforming the data in an attempt to remove heteroskedasticity.

D. None of the above.

Q.3793 Multicollinearity occurs when several variables can significantly explain one or more independent variables. Which one of the following is most likely to be true about multicollinearity?

A. Multicollinearity does pose technical problems in parameter estimation, and data modeling.

B. When there is multicollinearity in a model, the coefficients tend to be jointly statistically significant.

C. Multicollinearity can be detected using the Variance Inflation Factor, where a variable with high VIF is considered for inclusion in the model.

D. All of the above.

Q.3794 There is a bias-variance tradeoff that amounts to choosing between including irrelevant variables and excluding relevant variables. There are many methods of choosing a final model from a set of explanatory variables. Among them is the general-to-specific model. Which of the following is right about the general-to-specific (GtS) model selection?

A. The appropriate variables are chosen from a pool of random variables.

B. The variables with the smallest t-statistics are excluded in the model.

C. The model is re-estimated with the random variables with the smallest t-statistic.

D. None of the above.

Q.3795 What is the main reason the *m*-fold cross-validation method of model selection is mostly used in modern data science?

A. It is relatively easy to execute.

B. The method is appropriate in modeling observations that can be used for out-of-sample predictions.

C. This method is suitable in large sample sizes.

D. All of the above.

Reading 21: Stationary Time Series

Q.469 Study the following statements regarding information criteria:
I. Akaike's information criteria are consistent
II. Akaike's information criterion always gives model orders that are at least as large as those obtained under the Schwarz's information criterion
III. If the residual sum of squares falls after the addition of an extra term, the value of the information criterion must fall
IV. The adjusted R-squared is an example of an information criterion

Which of the above statements is/are true?

A. I, II, and III

B. II and III

C. II and IV

D. All the above

Q.505 A time series is said to be stationary if:

A. Its statistical properties including the mean and variance do not change over time.

B. Its mean, variance, and covariances with lagged and leading values change over time.

C. Its mean remains constant but variance and covariances with lagged and leading values change over time.

D. Its mean and variance are variables but covariances with lagged and leading values do not change over time.

Q.506 Financial asset return time series have one common characteristic:

A. They are not weakly stationary.

B. They are highly correlated.

C. They do not exhibit any trend.

D. Their distributions have very thin tails.

Q.507 Which of the following characteristics apply to a white noise process?
I. Zero mean
II. Autocovariances that are constant
III. Autocovariances that are zero except at lag zero
IV. Constant variance

A. I and III

B. II and III

C. I and IV

D. I, III and IV

Q.508 Distinguish between independent white noise and normal (Gaussian white noise).

A. An independent white noise is a time series that exhibits both serial independence and a lack of serial correlation while a normal white process is a time series that's serially independent, serially uncorrelated, and is normally distributed.

B. A normal white noise is a time series that exhibits both derail independence and a lack of serial correlation while an independent white noise is a time series that's serially independent, serially uncorrelated, and is normally distributed.

C. An independent white noise is a time series with equal mean and variance while a normal white noise is a time series where the mean is not equal to the variance.

D. An independent white noise is discrete while a normal white noise is continuous.

Q.509 Which of the following is not a characteristic describing the dynamic nature of a white noise process?

A. The unconditional mean and variance must be constant for any covariance stationary process.

B. The absence of any correlation means that all autocovariance and autocorrelations are not zero beyond displacement zero.

C. Events in a white noise process do not exhibit any correlation between the past and the present.

D. Both conditional and unconditional means and variances are the same for an independent white noise process.

Q.510 Which of the following statements is most likely correct regarding lag operators? Lag operators:

A. only use lagged future values.

B. are of limited use in modeling a time series.

C. consider only infinite-order polynomials

D. quantify how a time series evolves by lagging a data series.

Q.511 Unlike structural models, pure time series models do not incorporate any explanatory variable. Which of the following is a disadvantage of pure time series models when compared to the structural models?

A. They are not theoretically motivated.

B. They cannot produce forecasts easily.

C. They cannot be used when the data has a very high frequency.

D. It's difficult to select the most appropriate explanatory variables to include in a pure time-series model.

Q.512 The following sample autocorrelation estimates are obtained using 200 data points:

Lag	1	2	3
Coefficient	0.3	−0.15	−0.10

Compute the value of the Box-Pierce Q-statistic.

A. 12.6

B. 28.0

C. 18.2

D. 24.5

Q.513 The following sample autocorrelation estimates are obtained using 250 data points:

Lag	1	2	3
Coefficient	0.3	−0.15	−0.10

Compute the value of the Ljung Box Q statistic.

A. 18

B. 31.04

C. 30

D. 35

Q.514 The Box Pierce and the Ljung Box Q-statistics are used to measure the degree to which autocorrelations vary from zero and to establish whether white noise might be present in a set of data. Which of the following statements is incorrect regarding these two test statistics?

A. The Box Pierce test has better small sample properties compared to the Ljung Box test.

B. Asymptotically (as the sample size increases), the values of the two test statistics will be equal.

C. The Box Pierce test is sometimes oversized for small samples.

D. Both tests show a tendency to reject the null hypothesis of zero autocorrelations as n tends towards infinity.

Q.515 All the following characteristics indicate a time series that's covariance stationary EXCEPT:

A. Stability of the autocorrelation.

B. Stability of the mean.

C. Stability of the covariance structure.

D. A nonconstant variance.

Q.516 Which of the following statements is most likely correct regarding lag operators?

A. They only use lagged future values.

B. They are of limited use in modeling a time series.

C. They consider only infinite-order polynomials.

D. They quantify how a time series evolves by lagging a data series.

Q.517 Which of the following statements are true with regard to sample partial correlations?

A. They are identical to sample autocorrelations.

B. They utilize non-linear regressions.

C. They typically fall within a one-standard-error band.

D. They differ from sample autocorrelation in the size of the dataset to which they apply.

Q.518 The following sample autocorrelation estimates are obtained using 300 data points:

Lag	1	2	3
Coefficient	0.25	−0.1	−0.05

Compute the value of the Ljung Box Q statistic.

A. 20

B. 22.74

C. 24

D. 18.45

Q.519 The following sample autocorrelation estimates are obtained using 300 data points:

Lag	1	2	3
Coefficient	0.25	−0.1	−0.05

Calculate the value of the Box Pierce Q-statistic.

A. 22.5

B. 22.74

C. 21.5

D. 18

Q.521 Assume you have an MA(1) with zero mean and 0.5 as the moving average coefficient. Determine the value of the autocovariance at lag 1.

A. 0.5

B. 0.25

C. 1

D. It's impossible to determine the values of autocovariances without knowing disturbing variances.

Q.522 Which of the following is an autoregressive model with order 2?

A. $x_t = b_0 + b_1 x_{t-1} + \epsilon_t$

B. $x_t = b_0 + b_1 x_{t-1} + b_2 x_{t-2} + \epsilon_t$

C. $x_t = b_0 + b_1 x_{t-1} + b_2 x_{t-2} + b_3 x_{t-3} + \epsilon_t$

D. $x_t = b_0 + b_1 + \epsilon_t$

Q.524 The partial autocorrelation function is necessary for distinguishing between:

A. Models linked to the ARMA family.

B. An MA and an ARMA model.

C. An AR and an ARMA model.

D. None of the above.

Q.526 Consider the time series $Y_t = 1 + 0.5t + Z_t$ where $Z_t \sim WN(0, 1)$Determine the mean function of Y_t.

A. 0.5t

B. 1

C. 1 + 0.5t

D. 1.5

Q.527 If a time series is reasonably approximated as white noise, then each of the following is true EXCEPT:

A. Observations in the time series are normally distributed.

B. Serial correlations (autocorrelations) are zero.

C. In a large sample, the distribution of the sample autocorrelations is approximately normal with a variance of s^2.

D. In a large sample, the distribution of the sample autocorrelations is approximately normal with mean of zero.

Q.528 An autoregressive process of order q is considered stationary if:

A. The roots of the characteristic equation lie on the unit circle.

B. The roots of the characteristic equation lie outside the unit circle.

C. The roots of the characteristic equation lie inside the unit circle.

D. The characteristic equation is of order 1.

Q.529 Which of the following statements best explains the main setback of the moving average representation of a first-order moving average process, MA(1)?

A. It does not incorporate observable shocks, so the solution is to use an autoregressive representation.

B. It does not show evidence of autocorrelation cutoff.

C. It only incorporates observable shocks, so the solution is to use an autoregressive representation.

D. The process is highly complicated and can only be carried out using a computer program.

Q.530 The key difference between a moving average representation and an autoregressive process is that:

A. An autoregressive process is never covariance stationary.

B. An autoregressive process shows evidence of autocorrelation cutoff.

C. Unlike the autoregressive process, a moving average representation shows evidence of gradual decay.

D. A moving average representation shows evidence of autocorrelation cutoff.

Q.531 Consider the following statements regarding the modeling of seasonal data:
I. Both the autoregressive process and the autoregressive moving average process include lagged terms and are therefore appropriate for a relationship in motion
II. Both the autoregressive process and the autoregressive moving average process specialize in capturing only the random movements in data

A. I and II are both correct.

B. Only II is correct.

C. Only I is correct.

D. I and II are both incorrect.

Q.532 Consider the following statements regarding an autoregressive moving average (ARMA) process:
I. The process combines the lagged unobservable random shock characteristic of the MA process with the observed lagged time series characteristic of the AR process
II. The process involves gradually-decaying autocorrelations
Which of the above statement(s) is /are correct?

A. Only I is correct.

B. Only II is correct.

C. Both I and II are correct.

D. Both I and II are incorrect.

Q.533 What is the purpose of a q^{th}-order moving average process?

A. To add a fifth error term to an MA(1) process.

B. To add a third error term to an MA(1) process.

C. To add as many additional lagged variables as needed so as to produce a robust set of estimates for the time series.

D. To invert the moving average representation and make it more useful.

Q.534 An analyst is charged with developing a model to analyze employment data from a developing nation. Which of the following models would be the most appropriate?

A. A moving average process.

B. An autoregressive process.

C. Both AR and ARMA models.

D. None of the above.

Q.3367 The following sample autocorrelation estimates have been obtained using 200 data points:

Lag	1	2	3	4
Coefficient	0.15	−0.14	−0.1	−0.08

What is the value of the Box-Pierce Q-statistic?

A. 1.05

B. 17.1

C. 11.7

D. 12.5

Q.3368 A covariance stationary time series must satisfy which of the following requirements?

I. The expected value of the time series must be constant and finite in all periods
II. The variance of the time series must be constant and finite in all periods
III. The covariance of the time series with itself for a fixed number of periods in the past or future must be constant and finite in all periods

Which of them is correct?

A. Only III

B. I, II and III

C. I and III

D. II and III

Q.3370 Each of the following is a requirement for a series to be covariance stationary (aka, weak stationarity), **EXCEPT**:

A. The mean of the series is stable over time, i.e., $Ey_t = \mu$ {vs. μ_t}

B. The autocovariance at displacement (0) is finite

C. The autocovariance depends on time (t), but does not depend on the displacement (π)

D. The covariance structure of the series is stable over time

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Q.3371 Which of the following statements is (are) correct?

I. The Q-statistic measures the degree to which autocorrelations vary from zero and whether white noise is present in a dataset
II. The Box-Pierce Q-statistic represents the weighted sum of squared autocorrelations
III. The Ljung-Box Q-statistic represents the sum of squared autocorrelations

A. Only I

B. I, II and III

C. Only II

D. II and III

Q.3372 The first-order moving average MA(1) process has zero mean and constant variance defined as:

$$y_t = \varepsilon_t + 0.2\varepsilon_{t-1}$$

Based on the above assumption, the autocorrelation can be deduced as:

A. 0.1923

B. 0.2000

C. 0.0400

D. None

Q.3373 The first-order autoregressive AR(1) is defined as:

$$y_t = \varepsilon_t + 0.25y_{t-1}$$

Using the Yule-Walker equation, compute the autocorrelation of the AR(1).

A. 0.50

B. 0.25

C. 0.0625

D. None

Q.3374 Assume the shock in a time series is approximated by Gaussian white noise. Yesterday's realization, $y_{(t)}$ was 0.015 and the lagged shock was -0.160. Today's shock is 0.170.
If the weight parameter theta, θ, is equal to 0.70, determine today's realization under a first-order moving average, MA(1), process.

A. 0.254

B. 0.075

C. 0.062

D. 0.058

Q.3375 Consider the following AR(1) model with the disturbances having zero mean and unit variance

$$y_t = 0.2 + 0.3y_{t-1} + u_t$$

The (unconditional) variance of y will be given by:

A. 1.1500

B. 1.0989

C. 0.2198

D. 0.2145

Q.3376 An analyst is analyzing the sales and fitting time series model and found that sales are periodically spiked in autocorrelations as they gradually decay. Such behavior is most likely indicative of:

A. Seasonality in sales data

B. A regime change structural sales data series

C. A structural shift in sales data series

D. A differencing lag

Q.3960 The AR(2) model is defined as: $Y_t = 0.4 + 1.5Y_{t-1} - 0.7Y_{t-2} + \epsilon_t$ where ϵ_t is a white noise. What is the long-term mean of the time series?

A. 3.0

B. 1.0

C. 2.1

D. 2.0

Q.3962 The lag operator is applied to the AR times series as follows:

$$(1 - 0.2L)(1 - 0.6L^4)Y_t = \epsilon_t$$

What is the resulting time series?

A. $0.2Y_{t-1} + 0.6Y_{t-4} - 0.12Y_{t-5} + \epsilon_t$

B. $Y_{t-2} + 0.6Y_{t-4} - 0.12Y_{t-5} + \epsilon_t$

C. $Y_{t-2} + 0.6Y_{t-4} - 0.12Y_{t-4} + \epsilon_t$

D. $0.1Y_{t-1} + 0.6Y_{t-4} - 0.2Y_{t-5} + \epsilon_t$

Q.3963 The MA(2) model is defined as $Y_t = 0.1 + 0.8\epsilon_{t-1} + 0.16\epsilon_{t-2} + \epsilon_t$. What is the corresponding lag polynomial?

A. $\epsilon_t(0.4L^2 + 0.16L^2 + 3)$

B. $\epsilon_t(0.5L + 0.15L^2 + 3)$

C. $0.1 + \epsilon_t(0.8L^2 + 0.16L^3 + L)$

D. $\epsilon_t(0.2L + 0.14L^2 + 2)$

Q.3964 The sample autocorrelations for a time series are estimated to be $\hat{\rho}_1 = 0.20, \hat{\rho}_2 = -0.03$ and $\hat{\rho}_3 = 0.05$ from a sample size of 90. What is the value Ljung-Box Q statistic?

A. 3.45

B. 3.87

C. 20.54

D. 4.04

Q.3965 An investment analyst wishes to forecast the future returns based on the prevailing interest rate then. The analyst chooses AR times series to model the monthly interest rates movement over 20 years. The equivalent AR(1) model has an intercept of 0.24 and an AR parameter of 0.65. What is the mean-reverting value of the times series used by the analyst?

A. 0.69

B. 0.56

C. 0.65

D. 0.54

Reading 22: Nonstationary Time Series

Q.470 Forecasting involves using sample data to predict future movements. Which of the following is correct regarding forecasting?

A. Forecasts are only possible in the presence of time-series data.

B. Forecasts will always improve whenever the number of parameters is increased.

C. As the number of variables incorporated in a regression equation increases, the risk of over-fitting the in-sample data reduces.

D. In-sample forecasting ability is a very poor test of model appropriateness and adequacy.

Q.472 A Financial Risk Manager exam candidate suggests that a model based on financial theory is likely to lead to a high degree of out-of-sample forecast accuracy. Which of the following best explains why the candidate is correct?

A. A solid financial background significantly increases the chances of the model working in the out-of-sample period as well as for the sample data used to estimate the model's parameters.

B. A financial background increases the chances of use of authentic input data.

C. Financial theory incorporates industry-wide variables.

D. Financial theory would be easy to understand and research on.

Q.477 Joel Matip, FRM, is running a regression model to forecast in-sample data. He's worried about data mining and over-fitting the data. The criterion that provides the highest penalty factor based on degrees of freedom is the:

A. Schwarz information criterion.

B. Akaike information criterion.

C. Unbiased mean squared error.

D. Mean squared error.

Q.479 Which of the following criteria is most consistent?

A. MSE criterion

B. Akaike's information criterion

C. Schwarz information criterion

D. None of the above

Q.485 Define trend as used in business and economics.

A. A curve that represents the change in a series of data points collected over a given period of time.

B. A straight line extrapolated from past and present values to forecast future values of a given variable.

C. A pattern of gradual change in output as a result of data points moving in a given direction over time, and which can be represented by a line, curve, or graph.

D. A pattern of gradual change in output as a result of data points moving in a positive direction over time, and which can be represented by a line, curve, or graph.

Q.486 An FRM exam candidate studies labor participation rate for males 18 years and over, and obtains the following linear model:

$$P_t = \beta_0 + \beta_1 t$$

Where p_t stands for participation rate and t = time in years. The fact that β_1 (the regression slope) is positive means:

A. Participation rate decreases with increase in time.

B. Participation rate increases with time.

C. Time is the only explanatory variable.

D. As males grow older, less and less of them engage in labor.

Q.487 In which of the following scenarios would we expect to have a non-linear trend?

A. When a variable increases at a constant rate only.

B. When variable increases or decreases at either a constant or non-constant rate.

C. When the explanatory variable increases only at discrete intervals

D. When a linear trend has a negative regression slope

Q.488 Suppose we have the following linear trend model which holds for any time t:

$$Y_t = \beta_0 + \beta_1 TIME_t + \epsilon_t$$

Assuming that ϵ is independent zero-mean random noise, which of the following accurately represents the model at time $T + h$, if the forecast is made at time T?

A. $Y_t = \beta_0 + \beta_1 TIME_{(T+h)} + \epsilon_t$

B. $Y_{(T+h,T)} = \beta_0 + \beta_1 TIME_T$

C. $Y_{(T+h,T)} = \beta_0 + \beta_1 TIME_{(T+h)}$

D. $Y_{(T+h,T)} = \beta_0 + \beta_1 TIME_{(T+h)} + \epsilon_{(T+h)}$

Q.489 A linear trend is calculated as $T = 17.5 + 0.65t$. Determine the trend projection for period 10.

A. 28.15

B. 181.5

C. 82.5

D. 24

Q.490 A seasonal time series component:

A. Reflects variability due to natural disasters.

B. Reflects variability during a single year.

C. Reflects a regular, multi-year pattern of being above and below the trend line.

D. Reflects gradual variability over a long time period.

Q.491 Which one of the following can bring about seasonality?

A. Technologies linked to the calendar.

B. Preferences with links to the calendar.

C. Social events with links to the calendar.

D. All of the above.

Q.492 An FRM exam candidate wishes to determine the type of variation in a time series and singles out non-seasonal variation while at the same time discarding seasonal variation. The candidate's approach:

A. Is appropriate since seasonality has minimal impact on most phenomena, including economic ones.

B. Is appropriate because seasonal variation is very easy to establish without the need for intensive statistical analysis.

C. Is inappropriate because seasonality may account for a large part of the variation.

D. Is inappropriate because non-seasonal variation is irrelevant while studying economic relationships.

Q.493 An analyst wishes to use seasonal dummy variables (0s and 1s) to model seasonality. Suppose there are four seasons in a year. Which of the arrangements below would represent the third season (third quarter)?

A. 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, …;

B. 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, …;

C. 0, 0, 3, 0, 0, 3, 0, 0, 3, …;

D. 0, 1, 0, 0, 1, 0, 0, 1, 0 …;

Q.494 Which one of the following statements best explains the idea of holiday variation?

A. The dates of certain holidays may change from one country to another.

B. The number of holidays in a year differs from one country to another.

C. The number of holidays varies from year to year.

D. The dates of certain holidays change from year to year.

Q.495 Which of the following is not an example of seasonal variation?

A. Flower sales

B. Sales of Suntan oil

C. Use of electricity

D. Annual earnings of a limited liability company

Q.497 Quarter 1 sales for an automobile manufacturer were $180 million. If the quarter 1 seasonal index was 1.8, what is the estimate of annual sales for this firm?

A. $400 million

B. $180 million

C. $720 million

D. $100 million

Q.499 Which one of the following is correct? A time series data set with quarterly seasonality can be handled by:

A. Using three dummy variables.

B. Using two dummy variables – one for each season.

C. Deseasonalizing the data and then applying non-seasonal methods.

D. All the three choices above are incorrect.

Q.500 A season in the seasonality index can only occur:

A. Daily

B. Monthly

C. Weekly

D. All of the above

Q.502 An analyst applies the following time series model to daily data:R_t = returnsD_1 – dummy variable for Monday and zero otherwiseD_2 – dummy variable for Tuesday and zero otherwiseD_3 – dummy variable for Wednesday and zero otherwiseD_4 – dummy variable for Thursday and zero otherwiseWhat is the interpretation of the parameter estimate for the intercept?

A. It's the average return for the 5 days from Monday to Friday.

B. It's the Friday deviation from the mean return for the week.

C. It's the average return on Monday.

D. It's the average return on Friday.

Q.523 An analyst intends to use linear regression to model the relationship between two-time series. After some testing, she finds out that one of the time series has a unit root. She should:

A. Not use linear regression if the two time series are not co-integrated.

B. Not use linear regression.

C. Perform another test on a higher level of significance before proceeding to use linear regression.

D. Only use linear regression if the time series are co-integrated.

Q.3358 Roderick Jaynes, FRM, analyzed historical sales (S) for over 20 years and found that sales are increasing but its growth rate over the period is relatively constant. Which model is most suitable to forecast out-of-sample sales?

A. $S_t = \beta_0 + \beta_1 \times S_{t-1}$

B. $S_t = \beta_0 + \beta_1 \times t$

C. $\ln S_t = \beta_0 + \beta_1 \times t$

D. $S_t = \beta_0 + \beta_1 \times t + \beta_2 \times t^2$

Q.3362 After finding that sales of a company vary seasonally over each quarter, an analyst is trying to incorporate such seasonality effect and build the regression model using dummy variables. Which of the following statements is (are) correct?

I. There are four dummy variables required
II. There are three dummy variables required
III. A dummy variable, takes on a value of 1 if a particular condition is true and 0 if that condition is false.

A. Only II

B. I and III

C. II and III

D. Only I

Q.3363 A mortgage analyst produced a model to predict housing starts (given in thousands) within Florida in the US. The time series model contains both a trend and a seasonal component and is given by the following:

$$y_t = 0.2 \times Time_t + 10.5 + 3.0 \times D_{2t} + 5.4 \times D_{3t} + 0.7 \times D_{4t}$$

The trend component is reflected in variable $TIME_t$, where (t) = month.
Seasons are defined as follows :

Season	Months	Dummy
Winter	December,January and February	–
Spring	March, April and May	D_{2t}
Summer	June, July and August	D_{3t}
Fall	September, October and November	D_{4t}

The model starts in May 2019, i.e., $y_{(T+1)}$ refers to June 2019. What does the model predict for September 2020?

A. 23

B. 14

C. 13

D. 16

Q.3364 A ski resort has come up with a model to predict the number of guests (given in hundreds) checking in throughout the year. The time series model contains both a trend and a seasonal component and is given by the following:

$$y_t = 0.2 \times Time_t + 10.5 + 3.0 \times D_{2t} + 2.1 \times D_{3t} + 2.8 \times D_{4t}$$

The trend component is reflected in variable $TIME_{(t)}$, where (t) = month.
Seasons are defined as follows :

Season	Months	Dummy
Winter	December,January and February	–
Spring	March, April and May	D_{2t}
Summer	June, July and August	D_{3t}
Fall	September, October and November	D_{4t}

The model starts in April 2019, i.e., $y_{(T+1)}$ refers to May 2019. How many more guests are expected in April 2020 than in July of the same year?

A. 10

B. 30

C. 9

D. 15

Q.3366 A pure seasonal dummy model is constructed as below:

$$y_t = \sum_{i=1}^{s} \gamma_i D_{i,t} + \varepsilon_t$$

If all seasonal factors (γ_i) in the model are equal, it can be concluded that:

A. A seasonally adjusted time series is to be constructed

B. There is a lack of seasonality

C. There is a need for additional dummy variables

D. Both A and C

Q.3953 An investment analyst wants to fit the weekly sales (in millions) of his company by using the sales data from Jan 2018 to Feb 2019. The regression equation is defined as:

$$\ln Y_t = 5.105 + 0.044t, \quad t = 1, 2, \ldots, 100$$

What is the trend value estimate of the sales in the 90^{th} week?

A. 8,647.28 Million

B. 7,947.26 Million

C. 8,537.38 Million

D. 8,237.48 Million

Q.3954 A financial analyst wishes to conduct an ADF test on the log of 20-year real GDP from 1999 to 2019. The result of the tests is shown below:

Deterministic	γ	δ_0	δ_1	Lags	5%CV	1%CV
None	−0.004 (−1.555)			8	−1.940	−2.570
Constant	−0.008 (−1.422)	0.010 (1.025)		4	−2.860	−3.445
Trend	−0.084 (−4.376)	0.188 (−4.110)		3	−3.420	−3.984

The output of the ADF reports the results at the different number deterministic terms (first column), and the last three columns indicate the number of lags according to AIC and the 5% and 1% critical values that are appropriate to the underlying sample size and the deterministic terms. The quantities in the parenthesis (below the parameters) are the test-statistics. What deterministic term is most preferred for this model?

A. Constant

B. Trend

C. None (No deterministic components)

D. Both the constant and the trend

Q.3955 The seasonal dummy model is generated on the quarterly growth rates of mortgages. The model is given by:

$$Y_t = \beta_0 + \sum_{j=1}^{s-1} \gamma_j D_{jt} + \epsilon_t$$

The estimated parameters are $\hat{\gamma}_1 = 6.25, \hat{\gamma}_2 = 50.52, \hat{\gamma}_3 = 10.25$ and $\hat{\beta}_0 = -10.42$ using the data up to the end of 2019. What is the difference between the forecasted value of the growth rate of the mortgages in the second and third quarters of 2020?

A. 24.56

B. 32.45

C. 40.27

D. 30.32

Q.3956 A log trend model approximated on the interest rate (in %) movement is given as:

$$\ln Y_t = -0.1567 + 0.00134t + \hat{\epsilon}_t$$

for the last 20 years. The standard deviation of the residual is 0.0342. Assuming that the residuals are white noise, what is the point forecast of the interest rate after 3 years from now?

A. 0.8589%

B. 0.8453%

C. 0.7890%

D. 0.7945%

Q.3957 A log trend model is approximated on the interest rate (in %) movement in a certain market based on data from 2000 until 2020. The estimated model is given as:

$$\ln Y_t = -0.1567 + 0.00134t + \hat{\epsilon}_t$$

The standard deviation of the residual is 0.0342. Assuming that the residuals are white noise, what is the 95% confidence interval for interest rate movement 3 years from now.

A. [12.030, 13.754]

B. [12.018, 13.739]

C. [-0.0584, 0.0756]

D. [11.994, 13.713]

Q.3959 Which of the following statements best describes the time series with a unit-roots?

A. It is a random walk time series with a drift described using AR(1) model whose lag coefficient is 1

B. It is a random walk time series with a drift described using AR(1) model whose lag coefficient is 0

C. Time series with unit roots are covariance stationary.

D. All of the above

Reading 23: Measuring Return, Volatility, and Correlation

Q.550 Define volatility in the context of risk management.

A. The level of specific risk of an asset.

B. The standard deviation of the return provided by the variable per unit time, when the return is expressed using continuous compounding.

C. The standard deviation of returns on an asset per unit time.

D. The variance of the return provided by the variable per unit time, when the return is expressed using continuous compounding.

Q.551 The price of an asset is $80, and its daily volatility is 2%. Determine the one-standard-deviation move in the asset's price over a one-day period.

A. 1

B. 2

C. 1.6

D. 16

Q.552 If an asset has volatility equal to s, its variance rate is equal to:

A. S – 1

B. S^2

C. $\sqrt{s}$

D. S%

Q.553 Distinguish between historical and implied volatility.

A. Historical volatility measures the standard deviation of past price movements while implied volatility gives an estimate of future volatility in the price of the asset.

B. Historical volatility measures the standard deviation of past price movements while implied volatility is the immeasurable volatility in the future price of an asset.

C. Historical volatility is the volatility of an asset that has been recorded as at present, while implied volatility is the future volatility.

D. Historical volatility measures the total standard deviation of past price movements while implied volatility gives the historical volatility beyond a given benchmark.

Q.554 Suppose that we know from experience that $\alpha = 4$ for a certain financial variable and we observe that $P(v > 20) = 0.01$. Apply the Power Law and find the probability that $v > 10$.

A. 22

B. 16,000

C. 20

D. 0.16

Q.555 Which of the following statements is **false**?

A. Correlation measures the strength of the linear relationship between two variables.

B. Mathematically, we determine correlation by dividing the covariance between two random variables by the product of their standard deviations.

C. Two variables are independent if the knowledge of one variable does not impact the probability distribution of the other variable.

D. If two variables have a correlation of zero, this implies they also have zero dependence between them.

Q.3381 Assumed that asset prices are normally distributed. The expected value of an asset price is $80 with daily volatility of 2%. Compute the 95% confidence interval of the asset price at the end of 4 days.

A. 80 ± 2.000

B. 80 ± 3.200

C. 80 ± 6.272

D. 80 ± 3.136

Q.3382 A zero correlation between two variables indicates that:

A. They are independent of each other

B. They do not have any linear relationship between them

C. They are linearly dependent on each other

D. They have a negative linear relationship

Q.4036 After arranging the data of a portfolio comprising of two assets X and Y from the period 2012 to 2016, it is found that the number of concordant data pairs is 2 and the number of discordant pairs is 4. On the basis of this information, which of the following is closest to the Kendall τ?

A. -0.13

B. -0.20

C. -0.08

D. 0.08

Q.4037 Which of the following statements is (are) correct?
I. The Spearman’s approach is also known as the Spearman's correlation coefficient for ranked variables.
II. Both the Spearman’s and the Kendall measures are nonparametric. They both use the numerical values of the elements in the formula for calculating the correlation coefficient, not the rating of the elements.
III. For calculating Kendall’s τ, finding the number of concordant pairs and number of discordant pairs is necessary.

A. I, II and III

B. I and III

C. I and II

D. II and III

Q.4038 A portfolio manager is trying to determine the correlation between the return of two assets. Given the following data about the yearly returns of the stocks, he decides to calculate the Kendall's τ correlation coefficient for the returns of these assets.

Year	Return of Asset X	Return of asset Y
1	3%	8%
2	1%	5%
3	−4%	6%
4	5%	2%
5	2%	9%

What is Kendall's τ correlation coefficient for the returns of the two assets?

A. -0.1

B. -0.2

C. 0

D. 0.1

Q.4039 A survey is conducted to find investors' perceptions of the financial market. The survey data takes the form (AAA, AA, A, ..., D). Which of the following statistical models would you apply to analyze such data?
I. The Pearson model
II. The Kendall model
III. The Spearman model

A. I and II

B. I and III

C. II and III

D. I, II and III

Q.4040 The application of statistical correlation models to access financial correlation is limited because of the following reasons:
I. The Spearman and the Kendall models work best with cardinal observations and consider the extreme value of outliers.
II. Both the Spearman and the Kendall approaches take the order of the elements into consideration while ignoring numerical values.
III. The Kendall t works best with only a few concordant and discordant pairs.
IV. Among all models, the Pearson approach is the best statistical model and is widely used because it measures nonlinear relationships and financial variables are mostly nonlinear.

A. I and IV

B. III and IV

C. II and III

D. II, III and I

Q.4041 An investor is analyzing the data of two assets X and Y for a period of 7 years. He applied all three statistical models to measure the correlation coefficient. The results were as follows:
Pearson correlation coefficient = -0.8501
Spearman correlation coefficient = -0.9
Kendall's t = -0.4

He again analyzed the same data but changed two values of asset X without affecting its rating. What would be the impact of this change on the results?

A. The Spearman results would change but the results of Pearson and Kendall approaches would remain unchanged.

B. The Pearson and the Kendall results would change but the Spearman results would remain unchanged.

C. The Kendall results would change but the results of the Spearman and Pearson approaches would remain unchanged.

D. The Pearson results would change but the results of the Spearman and the Kendall approaches would remain unchanged.

Q.4042 Consider the following data.

Time	Price
0	100
1	98.65
2	98.50
3	97.50
4	95.67
5	96.54

What is the value of the simple return at time 4?

A. 1.88%

B. -1.97%

C. -1.88%

D. 1.97%

Q.4043 Consider the following data.

Time	Price
0	100
1	98
2	98
3	97
4	99
5	P

If the simple return for the 5^{th} period is 1.75%, what is the value of p?

A. 99.56

B. 100.50

C. 100.73

D. 99.98

Q.4044 The prices of a portfolio at different times are as shown in the table below.

Time	Price
0	105.62
1	104.10
2	105.54
3	103.68
4	103.56

What is the value of continuously compounded return at time 4?

A. 0.81%

B. -0.0081

C. 0.0091

D. -0.0012

Q.4045 A simple return for an investment in a particular holding period is 15%. What is the equivalent continuously compounded return over the same holding period?

A. 0.1256

B. 0.1578

C. 0.1398

D. 0.1278

Q.4046 If the daily volatility of the price of gold is 0.3% in a given year. What is the annualized volatility of the gold price?

A. 4.67%

B. 3.56%

C. 2.56%

D. 4.76%

Q.4047 A financial analyst wishes to model the returns from investment using the normal distribution. The analyst approximates the skewness of the data to 0.35 and kurtosis of 3.04. The analyst performs the JB test at a 95% confidence level. What is the value of the test statistic as per the analyst's results if the sample size is 100? You might need to use the following chi-square table:

df	0.1	0.05	0.025	0.01	0.005
1	2.706	3.841	5.024	6.635	7.879
2	4.605	5.991	7.378	9.210	10.597
3	6.251	7.815	9.348	11.345	12.838
4	7.779	9.488	11.143	13.277	14.860
5	9.236	11.070	12.833	15.086	16.750
6	10.645	12.592	14.449	16.812	18.548
7	12.017	14.067	16.013	18.475	20.278
8	13.362	15.507	17.535	20.090	21.955
9	14.684	16.919	19.023	21.666	23.589
10	15.987	18.307	20.483	23.209	25.188
11	17.275	19.675	21.920	24.725	26.757
12	18.549	21.026	23.337	26.217	28.300

A. 2.028

B. 5.991

C. 1.0256

D. 6.484

Q.4049 Which of the following statements is true about the simple and continuously compounded returns?

A. The continuously compounded return is always less than the simple return.

B. The simple return is always less than the continuously compounded return.

C. The log return (continuously compounded return) approximates the simple return with the approximation error decreasing with an increase in simple return.

D. The simple return can go below -100% while the continuously compounded returns do not.

Reading 24: Simulation and Bootstrapping

Q.570 Which one of the following is NOT a method of choosing a probability distribution for a simulation model?

A. Parameter estimate technique.

B. Sampling technique.

C. Best fit technique.

D. Bootstrapping technique.

Q.571 Consider the following basic steps involved when conducting a Monte Carlo simulation:
I. Carry out regression and calculate the test statistic
II. Generate the data following the desired data generation process, drawing the errors from some given distribution
III. Save the test statistic or the parameter of interest
IV. Go back to stage 1 and repeat N times

Which of the following is the correct order of the steps above?

A. I, II, III, IV

B. I, III, II, IV

C. II, I, III, IV

D. II, I, IV, III

Q.572 In which of the following situations would bootstrapping be ineffective?

A. Use of non-independent data.

B. Sampling with replacement.

C. If there are no outliers in the data.

D. Re-sampling from regression residuals.

Q.573 Consider the following statements regarding Monte Carlo (MC) simulation:
I. One of the downsides of MC simulation is that it can be computationally intensive and sometimes necessitate the use of expensive software
II. MC simulation can be applied in the presence of data that takes on the lognormal distribution
III. Mc allows for a wider variety of scenarios than those that can be deduced from historical data by itself
IV. It can only be applied if portfolios contain linear positions

Which of these statements is (are) incorrect?

A. I and III

B. II only

C. IV only

D. I, II, and IV

Q.574 Construct a 95% confidence interval for the ending mutual fund capital amount where the number of simulations is 100, the mean ending capital is $200,000, and the standard deviation is $34,456.

A. [$193,247, $206,753]

B. [$193,177.7, $200,000]

C. [$193, $206]

D. [$180,000, $220,000]

Q.575 A researcher happens to use a very small number of replications during a Monte Carlo study. Which of the following statements will be true in this scenario?
I. Standard errors of the estimated quantities may be too large and quite unacceptable
II. The process may yield a statistic that's imprecise
III. The results of the process may be affected by unrepresentative combinations of random draws

A. All the above

B. I and II only

C. II only

D. II and III only

Q.576 Which of the following statements is correct regarding the use of antithetic variates during a Monte Carlo simulation exercise?

A. The antithetic variates reduce the sampling error through the correlation coefficient.

B. The antithetic variates method involves taking one over each random draw and then repeating the experiment using those values as the draws.

C. The antithetic variates method reduces the variance of the simulation results.

D. All of the above.

Q.577 Under which of the following situations would you prefer bootstrapping to pure simulation?

A. If you have a very small sample of actual data.

B. If the distribution of the actual data is unknown.

C. If the distribution of the data is known exactly.

D. All the above.

Q.578 The following are advantages of simulation EXCEPT:

A. It allows for the study of "what if" questions.

B. It saves a considerable amount of time for analysts.

C. It incorporates multiple relationships and serial correlations between random variables.

D. It's a computationally expensive method of analyzing future scenarios.

Q.579 Which of the following statements best explains why Monte Carlo simulations are considered exceptionally effective compared to probability trees when appraising a capital project?

A. Monte Carlo simulations incorporate scenarios that span the entire probability space.

B. Monte Carlo simulations consume less time.

C. Monte Carlo simulations are embedded within most modern computer programs.

D. Monte Carlo simulations allow for the comparison of only the net present values that are positive.

Q.580 John Neur, FRM, runs a Monte Carlo simulation to estimate the ending amount of capital in 25 years using monthly returns for three investments as the basis. Investments A and B are highly correlated while C has zero correlation with both A and B. In order to compute the output of the Monte Carlo simulation, John:

A. Cannot measure the correlations between the three investments.

B. Must accurately determine the probability distribution of the output.

C. Can easily examine effects on output variables when changing scenarios.

D. Must assume that the output is normally distributed.

Q.582 An analyst runs a simulation to estimate the future value of an investment of $10,000 today over a 40-year period. He uses random monthly returns that are normally distributed. How does the analyst's situation create a discretization error bias?

A. By using normally distributed returns.

B. By using a simulation period that's too long (40 years).

C. By assuming that returns are random.

D. By assuming that returns are generated on a monthly basis instead of a continuous basis.

Q.584 Construct a 95% confidence interval for the future value of a pension fund where the number of simulations is 100, the mean ending value is $400,000, and the standard deviation is $23,300.

A. ($395,433.2, $404,566.8)

B. ($400,000, $404,613)

C. ($395,456, $404,456)

D. ($395, $404)

Q.3387 Tom Breitling, FRM, is working on building a model using a Monte Carlo Simulation. However, he is concerned about the accuracy of the simulation. Which of the following is not a way of increasing the accuracy of the simulation?

A. Increasing the number of generated scenarios

B. Variance reduction techniques

C. Decreasing the standard error

D. Controlling the standard deviation

Q.3388 Which of the following variance reduction techniques is (are) required to reduce the standard error estimate which ultimately is important for the correctness of the simulation?

A. Antithetic variate technique

B. Control variate technique

C. Both options A and B

D. Neither options A nor B

Q.3389 Which of the following is NOT a disadvantage of Monte Carlo simulations in solving financial problems?

A. It might be computationally expensive

B. The results might not be precise

C. The results are often easy to replicate

D. Simulation results are experiment-specific

Q.3390 Tim Yang, FRM, is working on building a model using a Monte Carlo simulation. However, he is concerned about the accuracy of the simulation which is measured by its standard error. Tim initially runs a model with 81 simulations and the standard deviation was found to be 27%. He then runs the model with 144 simulations and the standard deviation is still 27%.
What are the standard errors for the simulations?

A. Standard error for the first simulation: 0.33%; Standard error for the second simulation: 0.19%

B. Standard error for the first simulation: 27%; Standard error for the second simulation: 27.00%

C. Standard error for the first simulation: 2.25%; Standard error for the second simulation: 3%

D. Standard error for the first simulation: 3%; Standard error for the second simulation: 2.25%

Q.4196 Which of the following statements correctly describes the difference between Monte Carlo Simulation and bootstrapping?

A. Monte Carlo Simulation generates variables and shocks from a particular distribution while bootstrapping generates the variables from observed data through random sampling.

B. Monte Carlo Simulation generates variables and shocks from observed data while bootstrapping generates the variables from a particular distribution..=

C. In Monte Carlo Simulation, random samples are used to draw indices when selecting data to be included in the simulation sample.

D. None of the above.

Q.4197 Which of the following is the most significant limitation of bootstrapping?

A. The “Black Swan” problem.

B. Bootstrapping can potentially construct samples that are significantly larger than historically observed datasets if the assumed distribution possesses the same feature.

C. Bootstrapping is suitable where the data being bootstrapped has a time dependence feature.

D. Bootstraps requires the use of more antithetic variables.

Q.4198 The estimated standard error for a Monte Carlo simulation without antithetic variables is 4.21. The antithetic variables are now included so that the correlation between the pairs is 0.22 and the simulation is repeated 144 times. What is the percentage change in standard error?

A. 10.65%

B. 46.65%

C. 40.84%

D. 10.45%

Q.4199 Assume that you want to generate random variables from U(-1,5) using random variables from U(0,1). What is the corresponding random variable of $0.10 \sim U(0,1)$?

A. -0.80

B. 0.50

C. -0.40

D. 0.70

Q.4200 Which of the following is the first step in a typical iid bootstrapping?

A. Generating data according to an assumed distribution.

B. Constructing a bootstrap sample.

C. Selecting an appropriate block size.

D. Generating a set of a random collection of m integers (1,2,3…n) with replacement.
