

Question Paper

Quantitative Methods-II (132): January 2007

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

1. If the percent of trend for a year in a time series is greater than 100%, it indicates that [< Answer >](#)
- The actual time series value lies below the trend line and the relative cyclical residual is positive
 - The actual time series value lies below the trend line and the relative cyclical residual is negative
 - The actual time series value lies above the trend line and the relative cyclical residual is negative
 - The actual time series value lies above the trend line and the relative cyclical residual is positive
 - The actual time series value is less than the estimated value, for the year.

(1 mark)

2. An Umpire tosses a coin at Hockey teams of India and Italy. The probability of winning the toss by Indian team is $1/2$. The variance of the number of successes in a binomial distribution is given by $\sqrt{5.07}$. [< Answer >](#)

Find the probability of obtaining exactly 3 successes?

- 0.1640
- 0.2875
- 0.2315
- 0.1079
- 0.1241.

(2 marks)

3. The following data pertains to the consumption of needs by a restaurant: [< Answer >](#)

Inputs	Units	Prices (in Rs. per unit)		Quantities Used (Units)	
		1999	2006	1999	2006
Sugar	Kilogram	10	42	320	450
Banana	Dozen	8	12	70	60
Rice	Kilogram	5	20	200	120
Jam	Kilogram	25	40	110	80

Laspeyres quantity Index for the year 2006 with the year 1999 as base year, is

- 109.41
- 106.96
- 198.23
- 206.04
- 100.93.

(1 mark)

4. The HR director of an organization wanted to know, what proportion of all persons who had ever been interviewed for a job with his organization, had been hired. A random sample of 350 interview records revealed that 65 persons in the sample had been hired. [< Answer >](#)

Find the upper confidence limit for the 95 percent interval estimate of population proportion.

- (a) 0.7235
- (b) 0.6569
- (c) 0.2268
- (d) 0.5456
- (e) 0.9846.

(3 marks)

5. In marginal analysis the minimum required probability of selling an additional unit, that justifies stocking of that additional unit, [< Answer >](#)

- (a) Does not depend on the marginal loss that can be incurred by not selling that unit
- (b) Does not depend on the marginal profit that can be earned by selling that unit
- (c) Decreases if the marginal profit increases
- (d) Increases if the marginal profit increases
- (e) Does not change if the marginal profit increases or decreases.

(1 mark)

6. A composite price index where the prices of the items in the composite are weighted by their relative importance is known as the [< Answer >](#)

- (a) Price relative
- (b) Unweighted aggregates price index
- (c) Weighted aggregates price index
- (d) Value index
- (e) Quantity index.

(1 mark)

7. The weighted average of price relatives using base 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) Paasches price index.

(1 mark)

8. The following details are available with regard to the sample data collected for a hypothesis test on means of two populations: [< Answer >](#)

$$n_1 = 24, n_2 = 14 \text{ and } s_1 = 16$$

The samples are independently collected and it is assumed that the two populations are normally distributed and have the same variance. The pooled estimate of the underlying common population variance is 180.5. What is the variance of the second sample? (Round off your answer to the nearest integer).

- (a) 36
- (b) 56
- (c) 47
- (d) 28
- (e) 40.

(2 marks)

9. The following data provides the values of sample range **R**, for samples of size 8 each.

[< Answer >](#)

Sample no.	1	2	3	4	5	6	7	8
Range (R)	9	5	9	8	3	12	11	10

Calculate the value of lower control limit for the **R** chart (Use the relevant **D₃** or **D₄** factor).

- (a) 1.14
- (b) 2.25
- (c) 3.24
- (d) 4.89
- (e) 5.05.

(1 mark)

10. Five coins are tossed 3,010 times and the number of heads appearing each time was noted. At the end, the following results were obtained:

[< Answer >](#)

No. of tails	0	1	2	3	4	5
Frequency	65	455	1200	800	430	60

With the help of the above data, we want to test whether the coins are unbiased. Which of the following is an appropriate null hypothesis for this test?

- (a) The coins are biased
- (b) The coins are unbiased
- (c) Some of the coins are biased
- (d) Exactly two coins are biased
- (e) All the coins are biased.

(1 mark)

11. The probability of an event is 'p'. If the experiment is repeated 'n' times then the probability of the event occurring every time is

[< Answer >](#)

- (a) p^n
- (b) $1/np$
- (c) p/n
- (d) n/p
- (e) $(p - 1)^n$.

(1 mark)

12. The demand for a particular product in a factory was found to vary for every two months in a year. In a sample study the following information was obtained:

[< Answer >](#)

Month	Jan	March	May	July	Sep	Nov
Products demanded	1132	1170	1114	1120	1120	1112

We need to test the hypothesis that the number of products demanded does not depend on the months of the year. What is the value of the test statistic for the above test?

- (a) 1.3159
- (b) 2.2226
- (c) 1.2079
- (d) 2.0911
- (e) 3.3079.

(2 marks)

13. Of the 16 boxes which contains 530 pen sets each, the number of defective pen sets in these boxes are [< Answer >](#) as follows:

325	431	365	312	285	322	296	210
371	453	315	336	374	399	284	231

Calculate the value of central line for the **p** chart for the fraction of defectives.

- (a) 0.8025
- (b) 0.7451
- (c) 0.6260
- (d) 0.4395
- (e) 0.3925.

(1 mark)

14. The ratio of the weighted average price of the goods in a basket in the current year to their weighted average price in the base year is 11 : 9. Both the weighted averages have been calculated using the consumption quantities in the current year as weights. [< Answer >](#)

Which of the following is **correct**?

- (a) Paasches price index = 122.22
- (b) Laspeyres price index = 130.55
- (c) Laspeyres price index = 120.80
- (d) Paasches price index = 140.00
- (e) Laspeyres price index = 171.43.

(2 marks)

15. Jain, the CEO of Hyundai company, feels that the longer a group of employees work together on an assembly line, the higher is the daily output rate. She has gathered the following data for a group of employees who worked together for 8 days: [< Answer >](#)

Daily output (units)	6	8	9	10	4	7	11	12
No. of employees	2	3	4	5	6	7	8	9

Which of the following is the intercept of the estimated regression line with the daily output as the dependent variable?

- (a) 4.355
- (b) 4.810
- (c) 5.428
- (d) 5.850
- (e) 6.156.

(2 marks)

16. The seasonal index and deseasonalized value in time series are given by 125 and 105 respectively, then [< Answer >](#) the value of the actual data is

- (a) 158.46
- (b) 131.25
- (c) 124.70
- (d) 142.10
- (e) 171.05.

(1 mark)

17. Which of the following statements is **false**?

[< Answer >](#)

- (a) Interval estimates are used for small populations only
- (b) An interval estimate is a range of values within which the actual value of the population parameter may fall
- (c) An interval estimate indicates the probability of the true population parameter falling within the range of values given
- (d) A point estimate is a single number that is used to estimate an unknown population parameter
- (e) A point estimate may be either right or wrong.

(1 mark)

18. The standard error of estimate of a simple regression line is

[< Answer >](#)

- (a) Equal to the slope of the regression line
- (b) Equal to the square root of the coefficient of determination
- (c) Equal to the Y intercept of the regression line
- (d) The measure of the variability of the observed values around the regression line
- (e) Equal to the coefficient of correlation between two variables.

(1 mark)

19. If the Paasches price index and Fishers ideal price index are 102.65 and 135.40 respectively, then the Laspyeres price index will be approximately equal to

[< Answer >](#)

- (a) 138.67
- (b) 145.23
- (c) 178.59
- (d) 156.54
- (e) 160.48.

(1 mark)

20. Glaxo is a reputed chemical company in manufacturing drugs. They conducted clinical trials on different batches of people of **A**, **B** and **C**. The following table gives the effectiveness of drug on 3 category of batches in four different weeks:

[< Answer >](#)

A	8	4	6	6
B	12	10	9	4
C	11	8	4	7

For a test of ANOVA, find the estimated common population variance, using the variance within the samples?

- (a) 3.080
- (b) 6.853
- (c) 7.526
- (d) 6.297
- (e) 7.809.

(3 marks)

21. On a population survey, we came to know that, as population increases their needs also increases and vice versa. But the study on population cannot explain 45 percent of the variations in needs. What is the coefficient of correlation between population and needs?

[< Answer >](#)

- (a) 0.7416
- (b) 0.5250
- (c) 0.4500
- (d) - 0.4500
- (e) - 0.5500.

(1 mark)

22. From a battalion of 580 soldiers belonging to the same region, a sample of 28 soldiers is taken. From [this sample](#), the average weight of the luggage carried by them is found to be 23 kg and the variance is found to be 12.56 (kg²).

The mean weight of the luggage carried by them has to be constructed at 95 percent confidence interval. The lower and upper confidence limits of the confidence interval are

- (a) 24.16 kg and 37.84 kg respectively
- (b) 21.62 kg and 24.37 kg respectively
- (c) 22.68 kg and 25.32 kg respectively
- (d) 25.5 kg and 27.5 kg respectively
- (e) 21.54 kg and 24.2 kg respectively.

(2 marks)

23. What is the probability of getting exactly 2 heads in 3 tosses of a fair coin? [Answer](#)

- (a) 30.5%
- (b) 32.5%
- (c) 35.5%
- (d) 37.5%
- (e) 40.0%.

(1 mark)

24. The coefficients 'a' and 'b' of a simple regression line are 12 and 1.3 respectively. What will be the [estimated value](#) of the dependent variable if the independent variable is equal to 22?

- (a) 30.3
- (b) 25.3
- (c) 40.6
- (d) 35.6
- (e) 20.5.

(1 mark)

25. The Godrej Ltd. is looking to find out the annual turnover of its 1,350 branches. How large a sample it [should take](#) in order to determine the mean annual turnover within $\pm$ Rs.1,800 lakhs at 95% confidence level?

You may assume that the annual turnover of Godrej Ltd. follow normal distribution with a standard deviation of Rs.4,499 lakhs.

- (a) 44
- (b) 24
- (c) 45
- (d) 36
- (e) 54.

(2 marks)

26. Which of the following is **not true** regarding the chi-square test? [Answer](#)

- (a) It is used as a test of significance for the difference between means of two or more populations
- (b) It is used to test the deviations between observed and theoretical frequencies
- (c) It is used to test whether there is any association between two attributes or not
- (d) It is used to test the goodness of fit
- (e) It is used to test the population variance.

(1 mark)

27. When a decision maker makes decision under conditions of risk

[< Answer >](#)

- (a) He cannot define all possible decision alternatives
- (b) He cannot quantitatively estimate the consequences of selecting any decision alternative
- (c) He cannot define the various states of nature that may occur
- (d) He can assign probabilities of occurrence to all the possible states of nature
- (e) He uses the regret criterion to make decision.

(1 mark)

28. Consider the following probability distribution of a variable **X**

[< Answer >](#)

X	5	10	15	20	25	30	35
p	0.1	0.05	0.05	0.1	0.3	0.2	0.2

In a Monte Carlo simulation process the number 58 was generated in a particular run from a uniform distribution of 0 – 99. The value of **X** in this run will be

- (a) 35
- (b) 20
- (c) 25
- (d) 15
- (e) 30.

(1 mark)

29. The price of commodities **A**, **B** and **C** per unit is Rs.55, Rs.82 and Rs.67 respectively in the year 2006. The unweighted aggregates price index for the year 2006 was 176 and the base year is 2004. The prices per unit of commodities **A** and **B** were Rs.58 and Rs.46 respectively in the year 2004. What was the price per unit of commodity **C** in the year 2004?

[< Answer >](#)

- (a) Rs.40.43
- (b) Rs.15.84
- (c) Rs.11.90
- (d) Rs.25.39
- (e) Rs.30.47.

(2 marks)

30. In the national wide sports championship finals three teams of different states **H.P**, **M.P** and **A.P** participated. The probability that the audience support **H.P** is 0.20, the probability that they support **M.P** is 0.30 and the probability that they support **A.P** is 0.50. It is assumed that these probabilities are accurate and that the selected teams have independent chance of winning towards the other teams.

[< Answer >](#)

What is the probability that out of a randomly chosen group of 12 persons from audience, less than 10 persons do not support the team from **M.P**?

- (a) 0.7472
- (b) 0.6268
- (c) 0.8545
- (d) 0.5922
- (e) 0.9723.

(2 marks)

31. In hypothesis testing, if the level of significance is made smaller, the rejection region

[< Answer >](#)

- (a) Becomes larger
- (b) Becomes smaller
- (c) Remains the same
- (d) Becomes equal to the acceptance region
- (e) Becomes larger than the acceptance region.

(1 mark)

32. Which of the following statements is **true**?

[< Answer >](#)

- (a) The mean of the sampling distribution of mean is greater than the population mean
- (b) The sampling distribution of mean approaches normality as the sample size decreases
- (c) As the standard error of mean increases, the value of any sample mean will be closer to the value of the population mean
- (d) As the standard error of mean decreases, the precision of the sample mean as an estimator of the population mean increases
- (e) The variance of the sampling distribution of mean is greater than the population variance.

(1 mark)

33. Which of the following statements is **not true**?

[< Answer >](#)

- (a) An unweighted aggregates price index does not attach any importance to the consumption or usage levels of the items covered
- (b) Laspeyres price index is an unweighted aggregates price index
- (c) Paasches price index is a weighted aggregates price index
- (d) A price index reflects the overall change in price for the basket of goods considered
- (e) Relatives are the ratios of the values for the current period over that of the base period.

(1 mark)

34. In testing the significance of individual regression coefficients, which of the following is/are **true**?

[< Answer >](#)

- I. The test statistic is the **t**-statistic.
 - II. The independent variables are tested individually.
 - III. The independent variables for which the null hypothesis is not rejected do not have a significant relationship with the dependent variable.
- (a) Only (I) above
 - (b) Only (II) above
 - (c) Both (I) and (II) above
 - (d) Both (II) and (III) above
 - (e) All (I), (II) and (III) above.

(1 mark)

35. The sample of size 35 is collected from a population of size 130, then the finite population correction factor to be used for calculation of standard error is equal to

[< Answer >](#)

- (a) 0.4452
- (b) 0.3784
- (c) 0.6364
- (d) 0.7382
- (e) 0.8581.

(1 mark)

36. When we consider sampling distributions, if the population is normally distributed, then the distribution of the sample means

[< Answer >](#)

- (a) Will be approximately normally distributed
- (b) Will be exactly normally distributed
- (c) Will have a discrete distribution
- (d) Will be binomially distributed
- (e) Will be exactly distributed as the standard normal distribution.

(1 mark)

37. Which of the following is the appropriate test statistic to use when comparing two population means by [< Answer >](#) using large independent random samples selected from populations with equal and known variances?

- (a) **t**-statistic
- (b) **z**-statistic
- (c) **F**-statistic
- (d) Chi-square statistic
- (e) Mean of the two sample means.

(1 mark)

38. For a sample randomly collected from a population, the following details are available: [< Answer >](#)

Sum of the squares of the observations = 3274

Sample mean = 17

Number of observations = 11

What is the estimated standard error of mean?

- (a) 0.4251
- (b) 0.2517
- (c) 0.5452
- (d) 0.9293
- (e) 0.6742.

(1 mark)

39. If the variable **X** resembles same as variable **Y**, then the covariance between the two variables reduces [< Answer >](#) to:

- (a) The covariance of either variables
- (b) The correlation of either variables
- (c) The standard deviation of either variables
- (d) The variance of either variables
- (e) The expected value of either variables.

(1 mark)

40. A **t**-statistic calculated on the basis of a sample of a specific size, has a **t**-distribution with number of [< Answer >](#) degrees of freedom equal to

- (a) The sample size
- (b) One less than the sample size
- (c) One more than the sample size
- (d) Twice the sample size
- (e) Half the sample size.

(1 mark)

41. Which of the following distributions can represent the experiments or processes in which each trial has [< Answer >](#) only two possible outcomes, the probability of the outcome of any trial remains fixed over time and the trials are statistically independent?

- (a) **t**-distribution
- (b) Normal distribution
- (c) **F**-distribution
- (d) Chi-square distribution
- (e) Binomial distribution.

(1 mark)

42. Which of the following statements is **true** with regard to index numbers?

[< Answer >](#)

- (a) The fixed weight aggregates price index does not allow the flexibility to select the base period for comparison of prices
- (b) Paasches price index tends to underestimate the rise in prices
- (c) Unweighted aggregates price index numbers link the price changes to the usage or consumption levels
- (d) Laspeyres price index has a downward bias
- (e) The weighted average of relatives price index uses base year prices as weights.

(1 mark)

43. Which of the following statements is/are **not true** with respect to time series analysis?

[< Answer >](#)

- I. Time-series analysis is used to detect patterns of change in statistical information over regular intervals of time.
 - II. Secular trends represent the long-term direction of a time series.
 - III. Of the four types of variation, cyclical variation is the most difficult to predict.
- (a) Only (I) above
 - (b) Only (II) above
 - (c) Only (III) above
 - (d) Both (I) and (II) above
 - (e) Both (II) and (III) above.

(1 mark)

44. The unweighted aggregates quantity index for a basket of commodities is 68. The average quantity consumed during the base year is 125 units.

[< Answer >](#)

What is the average quantity consumed during the current year?

- (a) 68 units
- (b) 85 units
- (c) 100 units
- (d) 125 units
- (e) 150 units.

(2 marks)

45. Which of the following is **not** a characteristic of the normal distribution?

[< Answer >](#)

- (a) The normal distribution is unimodal
- (b) The mean of the normal distribution lies at the center of the normal distribution curve
- (c) The normal distribution is a symmetrical distribution
- (d) The two tails of the normal distribution curve intersect the horizontal axis
- (e) The mean of the normal distribution is equal to its mode.

(1 mark)

46. A whole sale distributor has sold 26,300 rice bags during the year 2005-06. According to the secular trend equation, the estimated number for the year is 37,000. The cyclical variation for the year measured by the relative cyclical residual technique is

[< Answer >](#)

- (a) - 0.289
- (b) 0.940
- (c) 6.250
- (d) - 6.670
- (e) 1.67.

(1 mark)

47. When the population is **not** normally distributed, population variance is unknown and the sample size is [< Answer >](#) 50, the confidence interval for the population mean is based on

- (a) The **t**-distribution with an unknown number of degrees of freedom
- (b) The **t**-distribution with 30 degrees of freedom
- (c) The **F**-distribution
- (d) The standard normal distribution
- (e) The binomial distribution.

(1 mark)

48. The samples drawn from the two populations are independent. Calculate the standard error of difference [< Answer >](#) between means from the data given with regard to the hypothesis test?

$$H_0: \mu_1 - \mu_2 = 0$$

$$H_1: \mu_1 - \mu_2 \neq 0$$

$$n_1 = 16 \quad \sum x_1 = 124$$

$$n_2 = 24 \quad \sum x_2 = 100$$

The value of the test statistic is 0.425.

- (a) 4.856
- (b) 3.323
- (c) 5.234
- (d) 8.423
- (e) 9.560.

(2 marks)

49. If for a sample of size 36, the standard error of mean is 4, then the population variance will be: [< Answer >](#)

- (a) 289
- (b) 24
- (c) 36
- (d) 576
- (e) 9.

(1 mark)

50. The following information was obtained from the manager of a city water department for predicting the [< Answer >](#) consumption of water (in gallons) from the size of household:

Household size = **X**

Water consumption = **Y**

$$\sum X = 57 \quad \sum Y = 10,038 \quad n = 10$$

$$\sum X^2 = 433 \quad \sum Y^2 = 11,641,474 \quad \sum XY = 67,669.$$

The equation of the least squares regression for water consumption on household size is given by:

- (a) $\hat{Y} = 97053.7 + 96.692X$
- (b) $\hat{Y} = 999.220 + 0.803X$
- (c) $\hat{Y} = -1.0028 + 0.0067X$
- (d) $\hat{Y} = 452.656 + 96.692X$
- (e) $\hat{Y} = 1003.8 - 96.692 \bar{X}.$

(2 marks)

51. Consider the following information:

[< Answer >](#)

Spices	P ₀	P ₁
A	5.6	8.5
B	4.5	5.6
C	8.7	9.7
D	6.2	7.8
E	6.4	7.8

The Unweighted average of relative price index is approximately:

- (a) 110
- (b) 105
- (c) 140
- (d) 127
- (e) 135.

(2 marks)

52. The property of efficiency with regard to an estimator relates to the

[< Answer >](#)

- (a) Sample size
- (b) Size of the standard error of the sample statistic
- (c) Size of the standard deviation of the sample
- (d) Size of the sample variance
- (e) Size of the sample mean.

(1 mark)

53. In Vimal Oil. Ltd., 20 persons are working in drilling section. Out of them, there are 11 men and 9 women. One-day 7 of them were injured. Find what is the probability that 4 of the injured persons are women?

[< Answer >](#)

- (a) 0.4682
- (b) 0.2312
- (c) 0.3257
- (d) 0.4372
- (e) 0.3178.

(1 mark)

54. The finite population correction factor for sample of size greater than one is,

[< Answer >](#)

- (a) Always equal to 1
- (b) Always less than 1
- (c) Always equal to 0
- (d) Always more than 1
- (e) Always constant irrespective of the sample size.

(1 mark)

55. If a hypothesis is tested at a significance level of 10% then it means that

[< Answer >](#)

- (a) There is a 10% probability that the null hypothesis will be rejected though it is true
- (b) There is a 10% probability that the null hypothesis will be false
- (c) There is a 10% probability that the null hypothesis will be true
- (d) There is a 90% probability that the alternative hypothesis will be false
- (e) There is a 90% probability that the alternative hypothesis will be true.

(1 mark)

56. Which of the following statements is **not true**?

[< Answer >](#)

- (a) The purpose of hypothesis testing is to make a judgment about the difference between the sample statistic and the hypothesized population parameter
- (b) When the null hypothesis is rejected the alternative hypothesis is accepted
- (c) The purpose of hypothesis testing is to test the correctness of the computed value of the sample statistic
- (d) The acceptance of the null hypothesis does not prove that the null hypothesis is true
- (e) The acceptance of the alternative hypothesis does not prove that the null hypothesis is false.

(1 mark)

57. From an old library record of an analysis of correlation data, the following results are given:

[< Answer >](#)

Regression equations: $5X - 3Y + 22 = 0$ and $25X - 16Y + 127 = 0$.

One of these two regression equations is for **X** on **Y** (with **Y** as the independent variable) and the other is for **Y** on **X** (with **X** as the independent variable).

Find the mean value of **Y**.

- (a) 10
- (b) 11
- (c) 18
- (d) 5
- (e) 17.

(1 mark)

58. There are 16 questions each with 5 multiple choices. What is the probability of answering exactly 7 questions correctly?

[< Answer >](#)

- (a) 0.43820
- (b) 0.06450
- (c) 0.02067
- (d) 0.01965
- (e) 0.08589.

(1 mark)

59. The number of constants to be estimated in a multiple regression model is equal to

[< Answer >](#)

- (a) The number of independent variables
- (b) The number of independent variables plus 1
- (c) The number of independent variables minus 1
- (d) The number of observations
- (e) The number of observations minus 1.

(1 mark)

60. In testing of hypothesis, the decision to use a single-tailed or two-tailed test depends upon

[< Answer >](#)

- (a) The size of the sample
- (b) The null hypothesis
- (c) The values of the sample statistic
- (d) The alternative hypothesis
- (e) Shape of the distribution.

(1 mark)

61. The mean weekly sale of soap bars in departmental stores was 146.3 bars per store. After an advertising campaign the mean weekly sales in 22 stores for a typical week increased to 153.7 and showed a standard deviation of 17.2. What is your conclusion about the advertising campaign? [< Answer >](#)

- (a) The advertising campaign is not successful
- (b) The advertising campaign is successful
- (c) The test results in type I error
- (d) The test results in type II error
- (e) Cannot be determined from the given values.

(2 marks)

62. The linear trend estimating equation for a time series is given below: [< Answer >](#)

$$\hat{Y} = 152 + 5.6X$$

Where $X = \text{Year} - 2004$

$\hat{Y}$ is the estimated value of the dependent variable Y .

The observed value of Y for the year 2006 is 176.

What is the relative cyclical residual for the year 2006?

- (a) 3.912
- (b) 9.832
- (c) 7.843
- (d) 9.250
- (e) 10.90.

(1 mark)

63. The following table gives the probability distribution of a daily demand of a product. [< Answer >](#)

Demand ('000 units)	4	2	4
Probability	18%	58%	24%

The opening inventory was 2850 units and the daily demand is to be estimated. If in a run the random number generated was 72, then what is the closing inventory?

- (a) 700
- (b) 750
- (c) 800
- (d) 850
- (e) 555.

(1 mark)

64. The price of an item in the year 2001 (base year) was Rs.16 per unit and its price in the year 2006 was Rs.20 per unit. What is the price relative for the item for the year 2006? [< Answer >](#)

- (a) 120
- (b) 104
- (c) 136
- (d) 125
- (e) 320.

(1 mark)

65. A sports magazine conducted a survey among the spectators of major cricket tournament and found that for any randomly selected person the probability that he supports group **A** is 0.50, the probability that he supports group **B** is 0.30 and the probability that he supports group **C** is 0.20. It is assumed that these probabilities are accurate. [< Answer >](#)

What is the probability that out of a randomly chosen group of eight persons at least six do not support group **B**?

- (a) 0.238
- (b) 0.325
- (c) 0.448
- (d) 0.552
- (e) 0.905.

(2 marks)

66. For generating an $\bar{X}$ chart 20 samples are taken. The sum of all the observations is 360 and the value to be used for the centre line is 1.8. Then the size of each sample is [< Answer >](#)

- (a) 5
- (b) 10
- (c) 18
- (d) 20
- (e) 36.

(2 marks)

67. The area under the standard normal curve between the points 0 and 1.63 is 0.4484. And the area between the points -1.63 and 1.63 is given by: [< Answer >](#)

- (a) 0.4484
- (b) 0.9968
- (c) 0.9972
- (d) 0.8968
- (e) 0.8868.

(1 mark)

68. One of the leading liquor companies holds the information regarding the time series analysis of an actual profit of the year 2005 as Rs.256.75 lakhs and relative cyclical residual measure as -3.56% . Then what can be the estimated profit of the company in the year 2006? [< Answer >](#)

- (a) Rs.275.69 lakhs
- (b) Rs.247.60 lakhs
- (c) Rs.266.22 lakhs
- (d) Rs.265.89 lakhs
- (e) Rs.914.03 lakhs.

(2 marks)

69. For a basket of commodities the price of each commodity in a year **X** is thrice the price in the base year. What is the Marshall Edgeworth price index for year **X**? [< Answer >](#)

- (a) 50
- (b) 100
- (c) 300
- (d) 250
- (e) 150.

(1 mark)

70. The simple correlation coefficients between temperature (X_1), yield (X_2) and rainfall (X_3) are r_{12} (Between X_1 and X_2) = 0.42, r_{13} (Between X_1 and X_3) = 0.37 and r_{23} (Between X_2 and X_3) = 0.76. [< Answer >](#)

Calculate the multiple correlation coefficient $R_{1.23}$ for the three variables.

- (a) 0.4562
- (b) 0.5678
- (c) 0.4272
- (d) 0.5231
- (e) 0.3256.

(1 mark)

71. Which of the following components of time series can be separated using the percent of trend measure? [< Answer >](#)

- (a) Irregular variation
- (b) Secular trend
- (c) Seasonal variation
- (d) Cyclical variation
- (e) Both seasonal and irregular variations.

(1 mark)

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

$$n_1 = 49$$

$$n_2 = 81 \quad \sigma_1^2 = 286$$

The standard error of difference between means is $\sqrt{9.5}$.

The samples collected from the two populations are independent.

What is the standard deviation of the second population?

- (a) 23.4
- (b) 16.4
- (c) 15.6
- (d) 17.2
- (e) 14.8.

(2 marks)

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

(1 mark)

74. For the regression relationship the ratio of regression sum of squares to error sum of squares is 5 : 2. [< Answer >](#)
The total sum of squares is 730. What is the regression sum of squares?

- (a) 452.50
- (b) 386.24
- (c) 544.30
- (d) 480.71
- (e) 521.22.

(1 mark)

75. When the chi-square test is used as a test of independence, the number of degrees of freedom is determined by

[< Answer >](#)

- (a) The sample size
- (b) The ratio of sample size and the population
- (c) Number of rows in the contingency table, only
- (d) Number of columns in the contingency table, only
- (e) Both the number of rows and the number of columns in the contingency table.

(1 mark)

76. A normally distributed population has a known standard deviation of 1.0. What is the width of a 95% confidence interval for the population mean?

[< Answer >](#)

- (a) 1.00
- (b) 1.96
- (c) 0.98
- (d) 3.92
- (e) Cannot be determined from the given information.

(1 mark)

77. The central limit theorem claims that the sampling distribution of the mean

[< Answer >](#)

- (a) Is always normal
- (b) Is always normal only for small sample sizes
- (c) Approaches normality as sample size increases
- (d) Is a **t**-distribution if sample size is less than 30
- (e) Approaches normality if sample size is less than 30.

(1 mark)

78. Which of the following is an underlying assumption in ANOVA?

[< Answer >](#)

- (a) The populations follow unknown distributions
- (b) The sample means are equal
- (c) The samples are dependent on each other
- (d) The population variances are equal
- (e) The population variances are not equal.

(1 mark)

Suggested Answers

Quantitative Methods-II (132): January 2007

1. 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.

2. Answer : (a) [< TOP >](#)
Reason : Probability of success $p = 1/2$.
Then $q = 1 - p = 1/2$.
To find the value of n , put the values of p and q in variance.
i.e. variance = npq
$$\sqrt{5.07} = n \times \frac{1}{2} \times \frac{1}{2}$$
$$\therefore n = 9.006 \approx 9$$
$$p(r = 3) = {}^9C_3 \left(\frac{1}{2}\right)^3 \left(\frac{1}{2}\right)^6 = 0.1640$$

3. Answer : (e) [< TOP >](#)
Reason : Laspeyres Quantity Index for the given data is $\frac{\sum Q_1 \cdot P_0}{\sum Q_0 \cdot P_0} \times 100$
i.e., $\frac{450 \times 10 + 60 \times 8 + 120 \times 5 + 80 \times 25}{320 \times 10 + 70 \times 8 + 200 \times 5 + 110 \times 25} \times 100 = \frac{7580}{7520} \times 100 = 100.93$.

4. Answer : (c) [< TOP >](#)
Reason : Here $n = 350$,
Proportion of people getting selected is $p = 65 / 350 = 0.1857$.
Hence $q = 1 - p = 1 - 0.1857 = 0.8143$.
Now standard error of proportion = $\sqrt{\frac{pq}{n}}$
$$= \sqrt{\frac{0.1857 \times 0.8143}{350}}$$
$$= 0.021$$

The z value for the 95% confidence level is 1.96 from table.
The upper confidence limit for the estimate of the population proportion is
 $= \bar{p} + z\sigma_{\bar{p}} = 0.1857 + 1.96 \times 0.021 = 0.2268$.
The upper confidence limit for the estimate of population proportion is 0.2268.

5. Answer : (c) [< TOP >](#)
Reason : In marginal analysis minimum required probability of selling an additional unit decreases if Marginal Profit increases.

6. Answer : (c) [< TOP >](#)
Reason : A composite price index where the prices of the items in the composite are weighted by their relative importance is known as the weighted aggregate price index.

7. 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.

8. Answer : (c)

[<TOP>](#)

Reason : Pooled estimate of the underlying common population variance =

$$\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2} = \frac{(24 - 1)16^2 + (14 - 1)s_2^2}{24 + 14 - 2} = 180.5$$

$$\text{or } \frac{23 \times 256 + 13s_2^2}{36} = 180.5$$

$$\text{or } 13s_2^2 = 180.5 \times 36 - 5888$$

$$\text{or } s_2^2 = \frac{610}{13} \approx 47.$$

9. Answer : (a)

[<TOP>](#)

Reason : The central line of for the **R** chart = Mean of the sample range ($\bar{R}$)

$$\bar{R} = \sum R / n = 67 / 8 = 8.375$$

$$\text{The value of the lower control limit for the R chart} = \bar{R} D_3$$

$$= 8.375 \times 0.136 = 1.14.$$

10. Answer : (b)

[<TOP>](#)

Reason : The null hypothesis is that the coins are unbiased. The alternative hypothesis would be that the coins are biased.

If the coins are unbiased, then the distribution of heads will follow binomial distribution.

11. Answer : (a)

[<TOP>](#)

Reason : If the experiment is repeated 'n' times the probability of the event occurring every time is $p \times p \times p \dots n \text{ terms} = p^n$

12. Answer : (d)

[<TOP>](#)

Reason : Here we set up the null hypothesis, H_0 that the number of products demanded does not depend on the months of the year.

Under the null hypothesis, the expected frequencies of the products demanded on each of the six months would be:

$$\frac{1}{6} (1132 + 1170 + 1114 + 1120 + 1120 + 1112) = \frac{6768}{6} = 1128$$

This is a chi-square test of independence and the contingency table is given as:

Months	Frequency		$(f_i - e_i)^2$	$\frac{(f_i - e_i)^2}{e_i}$
	Observed (f_i)	Expected (e_i)		

Jan	1132	1128	16	0.0141
March	1170	1128	1764	1.563
May	1114	1128	196	0.1737
July	1120	1128	64	0.0567
Sep	1120	1128	64	0.0567
Nov	1112	1128	256	0.2269
Total	6768	6768		2.0911

Then the value of chi-square statistic is given by:

$$\chi^2 = \sum \frac{(f_i - e_i)^2}{e_i} = 2.0911$$

i.e.

13. Answer : (c)

[<TOP>](#)

Reason : Total number of defectives out of 8480 items in 16 samples is:

$$325 + 431 + 365 + \dots + 284 + 231 = 5309$$

$$\bar{p} = \frac{5309}{8480} = 0.6260$$

Therefore the central line is set at 0.6260.

14. Answer : (a)

[<TOP>](#)

$$\text{Reason : Paasches price index} = \frac{\sum P_1 Q_1}{\sum P_0 Q_1} \times 100 = \left[\frac{\frac{\sum P_1 Q_1}{\sum Q_1}}{\frac{\sum P_0 Q_1}{\sum Q_1}} \right] \times 100$$

$$= \frac{\text{WAV}(\text{current})}{\text{WAV}(\text{base})} \times 100 = \frac{11}{9} \times 100 = 122.22.$$

15. Answer : (c)

[<TOP>](#)

Reason : To get the regression constants we tabulate the given data as below:

No. of employees (X)	Daily Output(Y)	X ²	XY
2	6	4	12
3	8	9	24
4	9	16	36
5	10	25	50
6	4	36	24
7	7	49	49
8	11	64	88
9	12	81	108
Total = 44	67	284	391

$$\text{The coefficient } b = \frac{n \sum XY - (\sum X)(\sum Y)}{n \sum X^2 - (\sum X)^2}$$

$$= \frac{8 \times 391 - 44 \times 67}{8 \times 284 - 44^2} = \frac{180}{336} = 0.5357$$

$$\text{The coefficient } a = \bar{Y} - b\bar{X} = 8.375 - 0.5357 \times 5.5 = 5.428.$$

16. Answer : (b)

[<TOP>](#)

Reason : Actual data = (Seasonal index × Deseasonalized value)/100

$$= (125 \times 105)/100 = 131.25.$$

17. Answer : (a)

[<TOP>](#)

Reason : Interval estimates can be used for both small and large populations. All other options are correct.

18. Answer : (d)

[<TOP>](#)

Reason : (a) This is a wrong answer. The standard error of the estimate of a regression line is not the slope of the regression line.
(b) This is a wrong answer. The standard error of the estimate of a regression line is not The square root of the coefficient of determination.
(c) This is a wrong answer. The standard error of the estimate of a regression line is not the Y intercept of the regression line.
(d) This is the **right** answer. The standard error of the estimate of a regression line is the measure of the variability of the observed values around the regression line.
(e) This is a wrong answer. The standard error of the estimate of a regression line is not the coefficient of correlation between two variables.

19. Answer : (c)

[<TOP>](#)

Reason : Fisher's Ideal Index is the geometric mean of Laspeyres Index and Paasche's Index.

$$\text{So, } 135.40 = \sqrt{102.65 \times \text{laspyeres}} = (\text{approx.})$$

$$18333.16 = 102.65 \times \text{Laspyeres P.I}$$

$$\text{Laspyeres P.I} = 178.598$$

20. Answer : (c)

[<TOP>](#)

Reason : The Means of the samples are $\bar{x}_1 = 6$, $\bar{x}_2 = 8.75$, $\bar{x}_3 = 7.5$.

The grand mean, $\bar{\bar{x}} = [(8 + 4 + 6 + 6) + (12 + 10 + 9 + 4) + (11 + 8 + 4 + 7)] / 12 = 7.42$.

We calculate Within column variance as below:

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

$$s_1^2 = \frac{(8-6)^2 + (4-6)^2 + (6-6)^2 + (6-6)^2}{4-1}$$
$$= 2.666$$

$$s_2^2 = \frac{(12-8.75)^2 + (10-8.75)^2 + (9-8.75)^2 + (4-8.75)^2}{4-1}$$
$$= 11.58.$$

$$s_3^2 = \frac{(11-7.5)^2 + (8-7.5)^2 + (4-7.5)^2 + (7-7.5)^2}{4-1}$$
$$= 8.333.$$

$$\text{So, } \hat{\sigma}^2 = \left(\frac{4-1}{12-3} \right) \times (2.666 + 11.58 + 8.333) = 7.526.$$

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

21. Answer : (a)

[<TOP>](#)

Reason :

$$\begin{aligned}\text{Coefficient of correlation} &= + \sqrt{\text{Coefficient of determination}} \\ &= + \sqrt{1 - \text{Proportion of unexplained variations}} \\ &= \sqrt{1 - 0.45} \\ &= 0.7416\end{aligned}$$

(Positive square root because population increases as needs increases and vice versa)

22. Answer : (b)

[<TOP>](#)

Reason : $\bar{X} = 23$

$$s^2 (\text{Variance}) = 12.56$$

$$n = 28 \quad N = 580$$

$$\text{Sampling fraction, } \frac{n}{N} = \frac{28}{580} = 0.0482 < 0.05$$

$$\therefore \text{Estimated standard error of mean, } \hat{\sigma}_{\bar{x}} = \frac{s}{\sqrt{n}} = \frac{\sqrt{12.56}}{\sqrt{28}} = 0.67$$

Since the sample size is less than 30 and population variance is not known the t distribution will be used with 28 degrees of freedom.

t-values for the upper and lower confidence limits are ± 2.048

$$\therefore \text{Upper confidence limit} = \bar{X} + 2.048 \hat{\sigma}_{\bar{x}} = 23 + 2.048 \times 0.67 = 24.37 \text{ kg.}$$

$$\text{Lower confidence limit} = \bar{X} - 2.048 \hat{\sigma}_{\bar{x}} = 23 - 2.048 \times 0.67 = 21.62 \text{ kg.}$$

23. Answer : (d)

[<TOP>](#)

Reason : The binomial distribution formula has to be used.

$$n = 3, r = 2, p = 0.5, q = 0.5$$

$$\therefore P(2) = {}^n C_r p^r q^{n-r} = {}^3 C_2 (0.5)^2 (0.5)^{3-2} = (3) (0.5)^3 = 0.375 \text{ i.e. } 37.5\%$$

24. Answer : (c)

[<TOP>](#)

Reason : $\hat{y} = a + bx$

$$\text{Given: } a = 12 \text{ and } b = 1.3$$

$$\therefore \hat{y} = 12 + 1.3x$$

$$\text{For } x = 22, \hat{y} = 12 + 1.3(22) = 40.6.$$

25. Answer : (b)

[<TOP>](#)

Reason : We are required to find the sample size so that the mean annual earnings of the godrej companies should fall within $\pm$ Rs.lac 1800 at a confidence level of 95%.

The Z-value for 95% level of confidence is 1.96.

$$1.96 \sigma_{\bar{x}} = \text{Rs.lac } 1800$$

$$\sigma_{\bar{x}} = \text{Rs.lac } 1800 / 1.96$$

$$= \text{Rs.lac } 918.36$$

the standard error $\sigma_{\bar{x}}$ is also given by the following formula

$$\sigma_{\bar{x}} = \sigma / \sqrt{n}$$

$$918.36 = 4499 / \sqrt{n}$$

$$\sqrt{n} = 4499 / 918.36 = n = 23.99 \text{ or } 24$$

Thus sample may contain 24 godrej ltd companies at random.

26. Answer : (a)

[<TOP>](#)

Reason : Chi square test is used to :

Test the deviations between observed and theoretical values, Can be used to test whether there is any association or relationship between two or more attributes or not. It can be used to test the goodness of fit and as a test of population variance. But it can not be used for a test of significance for difference between means of two or more populations.

27. Answer : (d)

[<TOP>](#)

Reason : The regret criterion is used to make decision under conditions of uncertainty, not risk. Under conditions of risk, a decision maker can define all the possible alternatives, he knows the various states of nature that may occur, he can quantitatively estimate the consequences of selecting any alternative and he has sufficient knowledge to assign probabilities of occurrence to all the possible outcomes.

Hence (a), (b), (c) and (e) are incorrect.

28. Answer : (c)

[<TOP>](#)

Reason :

X	Probability	Cumulative Probability	Random numbers allotted
5	0.10	0.10	00 - 09
10	0.05	0.15	10 - 14
15	0.05	0.20	15 - 19
20	0.10	0.30	20 - 29
25	0.30	0.60	30 - 59
30	0.20	0.80	60 - 79
35	0.20	1.00	80 - 99

Since the random number generated was 58(which lies in between 30 - 59), the value of X in this run is 25.

29. Answer : (c)

[<TOP>](#)

Reason : Unweighted aggregates price index = $\frac{\sum P_1}{\sum P_0} \times 100$

$$\text{Or } 176 = \frac{(55 + 82 + 67)}{(58 + 46 + c)} \times 100$$

$$\text{Or } 204 \times 100 = 176 (58 + 46 + c)$$

$$\text{Or } 20400 = 18304 + 176c$$

$$\text{Or } C = \frac{20400 - 18304}{176} = \text{Rs. } 11.90.$$

30. Answer : (a) [<TOP>](#)
Reason : The probability that a randomly selected person supports M.P is 0.30. Then the probability that he/she does not support M.P is $1 - 0.30 = 0.70$
 $\therefore$ The event that a randomly selected person does not support M.P, follows a binomial distribution with probability of success = 0.70.
The probability that less than 10 out of 12 persons do not support M.P.
 $= 1 - P(\text{At least 10 persons do not support M.P})$
 $= 1 - [P(10) + P(11) + P(12)]$
 $= 1 - \left[{}^{12}C_{10} (0.70)^{10} (1-0.70)^2 + {}^{12}C_{11} (0.70)^{11} (1-0.70) + {}^{12}C_{12} (0.70)^{12} (1-0.70)^0 \right]$
 $= 1 - [0.1678 + 0.0712 + 0.0138]$
 $= 0.7472.$
31. Answer : (b) [<TOP>](#)
Reason : In hypothesis testing, if the level of significance is made smaller, the rejection region becomes smaller.
32. Answer : (d) [<TOP>](#)
Reason : As the standard error of mean decreases, the precision of the sample mean as an estimator of the population mean increases.
Other statements are false.
33. Answer : (b) [<TOP>](#)
Reason : Laspeyres price index is a weighted aggregates price index. Alternatives (a), (c), (d) and (e) are true.
34. Answer : (e) [<TOP>](#)
Reason : In testing the significance of individual regression coefficients the test statistic is the t distribution, we test the independent variables individually and we usually delete the variables where the null hypothesis is not rejected.
35. Answer : (e) [<TOP>](#)
Reason : When the sample size and population size are given the standard error can be found by the formula

$$\sqrt{(N-n)/(N-1)} = \sqrt{(95)/(129)} = 0.8581.$$
36. Answer : (b) [<TOP>](#)
Reason : When we consider sampling distributions, if the sampling population is normally distributed, then the distribution of the sample means will be exactly normally distributed.
37. Answer : (b) [<TOP>](#)
Reason : When comparing two population means by using large independent random samples selected from populations with equal and known variances the appropriate test statistic to use is the z statistic.
38. Answer : (d) [<TOP>](#)
Reason :
$$s = \sqrt{\frac{\sum x^2}{n-1} - \frac{n\bar{x}^2}{n-1}} = \sqrt{\frac{3274}{10} - \frac{11 \times 17^2}{10}} = 3.082$$

$$\text{Estimated standard error of mean} = \frac{s}{\sqrt{n}} = \frac{3.082}{\sqrt{11}} = 0.9293$$
39. Answer : (d) [<TOP>](#)
Reason : When the variables X and Y are same that implies the covariance between the variables reduces to the variance of either variables.
40. Answer : (b) [<TOP>](#)

Reason : A t-statistic calculated on the basis of a sample of a specific size has a t distribution with degrees of freedom equal to one less than the sample size.

41. Answer : (e)

[< TOP >](#)

Reason : (a), (b), (c) and (d) are distributions which are not appropriate for representing experiments which have the characteristics stated in the question. Binomial distribution represents such an experiment.

Hence the answer is (e).

42. Answer : (b)

[< TOP >](#)

Reason : The fixed weight aggregates price index allows the flexibility to select the base period for comparison of prices, because it uses the weights from a representative period.

Paasche's price index tends to underestimate the rise in prices.

Unweighted aggregates price index numbers do not link the price changes to the consumption levels.

Laspeyres price index has an upward bias.

The weighted average of relatives use the values (and not prices) as weights.

43. Answer : (c)

[< TOP >](#)

Reason : Time-series analysis is used to detect patterns of change in statistical information over regular intervals of time.

Secular trends represent the long-term direction of a time series. Of the four types of variation, irregular variation, not cyclical is the most difficult to predict. Hence, Statement III is false. Alternative (c) is the answer.

44. Answer : (b)

[< TOP >](#)

Reason : Unweighted aggregates quantity index
$$= \frac{\sum Q_1}{\sum Q_0} \times 100$$

$$= \frac{(\sum Q_1/n)}{(\sum Q_0/n)} \times 100$$

$$\text{or } 68 = \frac{(\sum Q_1/n)}{125} \times 100$$

$$\text{or } \frac{\sum Q_1}{n} = \frac{68 \times 125}{100} = 85 \text{ units}$$

(Where 'n' is the no. of commodities in the basket).

45. Answer : (d)

[< TOP >](#)

Reason : The tails of a normal distribution extend indefinitely and do not intersect the horizontal axis.

46. Answer : (a)

[< TOP >](#)

Reason : The required cyclical variation for the given year by relative cyclical residual technique will be

$$= \left(\frac{y}{\hat{y}} - 1 \right) \times 100 = \frac{26,300 - 37000}{37000} \times 100 = -0.289.$$

47. Answer : (d)

[< TOP >](#)

Reason : By virtue of the Central Limit Theorem when the population is not normally distributed, population variance is unknown and the sample size is 50, the confidence interval for the population mean is based on the standard normal distribution.

48. Answer : (d)

[< TOP >](#)

Reason :

$$\text{Value of the test statistic} = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sigma_{\bar{x}_1 - \bar{x}_2}} = \frac{\left(\frac{124}{16} - \frac{100}{24}\right) - 0}{\sigma_{\bar{x}_1 - \bar{x}_2}} = \frac{3.58}{\sigma_{\bar{x}_1 - \bar{x}_2}} = 0.425$$

$$\text{or } \sigma_{\bar{x}_1 - \bar{x}_2} = \frac{3.58}{0.425} = 8.423$$

49. Answer : (d)

[<TOP>](#)

Reason : Standard error of mean = 4

$$n = 36$$

$$\sigma_{\bar{X}} = \frac{\sigma}{\sqrt{n}} \quad \text{i.e. } \sigma_{\bar{X}} \sqrt{n} = \sigma$$

$$\sigma = 4 \times 6 = 24$$

$$= 576.$$

50. Answer : (d)

[<TOP>](#)

$$\text{Reason : Slope, } b = \frac{\Sigma XY - \frac{1}{n}(\Sigma X)(\Sigma Y)}{\Sigma X^2 - \frac{1}{n}(\Sigma X)^2} = \frac{67669 - \frac{1}{10} \times 57 \times 10038}{433 - \frac{1}{10} \times 57^2} = \frac{10452.4}{108.1}$$

$$= 96.692$$

$$\text{Intercept, } a = \bar{Y} - b\bar{X} = \left(\frac{10038}{10}\right) - \left(96.692 \times \frac{57}{10}\right) = 452.656$$

$$\text{Equation} = \hat{Y} = 452.656 + 96.692X.$$

51. Answer : (d)

[<TOP>](#)

Reason : Unweighted average of relatives price index

$$\frac{\Sigma \left[\left(\frac{P_1}{P_0} \times 100 \right) \right]}{n}$$

Spices	$\frac{P_1}{P_0} \times 100$
A	151.8
B	124.4
C	111.5
D	125.8
E	121.8
	$\Sigma = 635.3$

$$\Sigma \left[\frac{P_1}{P_0} (\times 100) \right] = 635.3$$

$$\therefore \text{Unweighted average of relatives price index for year is } = \frac{635.3}{5} = 127. \text{ (approx)}$$

52. Answer : (b)

[<TOP>](#)

Reason : The property of efficiency with regard to an estimator refers to the size of the standard error.

53. Answer : (a)

[<TOP>](#)

Reason : The number of injured persons who are women follows hypergeometric distribution.

Given details are:

N = no. of persons working at Vimal Oil Ltd. = 20

r = no. of women candidates are = 9

x = desired success = 4

n = no. of injured persons = no. of trials = 7

$$P(x = 4) = \frac{{}^r C_x \cdot {}^{(N-r)} C_{(n-x)}}{{}^N C_n} = \frac{{}^9 C_4 \cdot {}^{(20-9)} C_{(7-4)}}{{}^{20} C_7} = \frac{220 \times {}^{11} C_3}{{}^{20} C_7} = 0.4682.$$

54. Answer : (b)

[< TOP >](#)

Reason : Finite population correction factor = $\sqrt{\frac{N-n}{N-1}}$
(N - n) < (N - 1)

∴ Finite population correction factor is always less than 1 for n > 1.

55. Answer : (a)

[< TOP >](#)

Reason : If a hypothesis is tested at a 10% significance level then, it means that there is a 10% probability that the null hypothesis will be rejected though it is true.

b, c, d & e are incorrect interpretations of the significance level

56. Answer : (c)

[< TOP >](#)

Reason : The purpose of hypothesis testing is not to test the correctness of the computed value of the test statistic. All other options are correct.

So the option (c) is not true in the purpose of hypothesis testing.

57. Answer : (e)

[< TOP >](#)

Reason : The mean value of the X series and Y series is the point of intersection of the two regression lines of X on Y and Y on X.

Therefore the points of intersection could be found by solving the two equations:

$$5X - 3Y + 22 = 0 \text{ and } 25X - 16Y + 127 = 0.$$

We get the values of $\bar{Y} = 17$ and $\bar{X} = 5.8$.

58. Answer : (d)

[< TOP >](#)

Reason : Let r = 7 and given n = 16.

The probability of answering a question correctly is taken as a success, then we have p = 0.20, q = 0.80, (i.e. each multiple choice has 0.2 probability of success).

Then applying the binomial distribution for r number of success out of n trials is:

$$P(r) = \binom{n}{r} p^r q^{n-r} = \binom{16}{7} (0.2)^7 (0.8)^9 = 0.01965$$

59. Answer : (b)

[< TOP >](#)

Reason : A multiple regression model is of the form:

$$Y = a + b_1 X_1 + b_2 X_2 + \dots + b_k X_k$$

The constants to be estimated are: a, b₁, b₂, ..., b_k.

∴ Number of constants to be estimated

= Number of independent variables (k) + 1.

60. Answer : (d)

[< TOP >](#)

Reason : In testing of hypothesis, the decision to use a single-tailed or two-tailed test depends upon the alternative

hypothesis.

61. Answer : (b)

[< TOP >](#)

Reason : We are given $n = 22$, $\bar{X} = 153.7$ and $s = 17.2$

Null hyp. The advertising campaign is not successful i.e.,

$$H_0: \mu = 146.3$$

Alternative hyp. $H_1: \mu > 146.3$ (right tail)

$$t = \frac{\bar{X} - \mu}{\sqrt{s^2 / (n - 1)}} \quad t_{22-1} = t_{21}$$

Test statistic under H_0 is:

$$t = \frac{153.7 - 146.3}{\sqrt{(17.2)^2 / 21}} = \frac{7.4 \times \sqrt{21}}{17.2} = 9.03$$

Tabulated value of t for 21 d.f at 5% level of significance for single tailed test is 1.72. since calculated value is much greater than the tabulated value, it is highly significant. Hence we reject the null hypothesis and conclude that the advertising campaign was successful in promoting sales.

62. Answer : (c)

[< TOP >](#)

Reason : Year = 2006

$$\therefore x = 2006 - 2004 = 2$$

$$\hat{Y} = 152 + (5.6 \times 2) = 163.2$$

$$\text{Relative cyclical residual} = \left(\frac{Y - \hat{Y}}{\hat{Y}} \right) \times 100$$

$Y = 176$

$$\therefore \text{Relative cyclical residual for the year 2006} = \left(\frac{176 - 163.2}{163.2} \right) \times 100 = 7.843.$$

63. Answer : (d)

[< TOP >](#)

Reason :

Daily demand('000)	Probability	Cumulative probability	Random numbers allocated
4	0.18	0.18	00-17
2	0.58	0.76	18-75
4	0.24	1.00	76-99

Since the random number generated was 72, which fall in between 18-75, the daily demand 2000.

So, the closing inventory = opening inventory – sales = 2850 – 2000 = 850.

64. Answer : (d)

[< TOP >](#)

Reason : The price relative for item A for 2006 is $\left(\frac{20}{16} \right) \times 100 = 125$. Hence from above discussion, we can infer that option (d) is correct.

65. Answer : (d)

[< TOP >](#)

Reason : The probability that a randomly selected person does not support Team B = $0.50 + 0.20 = 0.70 = p$.

Then the probability that he/she supports Team B is $1 - 0.70 = 0.30 = q$

Therefore we can assume that it follows a binomial distribution with probability of success (does not support Team B), $p = 0.70$ and probability of failure (supports Team B), $q = 0.30$.

The probability that at least six out of eight persons chosen does not support Team B is

$$\begin{aligned} P(6) + P(7) + P(8) &= {}^8C_6 \times (0.70)^6 \times (0.30)^2 + {}^8C_7 \times (0.70)^7 \times (0.30)^1 + {}^8C_8 \times (0.70)^8 \times (0.30)^0 \\ &= 0.2965 + 0.19765 + 0.057648 = 0.55179 \\ &= 0.552 \text{ (approx.)} \end{aligned}$$

66. Answer : (b)

[<TOP>](#)

Reason : Let the size of each sample be x .

The value to be used for the centre line is the grand mean. In this case the grand mean $(\bar{\bar{x}}) = 1.8$. Sum of all the observations = $\Sigma x = 360$ (given)

$$\text{Now, } \bar{\bar{x}} = \frac{\Sigma x}{n \times k}$$

Where,

n = Sample size = ?

k = number of samples = 20 (given)

$$\therefore n = \frac{\Sigma x}{\bar{\bar{x}} \cdot k}$$

$$\text{or } n = \frac{360}{20 \times 1.8} = 10$$

67. Answer : (d)

[<TOP>](#)

Reason : The area under the standard normal curve between the points 0 and 1.63 is 0.4484 and thus the area under the standard normal curve between the points -1.63 and 0 is also 0.4484, by symmetry. Hence the area under the standard normal curve between the points -1.63 to 1.63 is 0.8968.

68. Answer : (c)

[<TOP>](#)

Reason : Relative cyclical residual measure = -3.56 %

Actual profit of the year 2005 = Rs.256.75 lakhs

Percent of trend measure = 100 + Relative cyclical residual

$$= \frac{\text{Actual value}}{\text{Estimated value}} \times 100 = 100 + (-3.56) = 96.44$$

$$\begin{aligned} \therefore \text{Estimated profit} &= \text{Actual profit} \times \frac{100}{96.44} = 256.75 \times \frac{100}{96.44} \\ &= \text{Rs.266.22 lakhs.} \end{aligned}$$

69. Answer : (c)

[<TOP>](#)

Reason : $P_1 = 3P_0$

$$\text{Marshall Edgeworth price index} = \frac{\Sigma P_1 (Q_0 + Q_1)}{\Sigma P_0 (Q_0 + Q_1)} \times 100$$

$$= \frac{\Sigma 3P_0 (Q_0 + Q_1)}{\Sigma P_0 (Q_0 + Q_1)} \times 100 = \frac{3\Sigma P_0 (Q_0 + Q_1)}{\Sigma P_0 (Q_0 + Q_1)} \times 100 = 300.$$

70. Answer : (c)

[<TOP>](#)

Reason : We have to calculate the multiple correlation coefficient treating X_1 as dependent and X_2 and X_3 as independent variables, i.e., we have to find

$$R_{1.23} = \sqrt{\frac{r_{12}^2 + r_{13}^2 - 2 r_{12} r_{13} r_{23}}{1 - r_{23}^2}}$$

Substituting the given values

$$R_{1.23} = \sqrt{\frac{(0.42)^2 + (0.37)^2 - 2 (0.42 \times 0.37 \times 0.76)}{1 - (0.76)^2}} = 0.4272.$$

71. Answer : (d)

[<TOP>](#)

Reason : The cyclical variations can be separated using the percent of trend measure.

72. Answer : (d)

[<TOP>](#)

Reason :

$$\sigma_{\bar{x}_1 - \bar{x}_2}^2 = \frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2} = \frac{286}{49} + \frac{\sigma_2^2}{81} = (\sqrt{9.5})^2$$

$$\text{or } \frac{286}{49} + \frac{\sigma_2^2}{81} = 9.5$$

$$\text{or } \sigma_2^2 = \left(9.5 - \frac{286}{49}\right) \times 81 = 296.72$$

$$\therefore \sigma_2 = \sqrt{296.72} = 17.2$$

73. Answer : (d)

[<TOP>](#)

Reason : (a): In a p chart, the center line is drawn on the basis of overall sample proportion.

(d): In a p chart, the lower control limit can only be greater than or equal to zero.

(b), (c) and (e): the upper and lower control limits are fixed by adding and subtracting the estimated standard error of proportion from the overall sample proportion.

74. Answer : (e)

[<TOP>](#)

$$\text{Reason : Coefficient of determination} = \frac{\text{RSS}}{\text{TSS}} = \frac{\text{RSS}}{\text{ESS} + \text{RSS}}$$

$$= \frac{\frac{\text{RSS}}{\text{ESS}}}{\frac{\text{ESS}}{\text{ESS}} + \frac{\text{RSS}}{\text{ESS}}} = \frac{\frac{5}{2}}{1 + \frac{5}{2}} = 0.714$$

$$\therefore \frac{\text{RSS}}{\text{TSS}} = 0.714 \quad \text{or } \text{RSS} = 0.714 \times \text{TSS} = 0.714 \times 730 = 521.22.$$

75. Answer : (e)

[<TOP>](#)

Reason : (a) This is a wrong answer. The number of degrees of freedom does not depend on the sample size.

(b) This is the wrong answer. The number of degrees of freedom does not depend on the ratio of sample size and the population.

(c) This is the wrong answer. The number of degrees of freedom does not depend on the number of rows in the contingency table only.

(d) This is the wrong answer. The number of degrees of freedom does not depend on the number of columns in the contingency table only.

(e) This is the right answer. When the chi-square distribution is used as a test of independence, the number of degrees of freedom is related to both the number of rows and the number of columns in the contingency table.

76. Answer : (e)

[<TOP>](#)

Reason : Width of confidence interval for mean = UCL – LCL

$$= (\bar{x} + z\sigma_{\bar{x}}) - (\bar{x} - z\sigma_{\bar{x}})$$

$$= 2z\sigma_{\bar{x}}$$

$\sigma_{\bar{x}}$ cannot be known without knowing the sample size, which is not given. Hence the width can not be determined on the basis of the given information.

77. Answer : (c)

[<TOP>](#)

Reason : The central limit theorem claims that the sampling distribution of the mean approaches normality as sample size increases.

78. Answer : (d)

[<TOP>](#)

Reason : One of the assumptions in ANOVA is that the population variances are equal.

[< TOP OF THE DOCUMENT >](#)