

Question Paper

Quantitative Methods – II (132) : April 2005

- Answer all questions.
- Marks are indicated against each question.

1. The academic council of Osmania University has decided to bring some changes to its existing grading system. The university wants to determine what proportion of the students is in favour of the new grading system. The total number of students enrolled in the university is 60,000 and the university feels that at least 36,000 of them support the changes. What should be the sample size that will enable the university to be 89.9 percent certain of estimating the true proportion in the favour of the new system within plus and minus 0.02? [< Answer >](#)

(a) 1,075 (b) 1,411 (c) 1,613 (d) 1,680 (e) 1,711.

(2 marks)

2. There are 25 students in a class, which consists of 14 boys and 11 girls. 5 students of the class were absent on a particular day. What is the probability that two of the absent students were girls? [< Answer >](#)

(a) 0.3768 (b) 0.6232 (c) 0.00104 (d) 0.00685 (e) 0.99315.

(1 mark)

3. A random variable, **Q**, has the following probability distribution: [< Answer >](#)

Q	60	80	100	120	140
Probability	0.15	0.25	0.30	0.20	0.10

If thirty values of **Q** are observed then what will be the standard deviation of the number of observations that will be more than 100?

(a) 2.51 (b) 6.3 (c) 9.0 (d) 21.0 (e) 15.0

(1 mark)

4. The projected returns on the securities of Mittal Steel and Reddy Pharma for year 2005 with their respective probabilities are as follows: [< Answer >](#)

Market Condition	Probability	Return (%)	
		Mittal Steel	Reddy Pharma
Bullish	40 %	40	35
Stable	50 %	25	25
Bearish	10 %	-15	20

What is the covariance between the returns on the securities of the two companies?

(a) 67.0 % squared (b) 73.0 % squared (c) 77.5 % squared
(d) 87.5 % squared (e) 93.0 % squared.

(2 marks)

5. An analyst believes that the earnings per share for Company **A** for the next fiscal year is expected to have the following [distribution](#):

Earnings/share	Probability
Rs. 1.16	0.1
Rs. 1.17	0.1
Rs. 1.18	0.2
Rs. 1.19	0.2
Rs. 1.20	0.4

The standard deviation (in Rs.) of the earnings per share estimates for company **A** is

- (a) 0.0002 (b) 0.01345 (c) 0.0141 (d) 0.0158 (e) 1.187.

(1 mark)

6. Assume **z** is a standard normal random variable.

$$P(-2.0 < \mathbf{z} < -1.0) =$$

- (a) 0.8185 (b) 0.1469 (c) 1.0000 (d) 0.1359 (e) 0.4772.

(1 mark)

7. A businessman has to decide on investing in one of three assets. The net gains from the assets under three different states [of nature](#) are given below:

Net gains (in Rs.)

Asset	State of nature		
	S ₁	S ₂	S ₃
A	30,000	12,000	10,000
B	40,000	37,000	-6,000
C	50,000	25,000	-30,000

The businessman is not in a position to assign probabilities of occurrence to the three states of nature. Further, he is perfectly pessimistic about the future. Which asset should he invest in?

- (a) Asset **A** (b) Asset **B** (c) Asset **C**
 (d) Either asset **B** or **C** (e) Either asset **A** or **B**.

(1 mark)

8. Variable **X** follows a normal distribution with mean 20 and variance 25. Let **Y = X + 10**. What is the standardised value of **Y** if **X = 10**? [Answer](#)

- (a) -4 (b) -2 (c) 2 (d) 4 (e) -2.50.

(1 mark)

9. An instructor plots the curve for the class grades so that the top 10% of the students in class receive an **A** grade for the [semester](#). During the past semester, the grades were approximately normally distributed with a mean of 217 points and a standard deviation of 32 points. What are the minimum points needed to earn an **A** grade for the semester?

- (a) 217 (b) 230 (c) 245 (d) 258 (e) 270.

(1 mark)

10. The manager of the quality department for a tyre manufacturing company wants to study the average tensile strength of rubber used in making a certain brand of radial tyre. The population is normally distributed and the population standard deviation is known. She wants to test the null hypothesis that the mean tensile strength is equal to 800 pounds per square inch against the alternative hypothesis that the mean tensile strength is more than 800 pounds per square inch. She has taken a sample of 25 observations and the test statistic is calculated to be 1.695. If the significance level is 0.05, then [< Answer >](#)

- (a) The critical value is 1.645 and the null hypothesis is accepted
- (b) The critical value is 1.645 and the null hypothesis is rejected
- (c) The critical value is 1.711 and the null hypothesis is accepted
- (d) The critical value is 1.711 and the null hypothesis is rejected
- (e) The critical value is 1.282 and the null hypothesis is rejected.

(1 mark)

11. If we accept $H_0 : \mu = 40$ vis-a-vis $H_1 : \mu \neq 40$ at a given level of significance with a negative value of the test statistic (the sample mean is non-negative), then a test with $H_0 : \mu = 40$ versus $H_1 : \mu < 40$ using the same sample and the same level of significance [< Answer >](#)

- (a) Will always accept H_0
- (b) Will always reject H_0
- (c) May or may not accept H_0
- (d) Will certainly lead to a Type I error
- (e) Will certainly lead to a Type II error.

(1 mark)

12. A sample has been taken from a population and the sample mean has been found to be 80. The population variance is not known. The sample size is 16 and the upper limit of a 95 percent confidence interval for the population mean is 101.31. What is the sample variance? [< Answer >](#)

- (a) 100
- (b) 16
- (c) 1600
- (d) 3200
- (e) 800.

(1 mark)

13. The mean and the variance of a simple random sample are found to be 12 and 9.6 respectively. The sample size is 6 and it is less than 5 percent of the population size. It is known that the population is normally distributed. What is the 95 percent confidence interval for the population mean, on the basis of the given information? [< Answer >](#)

- (a) (9.432, 14.571)
- (b) (8.748, 15.252)
- (c) (8.905, 15.095)
- (d) (2.40, 21.60)
- (e) (8.252, 15.748).

(1 mark)

14. The following details are available with regard to a hypothesis test on means of two populations: [< Answer >](#)

$$H_0: \mu_1 - \mu_2 = -1$$

$$H_1: \mu_1 - \mu_2 \neq -1$$

$$n_1 = 64 \quad \sum x_1^2 = 1852 \quad \sum x_1 = 320$$

$$n_2 = 36 \quad \sum x_2^2 = 891 \quad \sum x_2 = 144$$

The samples collected from the two populations are independent.

What is the value of the test statistic?

- (a) -3.578
- (b) 3.578
- (c) 0
- (d) -0.354
- (e) 1.789.

(2 marks)

15. The following details are available with regard to a hypothesis test on means of two populations:

[< Answer >](#)

$$H_0: \mu_1 = \mu_2 + 1$$

$$H_1: \mu_1 > \mu_2 + 1$$

$$n_1 = 64 \quad \sigma_1^2 = 256 \quad \sum x_1 = 320$$

$$n_2 = 36 \quad \sigma_2^2 = 144 \quad \sum x_2 = 144$$

The samples collected from the two populations are independent. If the significance level is 0.05 then

- (a) The critical value is 1.645 and the null hypothesis is accepted
- (b) The critical value is -1.645 and the null hypothesis is accepted
- (c) The critical values are ± 1.96 and the null hypothesis is rejected
- (d) The critical values are ± 1.96 and the null hypothesis is accepted
- (e) The critical values are ± 1.645 and the null hypothesis is rejected.

(1 mark)

16. The following details are available with regard to a hypothesis test on a population mean:

[< Answer >](#)

$$H_0: \mu = 16$$

$$H_1: \mu < 16$$

$$\sigma^2 = 81$$

$$n = 36$$

The significance level is 0.05. For which of the following values of the sample mean will the null hypothesis be rejected?

- (a) 13.48 (b) 14.25 (c) 14.50 (d) 15.15 (e) 15.50.

(1 mark)

17. The time that it takes to find a taxi when leaving a restaurant follows a left skewed distribution with a mean of 18 minutes and a standard deviation of 8 minutes. If 100 restaurant patrons are randomly sampled and the average time that it takes for them to find a taxi is calculated, then what is the probability that the sample mean will be less than 19 minutes?

[< Answer >](#)

- (a) 0.50 (b) 0.3944 (c) 0.6025 (d) 0.9332 (e) 0.8944.

(1 mark)

18. The following details are available with regard to a test of hypothesis for the population mean :

[< Answer >](#)

$$H_0: \mu = 18$$

$$\bar{x} = 24$$

$$n = 36$$

$$\sum x^2 = 52236$$

What is the value of the test statistic?

- (a) 1.20 (b) 1.44 (c) 2.40 (d) 1.00 (e) 0.83.

(1 mark)

19. The following details are available for a hypothesis test on population proportion:

[< Answer >](#)

$$H_0: p = 0.40$$

$$H_1: p \neq 0.40$$

Value of the test statistic = 1.5492

Sample size = 360

What is the sample proportion?

- (a) 0.44 (b) 0.56 (c) 0.40 (d) 0.60 (e) 0.04.

(1 mark)

20. The following details are available with regard to a hypothesis test on means of two populations:

[< Answer >](#)

$$\sigma_1^2 = 256$$

$$\sigma_2^2 = 144$$

$$n_2 = 36$$

The standard error of difference between means is $\sqrt{8}$.

The samples collected from the two populations are independent.

What is the sample size taken from the first population?

- (a) 8 (b) 16 (c) 64 (d) 256 (e) 36.

(1 mark)

21. The estimated regression equation of the variable **Y** on **X** is : $\hat{Y} = 10 + 5X$.

[< Answer >](#)

Let $Z = Y + 2$.

What is the intercept of the estimated regression equation of **Z** on **X** (**X** is the independent variable)?

- (a) 10 (b) 8 (c) 12 (d) 20 (e) 5.

(1 mark)

22. Indiana Ltd. produces different types of products in the field of information technology. The research and development department of the company has been witnessing a growth in the research activities over the past few years. The data on research expenditure in the recent past are given below:

[< Answer >](#)

Year (X)	1999	2000	2001	2002	2003	2004
Research expenditure (Rs. in crores) (Y)	45	38	58	65	75	85

Which of the following is the linear equation that describes the trend in the expenditure on research by the company? [**X** is coded as $x = 2(X - \bar{X})$]

- (a) $\hat{Y} = 4.543 + 61x$ (b) $\hat{Y} = 61 + 4.543x$ (c) $\hat{Y} = 35 + 8.54x$
(d) $\hat{Y} = 45 + 7.25x$ (e) $\hat{Y} = 30 + 2.15x$.

(2 marks)

23. The following information pertains to the actual and estimated sales on the basis of trend line, of Bobby soap from the year 1997 to 2004. [< Answer >](#)

Year	1997	1998	1999	2000	2001	2002	2003	2004
Actual Sales (Rs. in lakh)	7.5	7.8	8.2	8.2	8.4	8.5	8.7	9.1
Estimated Sales (Rs. in lakh)	7.6	7.8	8.0	8.2	8.4	8.6	8.8	9.0

According to the relative cyclical residual measure, in which year does the largest fluctuation from trend occur?

- (a) 1997 (b) 1999 (c) 2002 (d) 2003 (e) 2000.

(1 mark)

24. The following is the matrix of correlation coefficients between three variables Y , X_1 and X_2 . [< Answer >](#)

	Y	X_1	X_2
Y	1	0.7	0.5
X_1	0.7	1	0.6
X_2	0.5	0.6	1

How much variation in Y is explained by X_1 if X_2 is kept constant?

- (a) 33 % (b) 58 % (c) 61 % (d) 72 % (e) 83 %.

(1 mark)

25. A multiple regression relationship contains two independent variables. The standard error of estimate is 4.8. Error sum of squares = 576. [< Answer >](#)

What is the number of data points?

- (a) 24 (b) 25 (c) 26 (d) 27 (e) 28.

(1 mark)

26. A dealer of grocery-items requires an overall comparison of prices of the commodities he deals in, between the years 2000 and 2004. The following information is provided by him: [< Answer >](#)

(Rs.)

Commodities	Sugar	Salt	Wheat	Rice	Pulses
$P_0 (Q_0 + Q_1)$	15750	1512.50	10500	18450	28600
$P_1 (Q_0 + Q_1)$	20650	2337.50	13125	22500	40950

Note: P_0 , P_1 , Q_0 and Q_1 have their standard meanings.

The Marshall-Edgeworth price index for the year 2004 with the year 2000 as the base year is

- (a) 123.25 (b) 128.65 (c) 133.08 (d) 145.45 (e) 155.64.

(1 mark)

27.

[< Answer >](#)

Item	Quantity (Kgs.)		Unit Price (Rs.)	
	1994	2004	1994	2004
A	15	20	1.70	2.10
B	20	20	19.00	22.00
C	25	30	3.00	3.10

The weighted aggregates price index for the year 2004 with the year 1994 as base year, using Paasches method, is

- (a) 108.96 (b) 114.09 (c) 115.09 (d) 116.09 (e) 117.09.

(1 mark)

28. An economist believes that the rent charged (Y) by the owners of apartments is determined by the number of rooms (X_1) and the distance from the city center (X_2). He has estimated the following regression equation: [< Answer >](#)

$$\hat{Y} = 96.54 + 1526.84X_1 - 290.476X_2$$

The estimated rent for a 3-room apartment located 4 kms away from the city center is

- (a) Rs. 3,515 (b) Rs. 3,915 (c) Rs. 4,290
(d) Rs. 4,570 (e) Rs. 4,677.

(1 mark)

29. The manager of a food chain outlet wants to ensure that the variability in the service time by their bearers is in control. He does a sampling of the average time taken by the bearers in serving the customers in the outlet. He finds the mean of the sample range to be 1.5 minutes. If he has collected five samples, each containing ten observations to conduct the test then what is the upper control limit (in minutes) of the $\bar{R}$ chart? (Use the relevant D_4 factor). [< Answer >](#)

- (a) 0.335 (b) 1.005 (c) 1.500 (d) 2.005 (e) 2.666.

(1 mark)

30. Ocimum Labs is a renowned company manufacturing biochemistry based products. It has produced clones of popular genes such as DNA, RNA and Oops. The number of pairs sold for each of the genes on different days is as follows: [< Answer >](#)

DNA	RNA	Oops
8	11	9
4	10	7
2	4	5
10	10	9

A test of ANOVA is to be performed for testing the equality of the mean number of pairs sold of the three genes.

What is the estimated population variance on the basis of the variance within the samples?

- (a) 3.0833 (b) 5.4853 (c) 7.6453 (d) 9.0833 (e) 12.4533.

(1 mark)

31. The following details are available with regard to a basket of commodities:

[< Answer >](#)

Commodity	P_0Q_0 (Rs.)	$\frac{Q_1}{Q_0}$
A	320	3/4
B	1000	1/2
C	1120	5/7
D	760	13/19

What is Laspeyres quantity index?

- (a) 64.4 (b) 155.3 (c) 240 (d) 89.3 (e) 147.4.

(1 mark)

32. The following details are available with regard to an estimated regression relationship $\hat{Y} = a + bX$

[< Answer >](#)

Error sum of squares = 56

Number of observations = 8

At $X = 2$, $\hat{Y} = 24$.

What is the 90 percent prediction interval for the value of Y at $X = 2$?

- (a) (17.56, 29.988) (b) (17.56, 30.125)
(c) (18.064, 29.936) (d) (18.064, 30.125) (e) (18.064, 31.756).

(1 mark)

33. The standard error of estimate of a simple regression relationship between variables X (independent variable) and Y (dependent variable) is 4.5. The number of observations is 10 and the total sum of squares is 1350. What is the coefficient of determination?

[< Answer >](#)

- (a) 0.88 (b) 0.9381 (c) 0.7744 (d) 0.12 (e) 0.0619.

(1 mark)

34. If the ratio between Laspeyres index number and Paasches index number is 28 : 27, find the missing figure in the following table:

[< Answer >](#)

Commodity	Base Year		Current Year	
	Price (Rs.)	Quantity (Kgs.)	Price (Rs.)	Quantity (Kgs.)
X	1	10	2	5
Y	1	5	?	2

- (a) 1 (b) 2 (c) 3 (d) 4 (e) 5.

(1 mark)

35. The coefficient of correlation between variables X and Y is 0.75.

[< Answer >](#)

$$\sigma_X^2 = 625 \quad \sigma_Y^2 = 256$$

What is the covariance between $3X$ and $4Y$?

- (a) 900 (b) 1200 (c) 400 (d) 1800 (e) 3600.

(1 mark)

36. The weighted average of price relatives using base year values as weights is same as the

[< Answer >](#)

- (a) Unweighted aggregates price index (b) Unweighted aggregates quantity index
(c) Laspeyres price index (d) Laspeyres quantity index
(e) Paasche's price index.

(1 mark)

37. Which of the following techniques enables us to test whether means of more than two populations are equal?

[< Answer >](#)

- (a) Analysis of variance (b) Chi-square test
(c) Decision tree analysis (d) Marginal analysis (e) Correlation analysis.

(1 mark)

38. A new shearing machine is set to cut off a piece of steel from a long bar. For various reasons the machine at times cuts off a piece that is too long or too short. These unacceptable pieces are automatically dropped in a box and the operator of the shearing machine must count these defectives after every 100 pieces are sheared off. The record after the first day of operation is:

[< Answer >](#)

Number of sheared off pieces	100	100	100	100	100
Number of defectives	5	6	7	4	8

Set out the upper control limit for the **p** chart.

- (a) 0.127 (b) 0.129 (c) 0.131 (d) 0.134 (e) 0.136.

(1 mark)

39. The following data provides the values of sample mean, $\bar{X}$, and range **R**, for samples of size 5 each.

[< Answer >](#)

Sample No.	1	2	3	4	5	6	7	8	9	10
Mean ($\bar{X}$)	11.2	11.8	10.8	11.6	11.0	9.6	10.4	9.6	10.6	10.0
Range (R)	7	4	8	5	7	4	8	4	7	9

Calculate the value of the lower control limit for the $\bar{X}$ chart. (Use the relevant **A₂** factor)

- (a) 7.4585 (b) 7.3474 (c) 7.2362 (d) 7.1251 (e) 7.0249.

(1 mark)

40. On the basis of observations made on 39 cotton plants, the correlation coefficients among the yield of cotton (**Y**), number of seed vessels (**X₁**) and height (**X₂**) are found to be:

[< Answer >](#)

r_{12} (Between **Y** and **X₁**) = 0.8, r_{13} (Between **Y** and **X₂**) = 0.65 and r_{23} (Between **X₁** and **X₂**) = 0.7

What would be the partial correlation between yield of cotton and the number of seed vessels, eliminating the effect of height?

- (a) 0.615 (b) 0.625 (c) 0.636 (d) 0.645 (e) 0.655.

(1 mark)

41. Calculate the coefficient of correlation between variables **X** and **Y**, from the following data:

[< Answer >](#)

X	9	8	7	6	5	4	3	2	1
Y	15	16	14	13	11	12	10	8	9

- (a) 0.91 (b) 0.88 (c) 0.95 (d) 0.81 (e) 0.99.

(2 marks)

42. For a given data set consisting of 5 paired observations of variables **X** and **Y** values, we have

[< Answer >](#)

$$\sum x y = -26, \sum x^2 = 40, \sum X = 30 \text{ and } \sum Y = 40,$$

where **x** and **y** are the deviations of values of **X** and **Y** from their respective means.

Find the regression equation of **Y** on **X** with **X** as the independent variable.

- (a) $\hat{Y} = 11.9 - 0.65X$ (b) $\hat{Y} = 0.65 + 11.9X$ (c) $\hat{Y} = -11.9 + 0.65X$
 (d) $\hat{Y} = 11.9 + 0.65X$ (e) $\hat{Y} = 0.65 - 11.9X$.

(1 mark)

43. Two random samples were drawn from two normal populations and their values are:

[< Answer >](#)

A	66	67	75	76	82	84	88	90	92	—	—
B	64	66	74	78	82	85	87	92	93	95	97

We want to test whether the population **B** has larger variance than the population **A**. What is the value of the test statistic for the above test?

- (a) 1.215 (b) 1.315 (c) 1.415 (d) 1.515 (e) 1.615.

(2 marks)

44. A random variable, **X**, has the following probability distribution:

[< Answer >](#)

X	20	40	60	80	100
Probability	0.15	0.25	0.30	0.20	0.10

Twenty values of **X** are observed. What is the likelihood that exactly twelve out of the twenty observations are at least 60?

- (a) 0.60 (b) 0.5442 (c) 0.00139 (d) 0.17971 (e) 0.82029.

(2 marks)

45. If Laspeyres price index and Paasche's price index are 107 and 109 respectively, then the Fisher's ideal price index will be approximately equal to

[< Answer >](#)

- (a) 106 (b) 107 (c) 108 (d) 110 (e) 111.

(1 mark)

46. In which technique of random sampling the first element of the sample is randomly selected from the population and the remaining elements are selected at uniform intervals of time, order or space?

[< Answer >](#)

- (a) Simple random sampling (b) Stratified sampling (c) Cluster sampling
 (d) Systematic sampling (e) Judgmental sampling.

(1 mark)

47. Which of the following indicates the long term behaviour of a variable?

[< Answer >](#)

- (a) Secular trend (b) Cyclical variation
 (c) Seasonal variation (d) Irregular variation (e) Coefficient of variation.

(1 mark)

48. The following information are available with regard to a sampling distribution of mean:

[< Answer >](#)

Sample size = 64

Probability that the sample mean is less than 65 = 0.0228

Population standard deviation = 20

It is assumed that the Central Limit Theorem will be applicable and the population mean is greater than 65.

What is the population mean?

- (a) 60 (b) 65 (c) 70 (d) 75 (e) 5.

(2 marks)

49. Assuming the applicability of the Central Limit Theorem, if the 95% confidence limits for the population mean are 73 and 80, which of the following represents the 99% confidence limits? (The confidence limits have been rounded off to the nearest integer)

[< Answer >](#)

- (a) 72 and 81 (b) 73 and 82 (c) 72 and 82
(d) 71 and 83 (e) 70 and 84.

(2 marks)

50. The details for a 97% confidence interval for a population mean are given below:

[< Answer >](#)

Population standard deviation = 4

Sample size = 36

Lower confidence limit = 18.553

Upper confidence limit = 21.447

If you test at the 3% significance level whether the population mean is greater than 19, then what will be the most logical conclusion?

- (a) The population mean is equal to 19 (b) The population mean is less than 19
(c) The population mean is more than 19 (d) The confidence interval is incorrect
(e) The sample mean is incorrect.

(2 marks)

51. Which of the following is **not true** with regard to regression or correlation analysis?

[< Answer >](#)

- (a) It derives the mathematical the relationship between two or more series
(b) It compares the variation in two or more series
(c) It proves the presence of a cause and effect relationship between two or more series
(d) It helps in determining the degree of association between two or more series
(e) It helps in estimating the value of one variable on the basis of the other variable.

(1 mark)

52. Given a probability distribution for a random variable, the covariance of the variable with itself is equal to

[< Answer >](#)

- (a) 0 (b) 1 (c) The variance of the variable
(d) The standard deviation of the variable (e) The expected value of the variable.

(1 mark)

53. The expected value of a binomial probability distribution is

[< Answer >](#)

- (a) Always equal to the variance (b) Always more than the variance
(c) Always less than the variance (d) Always equal to zero (e) Always equal to 1.

(1 mark)

54. Which of the following is **false** with regard to the maximin criterion of decision making?

[< Answer >](#)

- (a) It is assumed that the decision maker is pessimistic
- (b) It is assumed that whatever strategy is selected nature will respond in such a way as to produce the least possible gain
- (c) It is used to make decisions under conditions of uncertainty
- (d) It is used to make decisions under conditions of risk
- (e) It is used when probabilities of the various states of nature are not known.

(1 mark)

55. Which of the following, if known, may be sufficient for exactly describing a binomial distribution?

[< Answer >](#)

- (a) Exactly one observation from the distribution
- (b) At least one observation from the distribution
- (c) Only the mean of the distribution
- (d) Only the variance of the distribution
- (e) Both mean and variance of the distribution.

(1 mark)

56. Which of the following is considered to be unknown when the **t** statistic is calculated for a sample mean?

[< Answer >](#)

- (a) Hypothesised Population mean
- (b) Population variance
- (c) Sample variance
- (d) Sample size
- (e) Sample mean.

(1 mark)

57. Which of the following probability distributions is a distribution derived from the ratio of two random variables each of which follows a chi-square distribution?

[< Answer >](#)

- (a) Normal distribution
- (b) Hypergeometric distribution
- (c) t-distribution
- (d) F distribution
- (e) Binomial distribution.

(1 mark)

58. If x_1 and x_2 are two random variables independent of each other then, the variance of $x_1 + x_2$ is equal to the

[< Answer >](#)

- (a) Standard deviation of x_1 plus standard deviation of x_2
- (b) Standard deviation of x_1 minus standard deviation of x_2
- (c) Variance of x_1 plus variance of x_2
- (d) Variance of x_1 minus variance of x_2
- (e) Covariance of x_1 and x_2 .

(1 mark)

59. In a normal probability distribution

[< Answer >](#)

- (a) The total area under the probability distribution curve is less than 1
- (b) The total area under the probability distribution curve is more than 1
- (c) The area under the curve to the left of the mean is equal to the area under the curve to the right of the mean
- (d) The area under the curve to the left of the mean is more than the area under the curve to the right of the mean
- (e) The area under the curve to the left of the mean is less than the area under the curve to the right of the mean.

(1 mark)

60. Which criterion of decision-making is appropriate when the decision maker is aware of all possible states of nature and has sufficient information to assign probabilities of occurrence to the various states of nature?

[< Answer >](#)

- (a) Maximax criterion
- (b) Maximin criterion
- (c) Hurwicz criterion
- (d) Regret criterion
- (e) Expected value criterion.

(1 mark)

61. A graphical method of representing states of nature and courses of action is referred to as a

[< Answer >](#)

- (a) Decision tree
- (b) Histogram
- (c) Scatter diagram
- (d) Frequency distribution
- (e) Probability distribution.

(1 mark)

62. Other things remaining the same, if the sample size increases then the width of the confidence interval for the population mean

[< Answer >](#)

- (a) Decreases
- (b) Decreases by exactly the square root of the increase in the sample size
- (c) Decreases by exactly the reciprocal of the square root of the increase in the sample size
- (d) Decreases by exactly the increase in the sample size
- (e) Increases.

(1 mark)

63. Other things remaining the same, if there are two populations with known variances then, a random sample collected from the population with the lower variance will produce a confidence interval for the population mean which is _____ that produced by a random sample collected from the population with the higher variance.

[< Answer >](#)

- (a) Wider than
- (b) Narrower than
- (c) As wide as
- (d) A constant multiple, determined by the confidence level, of the width of
- (e) Half as wide as.

(1 mark)

64. The variance of the sampling distribution of mean is

[< Answer >](#)

- (a) Always equal to the variance of the underlying population
- (b) Less than the variance of the underlying population if the sample size is more than one
- (c) More than the variance of the underlying population if the sample size is more than one
- (d) Equal to the standard deviation of the underlying population if the sample size is more than one
- (e) Not dependent on the sample size.

(1 mark)

65. The sample mean is an unbiased estimator of the population mean because

[< Answer >](#)

- (a) The expected value of sample mean is greater than the population mean
- (b) The expected value of sample mean is less than the population mean
- (c) The expected value of sample mean is equal to the population mean
- (d) The expected value and variance of sample mean are equal
- (e) The expected value and standard deviation of sample mean are equal.

(1 mark)

66. The confidence level being same and the population variance not being known, a confidence interval for the population mean which is narrower than another for the same population, is **certainly**

[< Answer >](#)

- (a) Based on a sample with lower mean
- (b) Based on a sample of lower size
- (c) Based on a sample with higher variance
- (d) Based on a sample with lower estimated standard error of mean
- (e) Based on a sample with higher range.

(1 mark)

67. If a null hypothesis is rejected at a significance level of 0.05, then which of the following is correct?

[< Answer >](#)

- (a) It will certainly be rejected at a significance level of 0.01
- (b) It will certainly be accepted at a significance level of 0.01
- (c) It will certainly be accepted at a significance level of 0.10
- (d) It will certainly be rejected at a significance level of 0.10
- (e) It will be sometimes accepted and sometimes rejected at a significance level of 0.10.

(1 mark)

68. Which of the following is **false** with regard to hypothesis testing?

[< Answer >](#)

- (a) The purpose of hypothesis testing is to find out whether there is a significant difference between the sample statistic and the hypothesized population parameter
- (b) Rejection of null hypothesis implies the acceptance of alternative hypothesis
- (c) The acceptance of null hypothesis proves that it is true
- (d) The rejection of null hypothesis does not prove that it is false
- (e) The acceptance of the alternative hypothesis does not prove that it is true.

(1 mark)

69. A researcher is interested in determining the average urban household income for the state of Uttar Pradesh (U.P). He divides U.P. into homogeneous sectors and then randomly chooses 3 cities from each sector to sample. From each city, he randomly chooses 1000 families to survey. This type of sampling is referred to as

[< Answer >](#)

- (a) Systematic sampling
- (b) Cluster sampling
- (c) Simple random sampling
- (d) Stratified sampling
- (e) Judgmental sampling.

(1 mark)

70. When the population is normally distributed, population variance is known and the sample size is 15, the confidence interval for the population mean is based on

[< Answer >](#)

- (a) The standard normal distribution
- (b) The **t** distribution with 14 degrees of freedom
- (c) The **t** distribution with 15 degrees of freedom
- (d) The chi-square distribution
- (e) The **F** distribution.

(1 mark)

71. A test of independence of two factors is to be conducted on the basis of a contingency table. The contingency table has 2 rows and 4 columns. Which of the following distributions should be used?

[< Answer >](#)

- (a) Chi-square distribution with 6 degrees of freedom
- (b) Chi-square distribution with 8 degrees of freedom
- (c) Chi-square distribution with 3 degrees of freedom
- (d) F distribution with 2 degrees of freedom in the numerator and 4 degrees of freedom in the denominator
- (e) F distribution with 1 degree of freedom in the numerator and 3 degrees of freedom in the denominator.

(1 mark)

72. Which of the following is **true** with regard to the method of least squares used in simple regression analysis?

[< Answer >](#)

- (a) It minimizes the sum of the squared values of the independent variable
- (b) It minimizes the sum of the squared differences between the values of the independent variable and their mean
- (c) It minimizes the sum of the squared differences between the actual values of the dependent variable and the estimated values of the dependent variable as per the regression equation
- (d) It minimizes the sum of the squared differences between the values of the dependent variable and their mean
- (e) It minimizes the sum of the squared values of the dependent variable.

(1 mark)

73. If the percent of trend for a year in a time series is greater than 100%, it indicates that [< Answer >](#)

- (a) The actual time series value lies below the trend line and the relative cyclical residual is positive
- (b) The actual time series value lies below the trend line and the relative cyclical residual is negative
- (c) The actual time series value lies above the trend line and the relative cyclical residual is negative
- (d) The actual time series value lies above the trend line and the relative cyclical residual is positive
- (e) The actual time series value is less than the estimated value, for the year.

(1 mark)

74. If the regression equation is a perfect estimator of the dependent variable then which of the following is **false**? [< Answer >](#)

- (a) The standard error of estimate is zero
- (b) The coefficient of correlation is zero
- (c) The coefficient of determination is 1.00
- (d) All the data points fall on the regression line
- (e) The dependent variable has a perfect linear relationship with the independent variable.

(1 mark)

75. If r is the coefficient of correlation between two variables X and Y , then the proportion of variations in the observed Y values which is **not** explained by the regression line is equal to [< Answer >](#)

- (a) r^2
- (b) $1 - r^2$
- (c) r
- (d) $1 - r$
- (e) $1 + r^2$.

(1 mark)

76. Which of the following is **not true** with regard to the coefficient of multiple correlation $R_{1,23}$ between the dependent variable, Y , and the independent variables, X_1 and X_2 ? [< Answer >](#)

- (a) It is the positive square root of coefficient of multiple determination
- (b) $R_{1,23}$ can take values between 0 and 1
- (c) It is dependent on the coefficient of correlation between Y and X_1
- (d) It is dependent on the coefficient of correlation between Y and X_2
- (e) It is independent of the coefficient of correlation between X_1 and X_2 .

(1 mark)

77. Which of the following is **true** with regard to multicollinearity in multiple regression analysis? [< Answer >](#)

- (a) It increases the influence of the individual variables in the model
- (b) It reduces the predictive power of the model
- (c) It increases the reliability of the regression coefficients
- (d) It reduces the effectiveness of sensitivity analysis of the model
- (e) It arises if there is no correlation among the independent variables.

(1 mark)

78. Which of the following statements is **false** regarding Paasches price index? [< Answer >](#)

- (a) It is computed using the current year quantities as weights
- (b) In general, it reflects the change in the aggregate value of the current year's basket of goods compared to their value in the base year
- (c) It may not be easy to use when the number of commodities is large
- (d) The use of Paasches index requires the continuous use of new quantity weights for each period considered
- (e) As opposed to Laspeyres index, Paasches index generally tends to overestimate the prices.

(1 mark)

79. Which of the following indices satisfies the factor reversal test? [< Answer >](#)

- (a) Laspeyres index
- (b) Paasches index
- (c) Fisher's ideal index
- (d) Marshall-Edgeworth index
- (e) Unweighted aggregates index.

(1 mark)

80. Which of the following statements is **false** regarding Fisher's ideal price index?

[< Answer >](#)

- (a) It is the geometric mean of Laspeyres and Paasches price indices
- (b) It takes into account both current year and base year prices and quantities
- (c) It satisfies both time reversal and factor reversal tests
- (d) It is free from bias
- (e) For the same basket of goods Fisher's ideal price index will be more than both Laspeyres and Paasches price indices.

(1 mark)

81. Which of the following is **false** about index numbers?

[< Answer >](#)

- (a) Index numbers are expressed as a percentage
- (b) Index number for the base year is always 100
- (c) Index number has the unit of the variable that is being compared
- (d) Index number is calculated as a ratio of the current value of the variable to its value in the base year
- (e) Index number for a group of commodities indicates the overall change in the variable being compared.

(1 mark)

82. Which pattern in the $\bar{x}$ charts generally indicates the presence of non-random variations in the process?

[< Answer >](#)

- (a) Increasing or decreasing trend
- (b) Cycles
- (c) Hugging the center line
- (d) Hugging the control limits
- (e) Randomly scattered means between the control limits.

(1 mark)

83. Which of the following is **true** with regard to the **p** chart in quality control?

[< Answer >](#)

- (a) The center line is drawn on the basis of overall sample mean
- (b) The lower control limit can only be greater than or equal to zero
- (c) The upper control limit is equal to the overall sample proportion
- (d) The lower control limit is equal to the overall sample proportion
- (e) The upper and the lower control limits are based on the overall sample mean.

(1 mark)

84. Which of the following is **false** regarding a chi-square distribution?

[< Answer >](#)

- (a) Chi-square distribution has only one parameter
- (b) The distribution becomes sharply positively skewed when the number of degrees of freedom is large
- (c) For large number of degrees of freedom the distribution approaches symmetry
- (d) The distribution is continuous
- (e) The distribution is unimodal.

(1 mark)

85. A test of ANOVA is applied to data obtained from four samples, where each sample contains six observations. At a 5% significance level what is the critical value for the test?

[< Answer >](#)

- (a) 3.13
- (b) 3.10
- (c) 3.49
- (d) 2.87
- (e) 3.52.

(1 mark)

86. A fitted regression equation is given by $\hat{Y} = 20 + 0.75X$. What is the value of the residual at the point $X = 100$, $Y = 90$?

[< Answer >](#)

- (a) 5
- (b) 10
- (c) 0
- (d) 15
- (e) -5.

(1 mark)

87. The covariance between two variables **X** and **Y** is 256. If the variance of variable **X** is 625 and the coefficient of correlation between **X** and **Y** is 0.64, the variance of the variable **Y** is approximately [< Answer >](#)

- (a) 4 (b) 8 (c) 16 (d) 64 (e) 256.

(1 mark)

88. The intercept on **Y**-axis of a simple regression line is 5. If the independent variable has a value of 5 and the estimated value of the dependent variable is 20 then the slope of the regression equation is [< Answer >](#)

- (a) 3 (b) 5 (c) 20 (d) 27 (e) 28.

(1 mark)

89. Which of the following **can not** have a negative value? [< Answer >](#)

- (a) Coefficient of correlation (b) Coefficient of determination
(c) Covariance (d) Slope of regression equation
(e) Intercept of regression equation.

(1 mark)

90. An aggregates price index where the price for each item is weighted by its current-period quantity is called the [< Answer >](#)

- (a) Laspeyres price index (b) Fisher's ideal price index
(c) Price relative (d) Unweighted aggregates price index
(e) Paasches price index.

(1 mark)

Suggested Answers

Quantitative Methods – II (132) : April 2005

1. Answer : (c)

[< TOP >](#)

Reason : The z value in the normal table for 89.9 percent confidence level is 1.64. We want our estimate to be within 0.02, so,

$$Z \sigma_{\bar{p}} = 0.02$$

$$\text{And } z = 1.64$$

$$\text{Then } 1.64 \sigma_{\bar{p}} = 0.02$$

Substituting the value of $\sigma_{\bar{p}}$ in the equation,

$$1.64 \sqrt{\frac{pq}{n}} = 0.02$$

$$\text{or, } \sqrt{\frac{pq}{n}} = 0.0122$$

As the university feels that the proportion of students favouring the new system

is $\frac{36000}{60000} = 0.60$. We can take this value as the estimate of the population parameter.

$$\text{Therefore, } \sqrt{\frac{0.6 \times 0.4}{n}} = 0.0122$$

$$\text{or, } n = \frac{0.6 \times 0.4}{(0.0122)^2} = 1612.4697$$

Therefore a sample size of **1613** would be appropriate to estimate the proportion of the students favouring the new system in an interval of ± 0.02 at a confidence level of 89.9%.

2. Answer : (a)

[< TOP >](#)

Reason : The number of absentees who are girls follows a hypergeometric distribution. The following details are available:

N = No. of elements in the population = 25

r = No. of elements in the population labelled success = No. of girls = 11

n = No. of trials = No. of absent students = 5

x = Desired number of successes = 2

$$P(x = 2) = \frac{{}^r C_x {}^{(N-r)} C_{(n-x)}}{{}^N C_n} = \frac{{}^{11} C_2 {}^{(25-11)} C_{(5-2)}}{{}^{25} C_5} = \frac{55 \times {}^{14} C_3}{{}^{25} C_5} = 0.3768$$

3. Answer : (a)

[< TOP >](#)

Reason : The desired event is $Q > 100$. $P(Q > 100) = 0.20 + 0.10 = 0.30$

Let X be the number of times Q assumes values greater than 100. Then X is binomially distributed with number of trials = 30 and probability of success = 0.30

The standard deviation of the number of observations greater than 100

$$= \sqrt{n.p(1-p)} = \sqrt{30 \times 0.30 \times (1 - 0.30)} = 2.51$$

4. Answer : (b)

[< TOP >](#)

Reason : Given a probability distribution of paired data $\{X, Y\}$, we can compute the covariance using the formula $\text{Cov}(X, Y) = \sum [X - E(X)][Y - E(Y)] P(X, Y)$

The calculations for the covariance are shown in the table below:

X	Y	P(X,Y)	X×p	Y×p	X-E(X)	Y-E(Y)	
		(p)	(a)	(b)	(c)	(d)	(c).(d).(p)
40	35	0.40	16.0	14.0	13	6.5	33.8
25	25	0.50	12.5	12.5	-2	-3.5	3.5
-15	20	0.10	-1.5	2.0	-42	-8.5	35.7
Total			27	28.5			73.00

Therefore the covariance of the returns is equal to 73.0 (%²).

5. Answer : (b)

[< TOP >](#)

Reason : $E(x) = (1.16 \times 0.1) + (1.17 \times 0.1) + (1.18 \times 0.2) + (1.19 \times 0.2) + (1.2 \times 0.4) = 1.187$

$$0.1(1.16-1.187)^2 + 0.1(1.17-1.187)^2 + 0.2(1.18-1.187)^2$$

$$\text{Variance} = +0.2(1.19-1.187)^2 + 0.4(1.2-1.187)^2$$

$$= 1.81 \times 10^{-4}$$

$$\text{Standard deviation} = \sqrt{\text{Variance}} = 0.01345.$$

6. Answer : (d)

[< TOP >](#)

Reason : $P(-2.0 < z < -1.0) = 0.4772 - 0.3413 = 0.1359$.

7. Answer : (a)

[< TOP >](#)

Reason : Since the businessman is perfectly pessimistic the appropriate decision criterion is Maximin criterion. The decision will be made as follows:

Net gains

(Rs.)

Asset	State of nature			Minimum gains
	S ₁	S ₂	S ₃	
A	30,000	12,000	10,000	10,000
B	40,000	37,000	-6,000	-6,000
C	50,000	25,000	-30,000	-30,000

The maximum of the minimum gains is offered by asset A. Hence he should invest in asset A.

8. Answer : (b)

[< TOP >](#)

Reason : Y will be normally distributed with mean $= \mu_x + 10 = 20 + 10 = 30$ and variance $= \sigma_x^2 = 25$ (because variance is independent of origin).

$$\text{For } X = 10, Y = 10 + 10 = 20$$

$$\text{Standardised value for } (Y = 20) = \frac{Y - \mu}{\sigma} = \frac{20 - 30}{\sqrt{25}} = -2$$

and

9. Answer : (d)

[< TOP >](#)

Reason : Top 10% implies an area of 0.40 between mean and the relevant value. This means a z-value of 1.282 approximately (after interpolation from the normal table).

$$1.282 = \frac{X - 217}{32}$$

$$\therefore \therefore X = (1.282 \times 32) + 217 = 258 (\text{approx.})$$

10. Answer : (b)

[< TOP >](#)

Reason : The population is normally distributed and the population standard deviation is known. So the standard normal distribution should be used. The test is right tailed and the significance level is 0.05. So the critical value for the test is 1.645. Since the test statistic is more than the critical value it falls in the critical region and we reject the null hypothesis.

11. Answer : (c)

[< TOP >](#)

Reason : If we accept $H_0: \mu = 40$ vis-a-vis $H_1: \mu \neq 40$ at a given level of significance with a negative value of the test statistic, then a test with $H_0: \mu = 40$ versus $H_1: \mu < 40$ using the same sample and the same level of significance may or may not accept H_0 because in a one tailed test the critical region in the left tail is larger than a two tailed test for the same level of significance. But we cannot certainly say whether the test statistic will fall in the critical region or in the acceptance region.

12. Answer : (c)

[< TOP >](#)

Reason : Since the sample is small ($n = 16$) and the population variance is not known the distribution to be used is t_{n-1} (or t_{15})

$$\begin{aligned} \therefore \text{UCL} &= \bar{x} + 2.131 \hat{\sigma}_{\bar{x}} \quad \text{or} \quad 2.131 \hat{\sigma}_{\bar{x}} = \text{UCL} - \bar{x} \\ &= 101.31 - 80 = 21.31 \end{aligned}$$

$$\text{Or } \hat{\sigma}_{\bar{x}} = \frac{21.31}{2.131} = 10$$

$$\text{Or } \frac{s}{\sqrt{n}} = 10$$

$$\text{Or Sample variance, } s^2 = 100n = 100 \times 16 = 1600$$

13. Answer : (b)

[< TOP >](#)

Reason : The sample size is small and the population variance is not known; so the appropriate distribution to apply for the confidence interval is t distribution with $6 - 1 = 5$ degrees of freedom.

Sample standard deviation, $s = \sqrt{9.6}$

Estimated standard error of mean $= \frac{s}{\sqrt{n}} = \frac{\sqrt{9.6}}{\sqrt{6}} = 1.265$

$\therefore$ 95% confidence interval for population mean =

$$\begin{aligned}\bar{X} \pm 2.571 \frac{s}{\sqrt{n}} &= 12 \pm 2.571 \times 1.265 \\ &= (8.748, 15.252)\end{aligned}$$

14. Answer : (b)

[<TOP>](#)

Reason : Estimated standard error of difference between means:

$$\hat{\sigma}_{\bar{x}_1 - \bar{x}_2}^2 = \frac{s_1^2}{n_1} + \frac{s_2^2}{n_2} = \frac{4}{64} + \frac{9}{36} = 0.3125$$

$$s_1^2 = \frac{1}{n_1 - 1} \left[\sum x_1^2 - n_1 \bar{x}_1^2 \right] = \frac{1}{63} \left[1852 - 64 \left(\frac{320}{64} \right)^2 \right] = 4$$

$$s_2^2 = \frac{1}{n_2 - 1} \left[\sum x_2^2 - n_2 \bar{x}_2^2 \right] = \frac{1}{35} \left[891 - 36 \left(\frac{144}{36} \right)^2 \right] = 9$$

$$\hat{\sigma}_{\bar{x}_1 - \bar{x}_2} = \sqrt{0.3125} = 0.559$$

Value of the test statistic =

$$\frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\hat{\sigma}_{\bar{x}_1 - \bar{x}_2}} = \frac{\left(\frac{320}{64} - \frac{144}{36} \right) - (-1)}{0.559} = \frac{2}{0.559} = 3.578$$

15. Answer : (a)

[<TOP>](#)

Reason : $H_0: \mu_1 = \mu_2 + 1 \Rightarrow \mu_1 - \mu_2 = 1$

$H_1: \mu_1 > \mu_2 + 1 \Rightarrow \mu_1 - \mu_2 > 1$

It is a right-tailed test at a significance level of 0.05. Both the samples are large. Hence the normal distribution should be used to approximate the sampling distribution of the difference between sample means.

$$\frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}} = \frac{\left(\frac{320}{64} - \frac{144}{36} \right) - 1}{\sqrt{\frac{256}{64} + \frac{144}{36}}} = \frac{1 - 1}{2.828} = 0$$

Value of the test statistic =

The critical value under the right tail obtained from the standard normal distribution is 1.645. The observed value of the test statistic falls well within the acceptance region. So we accept the null hypothesis.

16. Answer : (a)

[<TOP>](#)

Reason : Under the null hypothesis, the non-standardized critical values for this test are =

$$\mu - 1.645 \frac{\sigma}{\sqrt{n}} = 16 - 1.645 \sqrt{\frac{\sigma^2}{n}} = 16 - 1.645 \sqrt{\frac{81}{36}} = 13.5325$$

Hence the null hypothesis will be rejected for sample means less than 13.5325 and accepted for the values above 13.5325.

17. Answer : (e)

[<TOP>](#)

Reason : By Central Limit Theorem for large samples the sample mean is approximately normally distributed with mean = population mean and standard deviation

$$= \frac{\sigma}{\sqrt{n}}$$

$$\therefore E(\bar{x}) = \mu = 18 \text{ min}$$

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{8}{\sqrt{100}} = 0.80 \text{ min}$$

$$\therefore P(\bar{x} < 19) = P\left(Z < \frac{19-18}{0.80}\right) = P(Z < 1.25) = 0.50 + 0.3944 = 0.8944.$$

18. Answer : (a)

[<TOP>](#)

Reason : Since the sample size is large we can approximate the sampling distribution of mean by the normal distribution (by CLT). Since the variance of the population is unknown, the sample variance will be used for calculating the estimated standard error and the test statistic.

$$\text{Test statistic} = \frac{\bar{x} - \mu}{\hat{\sigma}_{\bar{x}}}$$

$$\hat{\sigma}_{\bar{x}} = \frac{s}{\sqrt{n}}$$

$$s = \frac{\left\{ \frac{1}{n-1} [\sum x^2 - n\bar{x}^2] \right\}^{\frac{1}{2}}}{30} = \frac{\left\{ \frac{1}{35} [52236 - 36 \times 24^2] \right\}^{\frac{1}{2}}}{30}$$

$$\therefore \text{Test statistic} = \frac{\frac{24-18}{\frac{30}{\sqrt{36}}}}{\frac{6}{5}} = 1.20.$$

19. Answer : (a)

[<TOP>](#)

Reason : Standardized test statistic = $\frac{\bar{p} - p_0}{\sigma_{\bar{p}}}$

$$p_0 = 0.40$$

$$\sigma_{\bar{p}} = \sqrt{\frac{p_0(1-p_0)}{n}} = \sqrt{\frac{0.40 \times 0.60}{360}} = 0.02582.$$

$$\therefore \frac{\bar{p} - 0.40}{0.02582} = 1.5492$$

$$\text{or } \bar{p} = 0.40 + (1.5492 \times 0.02582) = 0.44.$$

20. Answer : (c)

[<TOP>](#)

$$\sigma_{x_1 - x_2}^2 = \frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2} = \frac{256}{n_1} + \frac{144}{36} = (\sqrt{8})^2$$

$$\text{or } \frac{256}{n_1} + 4 = 8$$

$$\text{or } n_1 = \frac{256}{8-4} = 64$$

Reason :

21. Answer : (c)

[< TOP >](#)

Reason : Slope of the estimated regression equation of Z on X =

$$\begin{aligned} \frac{n \sum XZ - \sum X \sum Z}{n \sum X^2 - (\sum X)^2} &= \frac{n \sum X(Y+2) - \sum X \sum (Y+2)}{n \sum X^2 - (\sum X)^2} \\ &= \frac{n [\sum XY + 2 \sum X] - \sum X (\sum Y + \sum 2)}{n \sum X^2 - (\sum X)^2} \\ &= \frac{n \sum XY + 2n \sum X - \sum X \sum Y - \sum X \sum 2}{n \sum X^2 - (\sum X)^2} \\ &= \frac{n \sum XY + 2n \sum X - \sum X \sum Y - 2n \sum X}{n \sum X^2 - (\sum X)^2} \\ &= \frac{n \sum XY - \sum X \sum Y}{n \sum X^2 - (\sum X)^2} \\ &= \text{Slope of estimated regression equation of Y on X} \\ &= 5 \end{aligned}$$

Intercept of the estimated regression equation of Z on X =

$$\begin{aligned} \bar{Z} - b\bar{X} &= \frac{\sum Z}{n} - b\bar{X} \\ &\quad (\text{Where 'b' is slope of estimated Regression equation of Z on X}) \\ &= \frac{\sum (Y+2)}{n} - b\bar{X} = (\bar{Y} + 2) - b\bar{X} = 2 + (\bar{Y} - b\bar{X}) \\ &= 2 + \text{Intercept of estimated regression equation of Y on X} \\ &= 2 + 10 = 12 \end{aligned}$$

22. Answer : (b)

[< TOP >](#)

Reason : Let the following notations be used:

X : Year

x : Coded value of year = $2(X - \bar{X})$

Y : Research expenditure (in Rs.)

Year X	$x = 2(X - \bar{X})$	Y	xY	x^2
1999	-5	45	-225	25
2000	-3	38	-114	9
2001	-1	58	-58	1
2002	1	65	65	1
2003	3	75	225	9
2004	5	85	425	25

$\Sigma X = 12009$	$\Sigma Y = 366$	$\Sigma xY = 318$	$\Sigma x^2 = 70$
--------------------	------------------	-------------------	-------------------

$$\bar{X} = \frac{12009}{6} = 2001.5$$

$$\hat{Y} = a + bx$$

$$b = \frac{\Sigma xY}{\Sigma x^2} = \frac{318}{70} = 4.543$$

$$a = \bar{Y} = \frac{366}{6} = 61$$

∴ The linear trend equation is $\hat{Y} = 61 + 4.543x$

23. Answer : (b)

[<TOP>](#)

$$\text{Reason : Relative Cyclical Residual Measure} = \frac{Y - \hat{Y}}{\hat{Y}} \times 100$$

$$1997 : \frac{7.5-7.6}{7.6} \times 100 = -1.3158\%$$

$$1998 : \frac{7.8-7.8}{7.8} \times 100 = 0.0\%$$

$$1999 : \frac{8.2-8.0}{8.0} \times 100 = 2.5\%$$

$$2000 : \frac{8.2-8.2}{8.2} \times 100 = 0.0\%$$

$$2001 : \frac{8.4-8.4}{8.4} \times 100 = 0.0\%$$

$$2002 : \frac{8.5-8.6}{8.6} \times 100 = -1.1628\%$$

$$2003 : \frac{8.7-8.8}{8.8} \times 100 = -1.1364\%$$

$$2004 : \frac{9.1-9.0}{9.0} \times 100 = 1.111\%$$

The largest fluctuation from trend has taken place in the year 1999, i.e., 2.5 %

24. Answer : (a)

[<TOP>](#)

Reason : We know that the variation in Y explained by X_1 if X_2 is kept constant is given by the partial coefficient of determination denoted by

$$R^2_{12.3} = \frac{(r_{12} - r_{13} \cdot r_{23})^2}{(1 - r_{13}^2)(1 - r_{23}^2)}$$

$$\text{Therefore } R^2_{12.3} = \frac{(0.7 - 0.5 \times 0.6)^2}{(1 - 0.5^2)(1 - 0.6^2)}$$

$$\begin{aligned}
 &= \frac{(0.7-0.3)^2}{(0.75)(0.64)} \\
 &= \frac{0.4^2}{0.48} = 0.3333 \\
 &\approx \mathbf{0.33} \text{ i.e } 33\%.
 \end{aligned}$$

25. Answer : (e)

[< TOP >](#)

Reason : In multiple regression relationship:

$$\text{Standard error of estimate, } s_e = \sqrt{\frac{\sum (Y - \hat{Y})^2}{n - k - 1}} = \sqrt{\frac{\text{ESS}}{n - k - 1}}$$

Given : ESS = 576

n = ?

k = 2

$s_e = 4.8$

$$\therefore 4.8 = \sqrt{\frac{\text{ESS}}{n - 2 - 1}}$$

$$\therefore \frac{\text{ESS}}{n - 3} = 23.04$$

$$\text{or } \frac{576}{n - 3} = 23.04$$

$$\text{or } n = \frac{576}{23.04} + 3 = 28$$

26. Answer : (c)

[< TOP >](#)

$$\text{Reason : Marshall -Edgeworth price index} = \frac{\sum P_1(Q_0 + Q_1)}{\sum P_0(Q_0 + Q_1)} \times 100 = \frac{99562.50}{74812.5} \times 100 = 133.08$$

27. Answer : (b)

[< TOP >](#)

$$\text{Reason : The weighted aggregate price index using Paasche method is } \frac{\sum P_1 \cdot Q_1}{\sum P_0 \cdot Q_1} \times 100$$

$$\text{i.e., } \frac{2.10 \times 20 + 22.00 \times 20 + 3.1 \times 30}{1.70 \times 20 + 19 \times 20 + 3.00 \times 30} \times 100 = \frac{575}{504} \times 100 = 114.09.$$

28. Answer : (a)

[< TOP >](#)

$$\text{Reason : } \hat{Y} = 96.54 + 1526.84X_1 - 290.476X_2$$

Given: $X_1 = 3, X_2 = 4$

$$\therefore \hat{Y} = 96.54 + 1526.84(3) - 290.476(4) = 3515.16 \approx \text{Rs.}3515.$$

29. Answer : (e)

[< TOP >](#)

$$\text{Reason : The Upper Control Limit for the R chart is given as, } UCL = \bar{R} + \frac{3d_3}{d_2} \bar{R}$$

$$\begin{aligned}\bar{R} \left(1 + \frac{3d_3}{d_2} \right) &= \bar{R} \times D_4 \\ &= 1.5 \times 1.777 = 2.666 \text{ minutes.}\end{aligned}$$

30. Answer : (d)

[< TOP >](#)

Reason : $\bar{x}_1$ (mean sale of DNA); $\bar{x}_2$ (mean sales of RNA); $\bar{x}_3$ (Mean sales of Oops)

The means of the samples are $\bar{x}_1 = \frac{24}{4} = 6$; $\bar{x}_2 = \frac{35}{4} = 8.75$; $\bar{x}_3 = \frac{30}{4} = 7.5$

We calculate Within column variance as below:

$$\hat{\sigma}^2 = \sum \left(\frac{n_j - 1}{n_T - k} \right) \times s_j^2$$

$$s_1^2 = \frac{(8-6)^2 + (4-6)^2 + (2-6)^2 + (10-6)^2}{4-1} = \frac{40}{3}$$

$$s_2^2 = \frac{(11-8.75)^2 + (10-8.75)^2 + (4-8.75)^2 + (10-8.75)^2}{4-1} = \frac{30.75}{3}$$

$$s_3^2 = \frac{(9-7.5)^2 + (7-7.5)^2 + (5-7.5)^2 + (9-7.5)^2}{4-1} = \frac{11}{3}$$

$$\text{So, } \hat{\sigma}^2 = \left(\frac{4-1}{12-3} \right) \times \left(\frac{40}{3} + \frac{30.75}{3} + \frac{11}{3} \right) = 9.083.$$

31. Answer : (a)

[< TOP >](#)

$$\begin{aligned}\text{Reason : Laspeyres quantity index} &= \frac{\sum Q_1 P_0}{\sum Q_0 P_0} \times 100 = \frac{\sum \left[Q_0 P_0 \times \frac{Q_1}{Q_0} \right]}{\sum Q_0 P_0} \times 100 \\ &= \frac{\left(320 \times \frac{3}{4} \right) + \left(1000 \times \frac{1}{2} \right) + \left(1120 \times \frac{5}{7} \right) + \left(760 \times \frac{13}{19} \right)}{(320 + 1000 + 1120 + 760)} \times 100 \\ &= \frac{2060}{3200} \times 100 = 64.4 \quad (\text{approx.})\end{aligned}$$

32. Answer : (c)

[< TOP >](#)

$$\text{Reason : } S_e = \sqrt{\frac{\text{ESS}}{n-2}} = \sqrt{\frac{56}{8-2}} = 3.055$$

$$\begin{aligned}90\% \text{ prediction interval} &= \hat{Y} \pm t \times S_e = 24 \pm t_{6,0.10} S_e \\ &= 24 \pm (1.943 \times 3.055) = (18.064, 29.936).\end{aligned}$$

33. Answer : (a)

[< TOP >](#)

$$\text{Reason : } S_e = \sqrt{\frac{\text{ESS}}{n-2}} \quad \text{or} \quad \text{ESS} = S_e^2 (n-2)$$

$$\begin{aligned}\text{Coefficient of determination} &= \frac{\text{RSS}}{\text{TSS}} = \frac{\text{TSS} - \text{ESS}}{\text{TSS}} \\ &= \frac{1350 - 4.5^2(10 - 2)}{1350} = 0.88.\end{aligned}$$

34. Answer : (d)

[<TOP>](#)

Reason : Let the missing value be 'x'

Given that

$$\begin{aligned}\frac{L}{P} &= \frac{28}{27} \\ \text{or, } \frac{\frac{\sum P_1 Q_0}{\sum P_0 Q_0} \times 100}{\frac{\sum P_1 Q_1}{\sum P_0 Q_1} \times 100} &= \frac{28}{27} \\ \text{or, } \frac{20 + 5x}{10 + 2x} &= \frac{28}{27} \\ \text{or, } \frac{20 + 5x}{15} \times \frac{7}{10 + 2x} &= \frac{28}{27} \\ \text{or, } \frac{20 + 5x}{10 + 2x} &= \frac{20}{9} \\ \text{or, } x &= 4.\end{aligned}$$

35. Answer : (e)

[<TOP>](#)

Reason : Given that,

$$\begin{aligned}\rho_{X,Y} &= \frac{\text{Cov}(X, Y)}{\sigma_X \cdot \sigma_Y} = 0.75, \\ \text{or, } 0.75 &= \frac{\text{Cov}(X, Y)}{\sqrt{625 \times 256}}, \\ \text{or, } \text{Cov}(X, Y) &= 0.75 \times 25 \times 16 = 300. \\ \text{or, } \text{Cov}(3X, 4Y) &= 3 \times 4 \text{Cov}(X, Y) = 12 \times 300 = 3600.\end{aligned}$$

36. Answer : (c)

[<TOP>](#)

- Reason : (a) This is the wrong answer. The weighted average of price relatives using base values as weights is not same as the unweighted aggregates price index.
- (b) This is the wrong answer. The weighted average of price relatives using base values as weights is not same as the unweighted aggregates quantity index.
- (c) This is the **right** answer. The weighted average of price relatives using base values as weights is same as the Laspeyres price index.
- (d) This is the wrong answer. The weighted average of price relatives using base values as weights is not same as the Laspeyres quantity index.
- (e) This is the wrong answer. The weighted average of price relatives using base values as weights is not same as the Paasche's price index.

37. Answer : (a)

[< TOP >](#)

Reason : Analysis of variance can be used to test whether means of more than two populations are equal. No other techniques, mentioned in the other alternatives, can be applied in this respect. So the alternative (a) is correct.

38. Answer : (c)

[< TOP >](#)

Reason : Given that

Number of sheared off pieces	100	100	100	100	100
Number of defectives	5	6	7	4	8
Proportion defective	0.05	0.06	0.07	0.04	0.08

The mean of proportions = $0.30 / 5 = 0.06$

$$\begin{aligned} \text{Upper Control Limit for } \mathbf{p} \text{ chart} &= \bar{p} + 3\sqrt{\frac{\bar{p}\bar{q}}{n}} \\ &= 0.06 + 3\sqrt{\frac{0.06 \times 0.94}{100}} \\ &= 0.06 + 3 \times 0.0237 = 0.131 \end{aligned}$$

39. Answer : (e)

[< TOP >](#)

Reason : The central line of the $\bar{x}$ chart is = Mean of the sample means ($\bar{\bar{x}}$)

Mean of the sample means or grand mean, $\bar{\bar{x}} = 106.6 / 10 = 10.66$ units.

Mean of sample range = $\bar{R} = \sum R / n = 63 / 10 = 6.3$

$$\begin{aligned} \text{Lower Control Limit of } \bar{x} \text{ chart} &= \bar{\bar{x}} - A_2 \bar{R} \\ &= 10.66 - 0.577 \times 6.3 = \mathbf{7.0249} \end{aligned}$$

(The value of A_2 for sample of size 5 is 0.577 from control chart factors table)

40. Answer : (c)

[< TOP >](#)

Reason : We have to find the partial correlation between yield of cotton and the number of seed vessels, eliminating the effect of height

$$r_{12.3} = \frac{r_{12} - r_{13}r_{23}}{\sqrt{(1 - r_{13}^2)(1 - r_{23}^2)}}$$

Substituting the values in above expression, we get

$$r_{12.3} = \frac{0.8 - (0.65 \times 0.7)}{\sqrt{\{1 - (0.65)^2\} \{1 - (0.7)^2\}}} = \frac{0.345}{\sqrt{0.294525}} = 0.636$$

41. Answer : (c)

[< TOP >](#)

Reason : We use the following table to calculate the correlation coefficient:

X	$x = X - \bar{X}$	x^2	Y	$y = Y - \bar{Y}$	y^2	xy
9	4	16	15	3	9	12
8	3	9	16	4	16	12
7	2	4	14	2	4	4
6	1	1	13	1	1	1
5	0	0	11	-1	1	0

4	-1	1	12	0	0	0
3	-2	4	10	-2	4	4
2	-3	9	8	-4	16	12
1	-4	16	9	-3	9	12
$\Sigma X = 45$	$\Sigma x = 0$	$\Sigma x^2 = 60$	$\Sigma Y = 108$	$\Sigma y = 0$	$\Sigma y^2 = 60$	$\Sigma xy = 57$

We have $\bar{X} = 45 / 9 = 5$; $\bar{Y} = 108/9 = 12$ and $r =$

$$\frac{\Sigma xy}{\sqrt{\Sigma x^2 \Sigma y^2}} = \frac{57}{\sqrt{60 \times 60}} = 0.95$$

42. Answer : (a)

[<TOP>](#)

Reason : The regression equation of Y on X is : $Y_c = a + bX$.

$$b = \frac{\text{Cov}(X, Y)}{\text{Var}(X)} = \frac{\Sigma(X - \bar{X})(Y - \bar{Y})}{\Sigma(X - \bar{X})^2} = \frac{\Sigma xy}{\Sigma x^2} = \frac{-26}{40} = -0.65$$

$$a = \bar{Y} - b\bar{X} = (40/5) - (-0.65)(30/5) = 11.9$$

Therefore the regression equation is, $\hat{Y} = 11.9 - 0.65X$.

43. Answer : (c)

[<TOP>](#)

Reason : We calculate the variances of the two samples as follows:

X_1 : Observation from population A

X_2 : Observation from population B

Number	X_1	$(X_1 - \bar{X}_1)$	$(X_1 - \bar{X}_1)^2$	X_2	$(X_2 - \bar{X}_2)$	$(X_2 - \bar{X}_2)^2$
1	66	-14	196	64	-19	361
2	67	-13	169	66	-17	289
3	75	-5	25	74	-9	81
4	76	-4	16	78	-5	25
5	82	2	4	82	-1	1
6	84	4	16	85	2	4
7	88	8	64	87	4	16
8	90	10	100	92	9	81
9	92	12	144	93	10	100
10				95	12	144
11				97	14	196
Sum	720		734	913		1298
Mean	80			83		
Sample Variance			91.75			129.8

$$\text{Sample Variance} = \frac{\sum (X - \bar{X})^2}{n - 1}$$

$$= \frac{S_2^2}{S_1^2} = \frac{129.8}{91.75} = 1.415$$

The test statistic, F

While calculating the test statistic the higher sample variance should be placed in the numerator and the lower sample variance should be placed in the denominator.

44. Answer : (d)

[<TOP>](#)

Reason : The event that X assumes a value at least 60 occurs when $X = 60$ or 80 or 100

$$\begin{aligned} \therefore P(X \text{ assumes a value at least } 60) &= P(X \geq 60) \\ &= P(X = 60) + P(X = 80) + P(X = 100) \\ &= 0.30 + 0.20 + 0.10 \\ &= 0.60 \end{aligned}$$

Let Y be the no. of observations of the variable X, that are at least 60. Then Y will follow a binomial distribution with number of trials = 20 and probability of success (i.e. getting at least 60) = 0.60

$$\therefore P(Y = 12) = {}^{20}C_{12} (0.60)^{12} (1 - 0.60)^{20-12}$$

$$= 0.17971.$$

45. Answer : (c)

[< TOP >](#)

Reason : Fisher's ideal index is the geometric mean of Laspeyres index and Paasche's index.

$$\text{So, Fisher's ideal price index} = \sqrt{107 \times 109} = 108 \text{ (approx.)}$$

46. Answer: (d)

[< TOP >](#)

Reason: In systematic sampling the first element of the population is selected randomly but thereafter the elements are selected according to a systematic plan.

47. Answer: (a)

[< TOP >](#)

Reason: The secular trend shows the long term behaviour of a variable.

48. Answer : (c)

[< TOP >](#)

Reason : By Central Limit Theorem for large samples the sample mean is approximately normally distributed with mean = population mean and standard deviation

$$= \frac{\sigma}{\sqrt{n}}$$

$$E(\bar{x}) = \mu$$

$$P(\bar{x} < 65) = 0.0228$$

$$\therefore P(65 < \bar{x} < \mu) = 0.50 - 0.0228 = 0.4772 = P(k < z < 0)$$

From tables are find that $k = -2.0$

$$\begin{aligned} \therefore z = -2 &= \frac{\bar{x} - \mu}{\sigma_{\bar{x}}} \quad \text{or } -2 = \frac{65 - \mu}{\left(\frac{20}{\sqrt{64}}\right)} = \frac{65 - \mu}{2.50} \\ \text{or } -2 \times 2.50 &= 65 - \mu \\ \text{or } \mu &= 65 + 5 = 70. \end{aligned}$$

49. Answer : (a)

[< TOP >](#)

Reason : 95% confidence limits for the population mean:

$$73 = \bar{X} - 1.96\sigma_{\bar{X}} \quad (A)$$

$$80 = \bar{X} + 1.96\sigma_{\bar{X}} \quad (B)$$

$$\text{Adding the two equations and solving : } \bar{X} = \frac{73 + 80}{2} = 76.5$$

$$\text{Subtracting (A) from (B) and solving : } 7 = 2 \times 1.96\sigma_{\bar{X}}$$

$$\therefore \sigma_{\bar{X}} = \frac{7}{2 \times 1.96} = 1.7857$$

$\therefore$ 99% confidence limits are:

$$\text{Lower limit : } \bar{X} - 2.575\sigma_{\bar{X}} = 76.5 - (2.575 \times 1.7857) = 71.90 = 72 \text{ (approx.)}$$

$$\text{Upper limit : } \bar{X} + 2.575\sigma_{\bar{X}} = 76.5 + (2.575 \times 1.7857) = 81.1 = 81 \text{ (approx.)}$$

50. Answer : (a)

[< TOP >](#)

Reason : The 97% confidence interval for the population mean is (18.553, 21.447).

$$\therefore \text{Sample mean} = \frac{(18.553 + 21.447)}{2} = 20$$

$$H_0 : \mu = 19$$

$$H_1 : \mu > 19$$

Under the null hypothesis the non-standardized critical value of the sampling distribution of mean in the upper tail, for the 3% significance level, will be =

$$19 + 1.881 \frac{4}{\sqrt{36}} = 20.254$$

The sample mean is less than this critical value (on non-standardized scale).

$\therefore$ We accept H_0 .

Hence we can conclude at 3% significance level that the population mean is equal to 19.

51. Answer : (d) [< TOP >](#)
Reason : (a), (b), (c) and (e) are true; (d) is false about correlation analysis.
52. Answer : (c) [< TOP >](#)
Reason : The covariance of any random variable with itself is equal to the variance of the variable.
53. Answer : (b) [< TOP >](#)
Reason : The expected value of a binomial probability distribution is always more than the variance.
54. Answer : (d) [< TOP >](#)
Reason : The maximin criterion of decision making is useful to a pessimistic decision maker under conditions of uncertainty, not under conditions of risk.
55. Answer : (e) [< TOP >](#)
Reason : For a binomial distribution mean = np and variance = npq. So knowing the two is sufficient for exactly describing a binomial distribution.
56. Answer : (b) [< TOP >](#)
Reason : The population variance is considered to be unknown when the t-statistic is calculated for a sample.
57. Answer : (d) [< TOP >](#)
Reason : The F distribution is a distribution of the ratio of two random variables each of which follows a chi-square distribution.
58. Answer : (c) [< TOP >](#)
Reason : $\text{Var}(x_1 + x_2) = \text{Var}(x_1) + \text{Var}(x_2) + 2\text{Cov}(x_1, x_2)$
If x_1 and x_2 are independent then, $\text{Cov}(x_1, x_2) = 0$
 $\therefore \text{Var}(x_1 + x_2) = \text{Var}(x_1) + \text{Var}(x_2)$.
59. Answer : (c) [< TOP >](#)
Reason : In a normal probability distribution the total area under the curve to the left of the mean is equal to the total area under the curve to the right of the mean.
60. Answer : (e) [< TOP >](#)
Reason : When the decision maker is aware of all possible states of nature and has sufficient information to assign any probabilities of occurrence to the various

states of nature the appropriate criterion of decision-making is the expected value criterion.

61. Answer : (a) [<TOP>](#)
Reason : a. A decision tree is a graphical method which represents states of nature and courses of action.
b. A histogram is a graphical representation of a frequency distribution.
c. A scatter diagram shows the distribution of data points in regression analysis.
d. A frequency distribution is a distribution of data along with their frequencies.
e. A probability distribution is a distribution of values of a random variable along with their respective probabilities
62. Answer : (a) [<TOP>](#)
Reason : Other things remaining the same, if the sample size increases then the width of the confidence interval for the population mean decreases, because the standard error of mean decreases.
63. Answer : (b) [<TOP>](#)
Reason : Other things remaining the same, if there are two populations with known variances then, a random sample collected from the population with the lower variance will produce a confidence interval for the population mean which is narrower than that produced by a random sample collected from the population with the higher variance.
64. Answer : (b) [<TOP>](#)
Reason : The variance of the sampling distribution of mean is less than the variance of the underlying population if the sample size is more than one.
65. Answer : (c) [<TOP>](#)
Reason : The sample mean is an unbiased estimator of the population mean because the expected value of sample mean is equal to the population mean
66. Answer : (d) [<TOP>](#)
Reason : The confidence level being same and the population variance not being known, a confidence interval for the population mean which is narrower than another for the same population, is **certainly** based on a sample with lower estimated standard error of mean.
67. Answer : (d) [<TOP>](#)
Reason : If a null hypothesis is rejected at a significance level of 0.05, then it will always be rejected at a significance level of 0.10 because at a significance level of 0.10 the critical region is larger than the significance level of 0.05.
68. Answer : (c) [<TOP>](#)
Reason : The acceptance of null hypothesis does not prove that it is true because there are situations when the sample statistic falls within the acceptance region, though null hypothesis is false. That is why type II error occurs.
69. Answer : (d) [<TOP>](#)
Reason : This type of sampling is referred to as stratified random sampling because the entire population is divided in to classes (sectors) or strata which are homogeneous in nature and samples a fixed number of observations from each stratum.
70. Answer : (a) [<TOP>](#)

Reason : When the population is normally distributed, population variance is known and the sample size is 15, the confidence interval for the population mean is based on the standard normal distribution.

71. Answer : (c) [<TOP>](#)

Reason : Chi-square distribution with $(4 - 1)(2 - 1) = 3$ degrees of freedom.

72. Answer : (c) [<TOP>](#)

Reason : The method of least squares in simple regression analysis minimizes the sum of the squared differences between the actual values and estimated values of the dependent variable.

73. Answer : (d) [<TOP>](#)

Reason : If the percent of trend for a year in a time series is greater than 100%, it indicates that the actual time-series value lies above the trend line and the relative cyclical residual is positive.

74. Answer : (b) [<TOP>](#)

Reason : If the regression equation is a perfect estimator of the dependent variable then the coefficient of correlation is either +1 or -1, not zero. Other alternatives are true.

75. Answer : (b) [<TOP>](#)

Reason : The coefficient of determination r^2 measures how good the fit is and gives the variation explained by the model.

If r be the coefficient of correlation between two variables X and Y , then the variation that is not explained by the regression line is equal to $1 - r^2$.

' r ' is the coefficient of correlation and it signifies the degree of association between two variables.

' $1 - r$ ' does not give the variation that is not explained by the model.

' $1 + r^2$ ' does not have any meaning associated with it.

76. Answer : (e) [<TOP>](#)

Reason : Coefficient of multiple correlation is also dependent on the coefficient of correlation between the variables X_1 and X_2 .

77. Answer : (d) [<TOP>](#)

Reason : Multicollinearity reduces the effect of individual variables on the model. So It reduces the effect of any sensitivity analysis.

78. Answer : (e) [<TOP>](#)

Reason : As opposed to Laspeyres index, Paasche index generally tends to underestimate the prices or has a downward bias.

Hence, from above discussion, we can infer that option (e) is **false** regarding Paasche index.

Options (a), (b), (c) and (d) are all true regarding Paasche index.

79. Answer : (c) [<TOP>](#)

Reason : Except Fisher's Ideal Index, all other elementary indices, simple as well as weighted, fail to satisfy Factor Reversal Test.

Hence from above discussion, we can infer that option (c) is correct.

80. Answer : (e) [<TOP>](#)

Reason : Fisher's Ideal Index is the geometric mean of Laspeyres Index and Paasche's Index. So its value falls between the values of Laspeyres and Paasches indices. Hence, from above discussion, we can infer that option (e) is **false** regarding

Fisher's Ideal Index. Options (a), (b), (c) and (d) are all true regarding Fisher's Ideal Index.

81. Answer : (c) [<TOP>](#)

Reason : This is **not true** for index numbers. Index number is a ratio of the price, quantity or value of the commodities under study and therefore does not have any unit.

82. Answer : (a) [<TOP>](#)

Reason : In $\bar{x}$ charts, increasing or decreasing trend indicates that the presence of non-random variations.

83. Answer : (b) [<TOP>](#)

Reason : In a p chart, the center line is drawn on the basis of overall sample proportion.
In a p chart, the lower control limit can only be greater than or equal to zero.
The upper and lower control limits are fixed by adding and subtracting the estimated standard error of proportion from the overall sample proportion

84. Answer : (b) [<TOP>](#)

Reason : The distribution is positively skewed when the number of degrees of freedom is small.

85. Answer : (b) [<TOP>](#)

Reason : The distribution is F distribution with the following dof:
No. of degrees of freedom for the numerator = $k - 1 = 4 - 1 = 3$
No. of degrees of freedom for the denominator = $n_T - k = (4 \times 6) - 4 = 20$
 $\therefore$ Critical value at 5% significance level = 3.10.

86. Answer : (e) [<TOP>](#)

Reason : $\hat{Y} = 20 + 0.75X$.
At the point $X=100, Y=90, \hat{Y} = 20 + 0.75 \times 100 = 75 + 20 = 95$ but $Y = 90$
 $\therefore$ Residual $Y - \hat{Y} = 90 - 95 = -5$

87. Answer : (e) [<TOP>](#)

Reason :
$$r_{X,Y} = \frac{\text{CoV}(X, Y)}{\sigma_X \sigma_Y}$$

or
$$\sigma_Y = \frac{\text{Cov}(X, Y)}{r \cdot \sigma_X} = \frac{256}{0.64 \sqrt{625}} = 16$$

 $\therefore \sigma_Y^2 = 16^2 = 256$.

88. Answer : (a) [<TOP>](#)

Reason : Linear regression equation $Y = a + bX$
$$20 = 5 + 5 \times b$$

$$b = \frac{20-5}{5} = 3.$$

89. Answer : (b) [<TOP>](#)

Reason : Coefficient of determination cannot be negative; others can be negative.

90. Answer : (e) [<TOP>](#)

Reason : A weighted aggregate price index where the weight for each item is its current-period quantity is called the Paasche index.

[< TOP OF THE DOCUMENT >](#)