

Question Paper

Quantitative Methods – II (132) : April 2007

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

1. In a Bernoulli experiment the probability of success is 0.35 and the number of trials is 10. Then what is the [< Answer >](#)
approximate probability of getting one success?
(a) 0.0725
(b) 0.0546
(c) 0.0359
(d) 0.0447
(e) 0.0875.
- (2 marks)
2. The mean of a Binomial distribution is 8 and variance is 3.4. The probability of success is [< Answer >](#)
(a) 0.720
(b) 0.378
(c) 0.876
(d) 0.646
(e) 0.575.
- (1 mark)
3. Which of the following distributions can represent the experiments or processes in which each trial has only two [< Answer >](#)
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)
4. UCI Bank has observed that 65% of its borrowers pay their loan installments regularly. It is assumed that the loan [< Answer >](#)
accounts are independent of each other. The manager of the bank has randomly selected 7 loan accounts.
What is the probability that **at least** four out of the seven borrowers are paying their loan installments regularly?
(a) 80%
(b) 75%
(c) 85%
(d) 60%
(e) 70%.
- (1 mark)

5. A normal variable has the mean of 15 and a standard deviation of 7. What is the probability that the normal variable will take a value in the interval of 6.74 and 24.1? [< Answer >](#)

- (a) 65.56 %
- (b) 78.42 %
- (c) 83.64 %
- (d) 88.52 %
- (e) 97.47 %.

• (1 mark)

6. Which of the following best describes the expected value of a discrete random variable? [< Answer >](#)

- (a) It is the geometric average of all possible outcomes of the variable
- (b) It is the simple average of all possible outcomes of the variable
- (c) It is the weighted average of all possible outcomes of the variable
- (d) It is the outcome of the variable, which has the highest probability of occurrence
- (e) It is the highest probability of occurrence in probability distribution of the random variable.

• (1 mark)

7. Six coins are tossed 48 times. Using the Poisson distribution, find the approximate probability of getting six heads 3 times. [< Answer >](#)

- (a) 0.124
- (b) 0.245
- (c) 0.033
- (d) 0.325
- (e) 0.375.

• (2 marks)

8. Which of the following elements are commonly found in problems of decision making under uncertain conditions? [< Answer >](#)

- I. The decision maker has an objective to be achieved.
- II. There are several courses of action.
- III. There is a calculable measure of benefit or worth of the various courses of action.
- IV. There are events which are not controllable by the decision maker.

- (a) Both (I) and (II) above
- (b) Both (I) and (III) above
- (c) Both (II) and (III) above
- (d) Both (III) and (IV) above
- (e) All (I), (II), (III) and (IV) above.

• (1 mark)

9. The marginal profit and marginal loss of a product are 17 and 32 respectively. The marginal probability of sale of the product that will justify the stocking of the same is [< Answer >](#)

- (a) 0.484
- (b) 0.653
- (c) 0.546
- (d) 0.769
- (e) 0.812.

• (1 mark)

10. 'Expected profit' in a decision problem under risk

[< Answer >](#)

- (a) Is never one of the possible outcomes
- (b) Is always one of the possible outcomes
- (c) Gives maximum profit in minimum maximum criteria
- (d) Gives minimum profit in maximum minimum criteria
- (e) Is not necessarily one of the possible outcomes.

• (1 mark)

11. Which of the following statements is **not true** with respect to decision tree analysis?

[< Answer >](#)

- (a) The decision tree is considered as a mathematical method of a decision situation
- (b) It is difficult to develop a conditional profit table when there is a large number of scenarios
- (c) At every decision mode the decision maker chooses an alternative which gives him the highest probability of success
- (d) The decision tree is a graphic model depicting the entire decision process
- (e) The problem represented by a decision tree is solved from right to left.

• (1 mark)

12. A merchant expects to earn a profit of Rs.750 per day by selling hens without any prediction for the nature of demand. He expects to earn a profit of Rs.1,150 with perfect information about the future demand in the market. A middleman provides this information to the merchant. What maximum amount should the merchant pay for the information?

[< Answer >](#)

- (a) Rs.250
- (b) Rs.320
- (c) Rs.130
- (d) Rs.540
- (e) Rs.400.

• (1 mark)

13. An organization consisting of 420 individuals, a sample of 60 individuals is taken. From this sample, the average age of the individuals is found to be 36 years and the standard deviation is found to be 4.82 years.

[< Answer >](#)

A 95% confidence interval for the mean age of the individuals in the association has to be constructed. Find the upper confidence limit of the confidence interval?

- (a) 28.16 years
- (b) 32.05 years
- (c) 37.13 years
- (d) 30.17 years
- (e) 47.60 years.

• (3 marks)

14. Suguna steel has its branches all over the country and its annual production cost is increasing every year. Company started calculating the production cost among all its 32 branches. What sample size does it should consider to resolve the average production cost within $\pm$ Rs.450 lakhs at 90% significance level?

[< Answer >](#)

We assume that the annual production cost of Suguna branches follow normal distribution with a standard deviation of Rs.400 lakhs.

- (a) 9
- (b) 2
- (c) 11
- (d) 12
- (e) 15.

• (2 marks)

15. The mean and the variance of a simple random sample are found to be 11 and 9.6 respectively. The population variance is known to be 6.24. The sample size is 5 and the population size is 35. What is the 95% confidence interval for the population mean, on the basis of the given information? (It is assumed that the population is normally distributed) [< Answer >](#)
- (a) (8.25, 13.74)
 - (b) (8.94, 13.05)
 - (c) (8.76, 13.24)
 - (d) (8.06, 13.94)
 - (e) (8.24, 13.76).

• (2 marks)

16. A 95% confidence interval for the proportion of milk produced in a given state is to be constructed and must be accurate to ± 0.08 of the point estimate. An opening sample provides an initial estimate of the proportion as 0.10. The smallest sample size that will provide the desired accuracy is [< Answer >](#)
- (a) 42
 - (b) 46
 - (c) 50
 - (d) 54
 - (e) 63.

• (2 marks)

17. In many situations managers resort to sampling to draw some conclusions about a population. Which of the following is **not** an advantage of sampling over a census? [< Answer >](#)
- (a) The population may be too large to be studied in full, hence sampling is the only feasible means
 - (b) A study of sample is usually cheaper than a census
 - (c) Sampling usually provides information quicker than a census
 - (d) In destructive testing sampling is the only available course
 - (e) The conclusions obtained from sampling are more accurate than census.

• (1 mark)

18. In making the estimates of population parameters using sample statistics, efficiency refers to the [< Answer >](#)
- (a) Size of the standard error of the sample statistic
 - (b) Possibility that the sample statistic gets closer to the population parameter as the sample size increases
 - (c) Degree of representativeness of the sample information
 - (d) Tendency of the estimator to take values that are different from the population parameter
 - (e) Usage of the sample information by the statistic.

• (1 mark)

19. In hypothesis testing, the critical region is that the region of the sampling distribution [< Answer >](#)
- (a) Which always lies in the left tail of the sampling distribution
 - (b) Which always lies in the right tail of the sampling distribution
 - (c) In which the value of sample statistic must fall, for the null hypothesis to be rejected and the alternative hypothesis to be accepted
 - (d) In which the value of the sample statistic must fall, for the decision maker to remain indifferent to the acceptance or rejection of the null hypothesis
 - (e) In which the value of sample statistic must fall, for the null hypothesis to be accepted.

• (1 mark)

20. Which of the following statements is **true** as the degree of freedom increases? [< Answer >](#)

- (a) The normal distribution approaches **t**-distribution
- (b) The **t**-distribution approaches binomial distribution
- (c) Binomial distribution approaches **F**-distribution
- (d) **F**-distribution approaches **t**-distribution
- (e) **t**-distribution approaches normal distribution.

• (1 mark)

21. Which of the following statements is appropriate for a two-tailed test? [< Answer >](#)

- (a) A test where null hypothesis is accepted if test statistic exceeds a given value
- (b) A test where a second sample is taken based on the first
- (c) A test used only when the sample size is small
- (d) A test where both upper and lower limits of confidence interval are used to take a decision of accepting null hypothesis
- (e) A test used only to measure the difference between two proportions.

• (1 mark)

22. The normal distribution is the appropriate distribution to use in testing of hypothesis about [< Answer >](#)

- I. A mean, when σ is unknown but n is large.
- II. A mean, when σ is known and the population is normal.
- III. A proportion when $np_{H_0} > nq_{H_0} > 5$.
- (a) Only (I) above
- (b) Only (III) above
- (c) Both (I) and (II) above
- (d) Both (II) and (III) above
- (e) All (I), (II) and (III) above.

• (1 mark)

23. Suppose a hypothesis test is being performed for a process in which a type I error will be very costly, but a type II error will be relatively inexpensive and unimportant. Which of the following would be the best choice for α in this test? [< Answer >](#)

- (a) 0.05
- (b) 0.01
- (c) 0.50
- (d) 0.25
- (e) 0.10.

• (1 mark)

24. The method of least squares states that the regression line should be drawn through the plotted points in such a way that [< Answer >](#)

- (a) The sum of the squares of the horizontal distances of the actual and estimated Y values should be maximum
- (b) The sum of the squares of the horizontal distances of the actual and estimated Y values should be minimum
- (c) The sum of the squares of the vertical distances of the actual and estimated Y values should be maximum
- (d) The sum of the squares of the vertical distances of the actual and estimated Y values should be minimum
- (e) The product of the squares of the vertical distances of the actual and estimated Y values should be minimum.

• (1 mark)

25. Consider the following data on the variables X and Y:

[< Answer >](#)

X	1	2	5	7	9	9	10	12
Y	2	2	4	5	6	8	8	9

Compute the standard error of the estimate given by the regression line.

- (a) 0.449
- (b) 0.736
- (c) 0.684
- (d) 0.326
- (e) 0.231.

• (2 marks)

26. For estimating an equation to be a perfect estimator of the dependent variable, which of these would have to be true?

[< Answer >](#)

- (a) The standard error of the estimate is zero
- (b) All the data points are on the regression line
- (c) The coefficient of determination is -1
- (d) All the data points does not lie on the regression line
- (e) Both (a) and (b) above.

• (1 mark)

27. We know that the standard error is the same at all points on a regression line because we assume that

[< Answer >](#)

- I. Observed values are normally distributed around each estimated value of y .
- II. All the available data points were taken into account when the regression line was calculated.
- III. The variance of the distributions around each possible value of y is the same.

- (a) Only (I) above
- (b) Only (II) above
- (c) Only (III) above
- (d) Both (I) and (III) above
- (e) All (I), (II) and (III) above.

• (1 mark)

28. If the correlation coefficient between two variables is -1 , then all the pairs of observations when plotted on a scatter diagram will lie

[< Answer >](#)

- (a) On the regression line
- (b) Above the regression line
- (c) Below the regression line
- (d) Close to the regression line
- (e) Far to the regression line.

• (1 mark)

29. The standard deviations of two variables and their covariance are 0.2, 0.2 and 0.04 respectively. The two variables

[< Answer >](#)

- (a) Have a low correlation coefficient
- (b) Are not correlated to each other
- (c) Are perfectly positively correlated
- (d) Are negatively correlated
- (e) Are perfectly negatively correlated.

• (1 mark)

30. Multiple regression analysis is used to

[< Answer >](#)

- (a) Relate changes in one dependent variable to one independent variable
- (b) Relate changes in one dependent variable to more than one independent variable
- (c) Establish a cause-effect relationship between multiple pairs of dependent and independent variables considered at the same time
- (d) Relate changes in more than one dependent variable to one independent variable
- (e) Relate changes in more than one dependent variable and more than one independent variable.

• (1 mark)

31. 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)

32. The production (in thousand litres) of a sunflower oil producing factory during seven years is given below:

[< Answer >](#)

Year	2000	2001	2002	2003	2004	2005	2006
Production ('000 litres)	75	83	90	79	95	110	80

What is the estimated production of sunflower oil for the year 2007 on the basis of a linear estimating equation that describes the trend in the sunflower oil production by the factory?

- (a) 52,135 litres
- (b) 61,423 litres
- (c) 70,585 litres
- (d) 98,000 litres
- (e) 80,564 litres.

• (2 marks)

33. A simple regression equation is developed which relates the variables **X** and **Y** ; **X** is the independent variable and **Y** is the dependent variable. The following details are available:

[< Answer >](#)

Y	45	9	63	13	21	15	16	14	17	23
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$$\sum XY = 3532 \quad \sum X = 149 \quad \sum X^2 = 2461$$

Number of data points = 10

What is the standard error of estimate of the regression equation?

- (a) 10.23
- (b) 15.54
- (c) 18.06
- (d) 19.00
- (e) 20.04.

• (2 marks)

34. If the standard error of estimate for a regression equation is zero then,

[< Answer >](#)

- (a) The estimated value of the dependent variable will always be less than its observed value
- (b) The estimated value of the dependent variable will always be more than its observed value
- (c) The estimated value of the dependent variable will always be equal to its observed value
- (d) The coefficient of correlation between the variables involved will be zero
- (e) The coefficient of correlation between the variables involved will be positive.

• (1 mark)

35. Which of the following is **true** with regard to a given coefficient of correlation and its corresponding coefficient of determination?

[< Answer >](#)

- (a) The coefficient of determination is always greater than or equal to zero, and less than or equal to 1
- (b) The coefficient of determination is always less than zero
- (c) The coefficient of determination is always equal to 1
- (d) The coefficient of determination always has the same sign as the coefficient of correlation
- (e) The magnitude of coefficient of determination is always higher than the magnitude of coefficient of correlation.

• (1 mark)

36. A simple regression equation is developed which relates the variables **X** and **Y**; **X** is the independent variable and **Y** is the dependent variable. The following details are available:

[< Answer >](#)

X	65	55	45	56	58	65
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$$\sum XY = 20,787 \quad \sum Y = 358 \quad \sum Y^2 = 22,122$$

Number of data points = 6

What is the coefficient of determination between the variables X and Y?

- (a) 0.205
- (b) 0.324
- (c) 0.050
- (d) -0.05
- (e) 0.450.

• (2 marks)

37. A regression relationship has been established between two variables **X** and **Y**, in which **X** is the independent variable. The coefficient of correlation between **X** and **Y** is 0.55. What percentage of the variation in **Y** is **not** explained by the regression relationship?

[< Answer >](#)

- (a) 60%
- (b) 45%
- (c) 55%
- (d) 70%
- (e) 75%.

• (1 mark)

38. For a regression equation, $\hat{Y} = 5 - 8X$, the coefficient of determination (r^2) is 0.64. The correlation coefficient between X and Y is equal to [< Answer >](#)
- (a) -0.80
 (b) -0.36
 (c) -0.06
 (d) 0.06
 (e) 0.36 .

• (1 mark)

39. The following regression relationship between two variables, X and Y , has been obtained: [< Answer >](#)
 $\hat{Y} = 156 - 2.4X$; where X is the independent variable and Y is the dependent variable.
 From the following details calculate the approximate 90 percent prediction interval for Y if $X = 1.80$?

$\Sigma Y^2 = 81,500$; $\bar{Y} = 110$; $\Sigma XY = 5,180$
 Number of observations = 5

- (a) 23.60 ± 6.56
 (b) 56.47 ± 34.38
 (c) 151.68 ± 122.50
 (d) 456.0 ± 104.0
 (e) 236.0 ± 34.38 .

• (3 marks)

40. Which of the following is **not true** with regard to a value index? [< Answer >](#)
- (a) It combines price changes and quantity changes
 (b) It is not as useful as price indices or quantity indices
 (c) It measures changes in the total monetary worth
 (d) It cannot distinguish between the price changes and quantity changes
 (e) An increase in the value index indicates with certainty that the prices have increased.

• (1 mark)

41. The following data are collected from a dealer of commodities: [< Answer >](#)

Commodity	Year			
	2000	2006	2004	
	Price (Rs./kg)	Price (Rs./kg)	Price (Rs./kg)	Quantity (kg)
Jowar	11.00	14.00	13.00	2500
Maize	8.50	11.50	9.75	1000
Wheat	3.50	5.00	4.25	500
Peas	12.50	14.00	13.00	750
Bajra	24.50	29.50	27.00	1200

What is the weighted average of relative price index for the year 2006, using the year 2004 for weighting and the year 2000 for the base year?

- (a) 103.33
 (b) 124.27
 (c) 137.57
 (d) 150.54
 (e) 161.67.

• (3 marks)

42. An index number is in fact a device that facilitates

[< Answer >](#)

- I. Comparison of the level of magnitude of a group of related variables under two or more situations.
- II. To bring out the changes in data magnitudes occurring over time.
- III. To highlight the variations in data on similar categories of objects.

- (a) Only (I) above
- (b) Only (II) above
- (c) Only (III) above
- (d) Both (I) and (II) above
- (e) All (I), (II) and (III) above.

• (1 mark)

43. The weighted average price of goods in a basket in the base year is 75% of their weighted average price in the current year. Both the weighted averages have been calculated using base year consumption quantities as weights. Which of the following is **correct**?

[< Answer >](#)

- (a) Paasches price index = 135.25
- (b) Paasches price index = 130.80
- (c) Laspeyres price index = 125.33
- (d) Laspeyres quantity index = 120.80
- (e) Laspeyres price index = 133.33.

• (1 mark)

44. The following details are available with regard to a group of goods:

[< Answer >](#)

Good	P_1Q_0	P_0Q_0	$\frac{Q_1}{Q_0}$
A	550	630	3/4
B	840	840	1/2
C	1350	750	3/5
D	840	630	5/6

What is Paasches price index for the group of goods?

- (a) 103.54
- (b) 123.08
- (c) 125.43
- (d) 130.47
- (e) 135.25.

• (2 marks)

45. When base year values are used as weights, the weighted average of relatives price index is the same as

[< Answer >](#)

- (a) Paasche's price index
- (b) Laspeyres price index
- (c) Marshall-Edgeworth index
- (d) The unweighted average of relatives price index
- (e) Fisher's ideal index.

• (1 mark)

46. The distortion of index numbers is due to the following:

[< Answer >](#)

- I. Inappropriate weighting of factors.
 - II. Availability of limited data.
 - III. Selection of an improper base.
 - IV. Incomparability of indices.
- (a) Only (II) above
 - (b) Only (III) above
 - (c) Both (I) and (III) above
 - (d) Both (II) and (IV) above
 - (e) All (I), (II), (III) and (IV) above.

• (1 mark)

47. The following data pertains to the requirements of a hotel per day:

[< Answer >](#)

Requirements	Price in 2006 (Rs./kg)	Price in 2002 (Rs./kg)
Rice	10.50	8.50
Wheat	12.50	11.50
Pulses	28.00	15.00

The base year is 2002. The unweighted aggregates price index for the year 2006 is approximately

- (a) 125.45
- (b) 134.21
- (c) 145.71
- (d) 110.00
- (e) 152.20.

• (1 mark)

48. Which of the following statements is/are **true**?

[< Answer >](#)

- (a) The various components of variation in a time series can be isolated even if the data is collected at irregular intervals of time
- (b) The cancellation of the highest and the lowest of the seasonal values reduces the extreme cyclical and irregular variations
- (c) Only after the isolation of the cyclical trend, we are able to conduct analysis for seasonal variation
- (d) The relative cyclical residual can be obtained by subtracting the per cent of trend value from 100
- (e) Both (b) and (d) above.

• (1 mark)

49. Repetitive and predictable movement around the trend line in one year or less is known as

[< Answer >](#)

- (a) Secular trend
- (b) Seasonal variation
- (c) Cyclical fluctuation
- (d) Irregular variation
- (e) Temporary variation.

• (1 mark)

50. Which of the following components of a time series is expressed as a percentage of the estimated values of the dependent variable as per the secular trend equation? [< Answer >](#)

- (a) Seasonal variation
- (b) Irregular variation
- (c) Cyclical variation
- (d) Short term variation
- (e) Random variation.

• (1 mark)

51. Which of the following series indicates the moving average of two data points of the observations 4, 5, 7, 8, 5, 2? [< Answer >](#)

- (a) 1.5, 2, 3.5, 3.5 and 4.5
- (b) 2.5, 5, 7.5, 6.5 and 4.0
- (c) 2.0, 5, 6.5, 5.5 and 3.5
- (d) 4.5, 6, 7.5, 6.5 and 3.5
- (e) 3.5, 4, 6.5, 7.5 and 8.5.

• (1 mark)

52. A business school is studying the number of enrollments to its various programs during six years. The following data are collected from their records: [< Answer >](#)

Year	2006	2005	2004	2003	2002	2001
Number of enrollments	162	153	142	148	123	147

The cyclical variations in the number of enrolments using the relative cyclical residual technique, for the year 2006, is

- (a) -2.53
- (b) -3.74
- (c) 2.55
- (d) 3.32
- (e) 3.06

• (2 marks)

53. A statistician assumes that, the rent (Y) charged 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 as: [< Answer >](#)

$$\hat{Y} = 85.12 + 452.5X_1 - 125.25X_2$$

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

- (a) Rs.653
- (b) Rs.942
- (c) Rs.542
- (d) Rs.742
- (e) Rs.842.

• (1 mark)

54. The auditor general of accounts has reviewed the inventory records to determine if the current inventory holdings of textbooks are typical. The inventory amounts for five years are given below: [< Answer >](#)

Year (X)	2002	2003	2004	2005	2006
Inventory (in Rs.'000)	3,654	2,845	2,564	3,568	3,584

If the time variable has been coded as $x = X - \bar{X}$, then which of the following is the linear trend equation for estimating inventory level for a given year in thousand rupees?

- (a) $\hat{Y} = 3,243 + 58.3x$
- (b) $\hat{Y} = 3,348 + 356x$
- (c) $\hat{Y} = 3,300 + 356x$
- (d) $\hat{Y} = 2,608 + 321x$
- (e) $\hat{Y} = 2,708 + 201x$

• (2 marks)

55. A fast food corner has been witnessing similar fluctuations in the demand of fast food in the same quarters each year over the last five years. The owner wants to study the movement of the demand to streamline his procurement plans. Which of component of the time series should be studied in order to get an accurate assessment of the behavior of demand within a period of one year? [< Answer >](#)

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

• (1 mark)

56. The level of the working capital needed by a small firm during the last six years is shown below: [< Answer >](#)

Year	2001	2002	2003	2004	2005	2006
Working capital in (Rs.lakh)	5.10	5.85	6.35	6.65	7.10	7.35

From the above given data estimate the level of working capital required during the years 2008 and 2009 respectively?

[Given the values of 'a' and 'b' as 6.4 and 0.2186 respectively]

- (a) Rs.6.256 lakhs and Rs.7.05 lakhs respectively
- (b) Rs.7.651 lakhs and Rs.8.05 lakhs respectively
- (c) Rs.8.254 lakhs and Rs.9.15 lakhs respectively
- (d) Rs.8.367 lakhs and Rs.8.58 lakhs respectively
- (e) Rs.9.452 lakhs and Rs.10.05 lakhs respectively.

• (2 marks)

57. If the sample size is 50 and the proportion of defective pieces in a batch of output is 0.08, then the upper control limit of **p-chart** will be [< Answer >](#)

- (a) 0.042
- (b) 0.038
- (c) 0.080
- (d) 0.115
- (e) 0.195.

• (1 mark)

58. A computer store purchases untested microchips for computers, from a wholesaler. It has to estimate the proportion of faulty microchips in the consignments supplied by the wholesaler. From a large consignment sent by the wholesaler a sample of 150 microchips were tested and 42 microchips were found to be faulty. [< Answer >](#)

A 98% confidence interval has to be constructed for the true population proportion of faulty microchips. The upper confidence limit of the confidence interval is

- (a) 0.2301
- (b) 0.3651
- (c) 0.1788
- (d) 0.3788
- (e) 0.5508.

• (2 marks)

59. The demand for a particular product in a factory was observed 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	950	945	950	955	965	959

Find the value of the χ^2 -statistic from the given data?

- (a) 0.1358
- (b) 0.2725
- (c) 0.3645
- (d) 0.4658
- (e) 0.5642.

• (2 marks)

60. Which of the following example has the characteristics of an attribute? [< Answer >](#)

- I. A person being a literate or not.
- II. The result of the candidate who has contested for the position of chairman of a labor union.
- III. Nuclear status of a nation in case of artillery.

- (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)

61. The lower control limit in an **R**-chart, if $\bar{R} = 3.2$, $d_2 = 3.254$ and $d_3 = 0.642$, is [< Answer >](#)

- (a) 0.945
- (b) 1.254
- (c) 1.306
- (d) 1.484
- (e) 2.064.

• (1 mark)

[< Answer >](#)

62. • If $n = 49$ and $\bar{p} = 0.19$, then the upper and lower control limits of the p-chart are
- (a) 0.8454 and 0.0326 respectively
 - (b) 0.3581 and 0.0219 respectively
 - (c) 0.4221 and 0.0731 respectively
 - (d) 0.6542 and 0.0121 respectively
 - (e) 0.7854 and 0.0565 respectively.

• (1 mark)

63. Mr. Mathew is responsible to overlook the emergency services at KIMS Hospital. He receives many complaints about the time taken by the ambulance in reaching the necessary location. He decides to check whether the complaints are genuine and whether the process is in-control. Each day he takes 10 calls and he repeats this for 14 days. The data collected is as follows:

[< Answer >](#)

Week		Mon	Tue	Wed	Thu	Fri	Sat	Sun
First week	$\bar{X}$	10.6	14.2	13.6	12.5	14.5	21.5	17.4
	R	13.5	18.5	23.6	17.3	13.7	20.9	21.4
Second week	$\bar{X}$	10.2	11.4	16.5	16.7	12	22	12.9
	R	11.9	19	11	14.3	21.4	23.8	22

What are the upper and lower control limits of the test?

- (a) 19.32 and 10.1 respectively
- (b) 20.5 and 12.5 respectively
- (c) 23.4 and 15.2 respectively
- (d) 18.5 and 11.6 respectively
- (e) 22.4 and 20.6 respectively.

• (3 marks)

64. On conducting a test of ANOVA on 3 samples of different sizes, as 11, 9 and 10. The number of degrees of freedom for the denominator of the F-ratio is

[< Answer >](#)

- (a) 10
- (b) 15
- (c) 27
- (d) 30
- (e) 32.

• (1 mark)

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

[< Answer >](#)

$$\begin{aligned}n_1 &= 25 & s_1 &= 15 \\n_2 &= 16 & s_2 &= 9\end{aligned}$$

The samples are independently collected and it is assumed that the two populations have the same variance. What is the estimated standard error of difference between means?

- (a) 5.236
- (b) 4.169
- (c) 6.245
- (d) 8.258
- (e) 10.05.

• (2 marks)

66. Which of the following is **false** regarding the chi-square test?

[< Answer >](#)

- (a) It is used for a test of significance for 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)

67. In performing a chi-square test of independence, as the difference between the respective observed and expected frequencies decreases, the likelihood of accepting the null hypothesis

[< Answer >](#)

- (a) Decreases
- (b) Increases
- (c) May decrease or increase depending on the number of rows and columns in the contingency table
- (d) Tends to become equal to the likelihood of rejecting it
- (e) Remains the same.

(1 mark)

68. Determine the critical **F** value from the table when there are two samples and a total of twenty observations. Assume 0.05 level of significance.

[< Answer >](#)

- (a) 2.85
- (b) 3.50
- (c) 4.41
- (d) 5.05
- (e) 6.50.

(1 mark)

69. When performing a chi-square test, what happens when expected frequencies in several categories are too small?

[< Answer >](#)

- (a) The value of the test statistic will be very high
- (b) The null hypothesis will be more likely to be accepted than it should be
- (c) The degrees of freedom are greatly reduced
- (d) The value of the test statistic will be close to zero
- (e) The degrees of freedom are greatly increased.

(1 mark)

70. A study compared the effects of four 1-month point-of-purchase promotions on sales. The unit sales for five stores using all four promotions in different months follow:

[< Answer >](#)

Free samples	75	83	85	79	78
One-pack gift	85	84	93	92	81
Rupees off	74	75	70	81	75
Refund by mail	78	69	75	82	81

A test of ANOVA has to be performed.

Estimate the population variance using the variance within the samples.

- (a) 15.825
- (b) 18.550
- (c) 19.500
- (d) 20.365
- (e) 21.625.

(3 marks)

71. Two random samples were drawn from two normal populations and their values are as follows:

[< Answer >](#)

A	62	59	61	65	78
---	----	----	----	----	----

B	84	85	81	90	78	74
---	----	----	----	----	----	----

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) 1.2487
- (b) 1.5495
- (c) 1.6849
- (d) 1.8196
- (e) 1.7356.

(2 marks)

72. When we carry out a chi-square test of independence which of the following can be stated in the null hypothesis?

[< Answer >](#)

- (a) The population mean is equal to a specified value
- (b) The population proportion is equal to a specified value
- (c) The population distribution follows a specified probability distribution
- (d) The population can be classified on the basis of two criteria which are not associated
- (e) The population can be classified on the basis of two criteria which are associated.

(1 mark)

73. Which of the following is the **not** a disadvantage of simulation?

[< Answer >](#)

- (a) These are very expensive and take a long time to develop
- (b) It does not generate optimal solutions to problems
- (c) Each application of simulation is ad hoc to a great extent
- (d) Simulation model does not produce answers by itself, whereas the user has to provide
- (e) It is suitable to analyze large and complex real-life problems, which cannot be solved by usual quantitative methods.

(1 mark)

Suggested Answers

Quantitative Methods – II (132) : April 2007

1. Answer : (a) [< TOP >](#)
Reason : In a Bernoulli experiment the probability of 'r' successes in 'n' trials is given by
$$P(r) = {}^nC_r p^r \cdot q^{(n-r)}$$
Given: Probability of success, $p = 0.35$
No. of successes, $r = 1$
Number of trials $n = 10$
 $\therefore$ Probability of failure, $q = 1 - p = 0.65$

$$\therefore P(r=1) = {}^{10}C_1 (0.35)^1 (0.65)^{(10-1)}$$

$$= 10 (0.35) (0.65)^9$$

$$= 0.0725.$$
2. Answer : (e) [< TOP >](#)
Reason : For the binomial distribution
Mean = np
Variance = npq
Given : Mean = 8 and Variance = 3.4
 $\therefore np = 8$ and $npq = 3.4$

$$q = \frac{3.4}{8} = 0.425$$
 $\therefore$ Probability of success, $p = 1 - q = 1 - 0.425 = 0.575.$
3. Answer : (e) [< TOP >](#)
Reason : (a), (b), (c) and (d) are the 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).
4. Answer : (a) [< TOP >](#)
Reason : The probability that a client is regularly paying the loan installments is 0.65.
The probability that at least 4 out of the seven borrowers pay their loan installments regularly
$$= {}^7C_4 (0.65)^4 \cdot (0.35)^3 + {}^7C_5 (0.65)^5 \cdot (0.35)^2 + {}^7C_6 (0.65)^6 (0.35) + {}^7C_7 (0.65)^7$$

$$= 35 \times (0.65)^4 (0.35)^3 + 21 \times (0.65)^5 \times 0.1225 + 7 \times (0.65)^6 \times (0.35) + (0.65)^7$$

$$= 0.800 \text{ i.e } 80\%.$$

5. Answer : (b) [< TOP >](#)
Reason : Probability that the normal variable with mean 15 and standard deviation 7 will take a value in the interval 6.74 and 24.1 is the area under the standard normal curve between the standard normal values $\frac{6.74-15}{7}$ and $\frac{24.1-15}{7}$.
The area between $z = -1.18$ and $z = 1.30$ is $0.3810 + 0.4032 = 0.7842$.
Therefore the required probability is **78.42 %**
6. Answer : (c) [< TOP >](#)
Reason : a. The expected value of a discrete random variable is not a geometric average of all possible outcomes of the variable.
b. The expected value of a discrete random variable is not a simple average of all possible outcomes of the variable.
c. The expected value of a discrete random variable is a weighted average of all possible outcomes of the variable.
d. The expected value of a discrete random variable is not the outcome, which has the highest frequency.
e. The expected value of a discrete random variable is not the highest probability of occurrence in the distribution of the random variable
7. Answer : (c) [< TOP >](#)
Reason : The probability of obtaining six heads in a throw of six coins(a single trial), is
 $P = (1/2)^6$, assuming that head and tail are equally probable.
 $\lambda = np = 48 \times (1/2)^6 = 0.75$
Hence using Poisson probability law, the required probability of getting 6 heads 3 times is given by:

$$P(x = 3) = \frac{e^{-\lambda} \cdot \lambda^r}{3!} = \frac{e^{-0.75} \cdot (0.75)^3}{3!} = 0.033$$
8. Answer : (e) [< TOP >](#)
Reason : All the elements stated in the alternatives are commonly found in problems of decision making under uncertain conditions.
9. Answer : (b) [< TOP >](#)
Reason : $P^* = ML / (ML + MP)$
Where P^* represents the minimum required probability of selling at least one additional unit to justify the stocking of that additional unit.
 $P^* = 32 / (32 + 17) = 32 / 49 = 0.653$.
10. Answer : (a) [< TOP >](#)
Reason : Expected profit in a decision problem under risk is never one of the possible outcomes.
Option (a) is suitable.
11. Answer : (c) [< TOP >](#)
Reason : Self-explanatory.
All other options (a), (b), (d) and (e) are correct, whereas option (c) is incorrect.

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

Reason : The market research firm can charge a value equal to “Expected value of perfect information”. This is equal to the difference of the expected profit with perfect information and expected profit without any predictions. In this case,

EVPI = Rs.1,150 – Rs.750 = Rs.400. The merchant will be ready to pay any amount up to Rs 400. Therefore the correct answer is (e).

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

Reason : Given: mean: $\bar{X} = 36$, std.dev: $s = 4.82$

$n = 60$ $N = 420$

Sampling fraction, $\frac{n}{N} = \frac{60}{420} = 0.143 > 0.05$

$\therefore$ Estimated standard error of mean, $\hat{\sigma}_{\bar{X}} = \frac{s}{\sqrt{n}} \sqrt{\frac{N-n}{N-1}}$

$$= \frac{4.82}{\sqrt{60}} \sqrt{\frac{420-60}{420-1}} = \frac{4.82}{\sqrt{60}} \times \sqrt{\frac{360}{419}} = 0.577$$

Since the sample size is greater than 30 the normal distribution will be used.

Z-values for the upper and lower confidence limit are ± 1.96

$\therefore$ Upper confidence limit = $\bar{X} + 1.96 \hat{\sigma}_{\bar{X}} = 36 + (1.96 \times 0.577) = 37.13$ years

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

Reason : We are required to find the sample size so that the mean annual production cost of suguna companies should fall within $\pm$ Rs.450 lakhs at a confidence level of 90%.

The Z-value for 90% level of confidence is 1.645.

$$1.645 \sigma_{\bar{X}} = \text{Rs.450 lakh}$$

$$\begin{aligned} \sigma_{\bar{X}} &= \text{Rs.450}/1.645 \\ &= \text{Rs.273.55 lakh} \end{aligned}$$

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

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

$$273.55 = 400 / \sqrt{n}$$

$$\sqrt{n} = 400 / 273.55 = n = 2.13 \text{ or } 2$$

Thus the sample may contain 2 suguna branches at random.

15. Answer : (b) [< TOP >](#)
Reason : Since the population variance is known the appropriate distribution to use is the normal distribution. Sample is more than 5% of population.
 $\therefore$ This is a case of finite population.
Population standard deviation, $\sigma = \sqrt{6.24}$
Estimated standard error of mean = $\frac{\sigma}{\sqrt{n}} \sqrt{\frac{N-n}{N-1}} = \frac{\sqrt{6.24}}{\sqrt{5}} \sqrt{\frac{35-5}{35-1}} = 1.049$
 $\therefore$ 95% confidence interval for population mean =
 $\bar{X} \pm 1.96 \frac{\sigma}{\sqrt{n}} \sqrt{\frac{N-n}{N-1}} = 11 \pm 1.96 \times 1.049 = (8.94, 13.05)$
16. Answer : (d) [< TOP >](#)
Reason :
 $1.96\sigma_p \leq 0.08$
 $\therefore 1.96 \sqrt{\frac{p(1-p)}{n}} \leq 0.08$
 $\Rightarrow 1.96 \sqrt{\frac{0.10(1-0.10)}{n}} \leq 0.08$
Squaring both sides we get
 $\frac{0.3457}{n} \leq 0.0064 \Rightarrow \frac{0.3457}{0.0064} \leq n$
 $\Rightarrow n \geq 54.02$
 $\therefore$ The sample size should be at least 54.
17. Answer : (e) [< TOP >](#)
Reason : (a) This is an advantage of sampling. The population may be too large to be studied in full. In such situations it is always better to use sampling compared to the study of whole population.
(b) This is an advantage of sampling. A study of sample is usually cheaper than a study of the population. As the number of observations required is less the cost incurred in obtaining and processing these information is also less for sampling.
(c) This is an advantage of sampling. Sampling usually provides information quicker than a census. Since the time required for studying the whole population is large, it is advisable to go for sampling to reduce the time spent in the studying the whole population.
(d) This is an advantage of sampling. In destructive testing, where the product becomes unusable after the performance of test, we cannot test the whole population. In such cases sampling is the only method of testing.
(e) This is **not** an advantage of sampling. In a sampling exercise we use a small number of samples to study the whole population the degree of accuracy is not very high. For accurate information census is always the preferable method compared to sampling.
18. Answer : (a) [< TOP >](#)
Reason : In making estimates of the population parameters using sample statistics, efficiency refers to the size of the standard error of the sample statistic.
19. Answer : (c) [< TOP >](#)
Reason : Option (c) is suitable. In hypothesis testing, the critical region is that the region of the sampling distribution in which the value of sample statistic must fall, for the null hypothesis to be rejected and the alternative hypothesis to be accepted.

20. Answer : (e) [< TOP >](#)
Reason : As the degree of freedom increases t distribution approaches normal distribution.
21. Answer : (d) [< TOP >](#)
Reason : A two tailed test is a test where both upper and lower limits of confidence interval are used to take a decision of accepting null hypothesis.
22. Answer : (e) [< TOP >](#)
Reason : All the options are appropriate in testing hypothesis.
23. Answer : (b) [< TOP >](#)
Reason : Since the cost of rejecting a null hypothesis is more, decision makers will set very low levels of significance in its testing.
24. Answer : (d) [< TOP >](#)
Reason : The method of least squares states that the regression line should be drawn through the plotted points in such a way that the sum of the squares of the vertical deviations of the actual and estimated Y values is minimum. Thus the line of regression becomes the line of 'best fit'. Therefore the correct answer is (d). Other alternatives are wrong.
25. Answer : (c) [< TOP >](#)
Reason :
$$b = \frac{n \sum XY - (\sum X)(\sum Y)}{n \sum X^2 - (\sum X)^2} = \frac{(8 \times 375) - (55 \times 44)}{(8 \times 485) - (55)^2} = \frac{580}{855} = 0.6784$$
$$a = \bar{Y} - b\bar{X} = \frac{44}{8} - 0.6784\left(\frac{55}{8}\right) = 0.8362$$

Standard error is calculated by
$$\sqrt{(\sum Y^2 - a \sum Y - b \sum XY) / (n - 2)}$$
$$= \sqrt{(294 - 0.8362(44) - 0.6784(375)) / (8 - 2)} = \sqrt{0.4678} = 0.684.$$
26. Answer : (e) [< TOP >](#)
Reason : If the standard error of the estimate is zero, the estimating equation is said to be perfect estimator of the dependent variable. When the standard error of the estimate is zero, it implies that all the data points are on the regression line.
27. Answer : (d) [< TOP >](#)
Reason : The standard error is the same at all points on a regression line because we assume that (i) Observed values are normally distributed around each estimated value of y (ii) The variance of the distributions around each possible value of y is the same. So the option (d) is correct.
28. Answer : (a) [< TOP >](#)
Reason : The correlation coefficient between two variables is -1, then all the pairs of observations when plotted on a scatter diagram will lie on the same regression line.
29. Answer : (c) [< TOP >](#)
Reason : The coefficient of correlation $r = \text{cov}(X, Y) / S_X S_Y = 0.04 / (0.2)(0.2) = 1$. Thus the two variables are said to be perfectly positively correlated.
30. Answer : (b) [< TOP >](#)
Reason : Multiple regression analysis is used to relate changes in one dependent variable to more than one independent variable.

31. 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.

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

Reason : Let the following notations be used:

X : Years

x : Coded value of year

Y : Production of sunflower oil (thousand liters)

X	$x = X - \bar{X}$	Y	xY	x^2
2000	-3	75	-225	9
2001	-2	83	-166	4
2002	-1	90	-90	1
2003	0	79	0	0
2004	1	95	95	1
2005	2	110	220	4
2006	3	80	240	9
		$\sum Y = 612$	$\sum xY = 74$	$\sum x^2 = 28$

$$\sum X = 14021$$

$$\therefore \bar{X} = \frac{14021}{7} = 2003$$

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

$$b = \frac{\sum xY}{\sum x^2} = \frac{74}{28} = 2.642 \quad a = \bar{Y} = \frac{612}{7} = 87.428$$

$$\therefore \hat{Y} = 87.428 + 2.642 x$$

For the year 2007: $x = 2007 - 2003 = 4$

$\therefore$ Estimated sugar production = $87.428 + (2.642 \times 4) = 98$ (thousand liters)

i.e. 98,000 liters

33. Answer : (c)

[<TOP>](#)

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

Reason :

Given:

$$n = 10 \quad \sum X = 149 \quad \sum X^2 = 2461 \quad \sum XY = 3532$$

$$\sum Y = 236$$

$$\therefore b = \frac{(10 \times 3532) - (149 \times 236)}{(10 \times 2461) - (149)^2} = \frac{156}{2409} = 0.065$$

$$a = \bar{Y} - b\bar{X} = \frac{236}{10} - 0.065 \left(\frac{149}{10} \right) = 22.63$$

$$\text{Standard error of estimate, } s_e = \sqrt{\frac{\sum Y^2 - a \sum Y - b \sum XY}{n - 2}}$$

$$\sum Y^2 = 8180$$

$$\therefore s_e = \sqrt{\frac{8180 - (22.63 \times 236) - (0.065 \times 3532)}{10 - 2}} = 18.06$$

34. Answer : (c)

[<TOP>](#)

Reason : The standard error of estimate for a regression equation is given by $\sqrt{\frac{\sum (y - \hat{y})^2}{n - 2}}$ where y is the actual value, $\hat{y}$ is the estimated value from the regression equation and n is the number of points. The above relation implies that the standard error of estimate will be zero, if the actual values and the estimated values are equal and in such case the correlation is either perfectly positive (+1) or perfectly negative (-1).

35. Answer : (a)

[<TOP>](#)

- Reason :
- The coefficient of determination is the square of coefficient of correlation (r). Hence it will always be ≥ 0 and ≤ 1 .
 - From above we can see that the coefficient of determination cannot be less than zero.
 - The coefficient of determination is will be equal to 1, only if the coefficient of correlation is equal to -1 or 1; in other cases it will be > 0 and < 1 .
 - The coefficient of determination is always positive; The coefficient of correlation may be negative.
 - Since $-1 \leq r \leq 1$, the coefficient of determination which is the square of coefficient of correlation (r), will always have magnitude less than or equal to r .

36.

Answer : (b)

[< TOP >](#)Reason : Coefficient of determination is given by r^2 .

$$r^2 = \frac{a \sum y + b \sum XY - n\bar{Y}^2}{\sum Y^2 - n\bar{Y}^2}$$

$$\sum Y = 358 \quad \sum Y^2 = 22122$$

$$b = \frac{n \sum XY - \sum X \cdot \sum Y}{n \sum X^2 - (\sum X)^2} = \frac{(6 \times 20787) - (344 \times 358)}{(6 \times 20000) - (344 \times 344)} = \frac{1570}{1664} = 0.9435$$

$$a = \bar{Y} - b\bar{X} = \left(\frac{358}{6}\right) - 0.943 \times \left(\frac{344}{6}\right) = 5.57$$

$$r^2 = \frac{(5.5721 \times 358) + (0.9435 \times 20787) - (6 \times 59.66^2)}{22122 - (6 \times 59.66^2)} = \frac{247.15}{761.8106} = 0.3244$$

 $\therefore$

37.

Answer : (d)

[< TOP >](#)Reason : Explained variation is given by $r^2 = (0.55)^2 = 0.3025$ and hence the unexplained variation is given by $= 1 - 0.3025 = 0.6975 \approx 70\%$.

38.

Answer : (a)

[< TOP >](#)Reason : Correlation coefficient is the square root of coefficient of determination. In this case $\sqrt{0.64} = \pm 0.80$. As the slope of the regression equation is negative so the correlation coefficient is -0.80 .

39.

Answer : (c)

[< TOP >](#)

$$\text{Reason : Standard error of estimate, } s_e = \sqrt{\frac{\sum Y^2 - a \sum Y - b \sum XY}{n - 2}}$$

$$\sum Y^2 = 81500 \text{ (given)}$$

$$\sum Y = \bar{Y} \times n = 110 \times 5 = 550$$

$$\sum XY = 5,180 \text{ (given)}$$

$$\hat{Y} = 156 - 2.4X$$

$$\therefore a = 156 \text{ and } b = -2.4$$

$$\therefore s_e = \sqrt{\frac{81500 - (156)(550) - (-2.4)(5180)}{5 - 2}} = 52.06.$$

The sample size is less than 30 and the standard deviation of the population is not known. Hence the appropriate distribution to be used for the prediction interval is the t-distribution.

$$\text{Degrees of freedom} = n - 2 = 5 - 2 = 3.$$

The appropriate t-value is 2.353 (from the t-table)

The limits of the prediction interval are given below:

$$\text{For, } x = 1.80, \quad \hat{Y} = 156 - 2.4(1.80) = 151.68$$

$$\begin{aligned} \text{The prediction interval is: } \hat{Y} - t(s_e) &= 151.68 \pm 2.353(52.06) \\ &= 151.68 \pm 122.50 \end{aligned}$$

40. Answer : (e) [< TOP >](#)
Reason : A value index cannot distinguish between the price changes and quantity changes. Hence an increase in the value index cannot indicate with certainty that the prices have increased.

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

$$\text{Weighted average of relatives price index} = \frac{\sum \left[\left(\frac{P_1}{P_0} \times 100 \right) (P_n Q_n) \right]}{\sum P_n Q_n}$$

P_0 = Base year (2000) price
 P_1 = Current year (2006) price
 P_n = Price in the year 2004 to be used in weights
 Q_n = Quantity in the year 2004 to be used in weights
 $\therefore$ Weighted average of relatives price index for 2006

$$= \frac{\left[\left(\frac{14}{11} \times 100 \right) \times (13 \times 2500) + \left(\frac{11.50}{8.50} \times 100 \right) \times (9.75 \times 1000) + \left(\frac{5.00}{3.50} \times 100 \right) \times (4.25 \times 500) + \left(\frac{14.00}{12.50} \times 100 \right) \times (13 \times 750) + \left(\frac{29.50}{24.50} \times 100 \right) \times (27 \times 1200) \right]}{[(13 \times 2500) + (9.75 \times 1000) + (4.25 \times 500) + (13 \times 750) + (27 \times 1200)]}$$

$$= \frac{4136363.64 + 1319117.65 + 303571.43 + 1092000 + 3901224.49}{86525} = 124.27$$

42. Answer : (e) [< TOP >](#)
Reason : An index number is in fact a device that facilitates then
- (i) Comparison of the level of magnitude of a group of related variables under two or more situations.
 - (ii) To bring out the changes in data magnitudes occurring over time
 - (iii) To highlight the variations in data on similar categories of objects.
- So option (e) is correct.

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

$$\text{Laspeyres price index} = \frac{\sum P_1 Q_0}{\sum P_0 Q_0} \times 100 = \frac{\left[\frac{\sum P_1 Q_0}{\sum Q_0} \right]}{\left[\frac{\sum P_0 Q_0}{\sum Q_0} \right]} = \frac{\text{WAV (current)}}{\text{WAV (base)}} \times 100$$

Given: $\frac{\text{WAV (base)}}{\text{WAV (current)}} \times 100 = 75$ or $\frac{\text{WAV (base)}}{\text{WAV (current)}} = \frac{75}{100}$ or

$$\frac{\text{WAV (current)}}{\text{WAV (base)}} = \frac{100}{75}$$

$$\therefore \text{Laspeyres price index} = \left(\frac{100}{75} \right) \times 100 = 133.33$$

44. Answer : (c)

[< TOP >](#)

Reason : Paasches price index = $\frac{\sum P_1 Q_1}{\sum P_0 Q_1} \times 100$

For each good : $P_1 Q_1 = P_1 Q_0 \times \frac{Q_1}{Q_0}$

$P_0 Q_1 = P_0 Q_0 \times \frac{Q_1}{Q_0}$

∴ We can rewrite from the table:

Good	$P_1 Q_0$	$P_0 Q_0$	$\frac{Q_1}{Q_0}$	$P_1 Q_1 = P_1 Q_0 \times \frac{Q_1}{Q_0}$	$P_0 Q_1 = P_0 Q_0 \times \frac{Q_1}{Q_0}$
A	550	630	3/4	412.5	472.5
B	840	840	1/2	420	420
C	1350	750	3/5	810	450
D	840	630	5/6	700	525
				$\sum P_1 Q_1$ 2342.5	$\sum P_0 Q_1$ 1867.5

∴ Paasches price index = $\frac{\sum P_1 Q_1}{\sum P_0 Q_1} \times 100 = \frac{2342.5}{1867.5} \times 100 = 125.43$.

45. Answer : (b)

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Reason : The weighted average of relatives price index when base year values are used as weights which is incidentally is the weighted aggregate price index using Laspeyres method. The weighted average of price relatives using base values is the same as the weighted aggregate of actual prices (Laspeyres method).

46. Answer : (e)

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Reason : The distortion of index numbers is due to (i) Inappropriate weighting of factors, (ii) Availability of limited data, (iii) Selection of an improper base and (iv) Incomparability of indices. Option (e) is correct.

47. Answer : (c)

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Reason : Unweighted aggregates price index = $\frac{\sum p_n}{\sum p_0} \times 100$

$$= \frac{(10.50 + 12.50 + 28)}{(8.50 + 11.50 + 15)} \times 100$$

$$= 145.71$$

48. Answer : (b)

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Reason : The cancellation of the highest and the lowest of the seasonal values reduces the extreme cyclical and irregular variations. All other options are false except (b).

49. Answer : (b)

[< TOP >](#)

Reason : Repetitive and predictable movement around the trend line in one year or less is known as Seasonal variation. So option (b) is true.

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

Reason : (a), (b) and (d) are not expressed as percentage of the estimated secular trend values. Cyclical variations are expressed as a percentage of the estimated secular trend values. Hence (c) is the answer.

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

Reason : The moving average of two data points of the observations 4, 5, 7, 8, 5 and 2 are $(4 + 5)/2$, $(5 + 7)/2$, $(7 + 8)/2$, $(8 + 5)/2$ and $(5 + 2)/2$ that is 4.5, 6, 7.5, 6.5 and 3.5.

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

Reason :

X	$(X - \bar{X})$	$x = (X - \bar{X}) \times 2$	Y	$\hat{Y}$	$\frac{Y - \hat{Y}}{\hat{Y}} \times 100 (\%)$	xY	x^2
2006	2006-2003.5	5	162	145.833 + 2.271(5) = 157.188	3.06	810	25
2005	2005-2003.5	3	153			459	9
2004	2004-2003.5	1	142			142	1
2003	2003-2003.5	-1	148			-148	1
2002	2002-2003.5	-3	123			-369	9
2001	2001-2003.5	-5	147			-735	25
			$\Sigma Y = 875$			$\Sigma xY = 159$	$\Sigma x^2 = 70$

$$\bar{X} = 12021/6 = 2003.5$$

The estimating equation is : $\hat{Y} = a + bx$

$$b = \frac{\Sigma xY}{\Sigma x^2} = \frac{159}{70} = 2.271$$

$$a = \frac{\bar{Y}}{6} = \frac{875}{6} = 145.833$$

$\therefore$ The estimating equation is : $\hat{Y} = 145.833 + 2.271x$

From above we can see that relative cyclical residual for 2006 is 3.06.

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

Reason : $\hat{Y} = 85.12 + 452.5X_1 - 125.25X_2$

Given: $X_1 = 3$, $X_2 = 4$

$\therefore \hat{Y} = 85.12 + 452.5(3) - 125.20(4) = 941.82 \approx \text{Rs.}942.$

54.

Answer : (a)

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Reason : We observe that the number of data points is odd. The working is shown below:

	Years (X)	Inventory (Y)	$x = X - \bar{X}$	$x.Y$	x^2
	2002	3654	-2	-7308	4
	2003	2845	-1	-2845	1
	2004	2564	0	0	0
	2005	3568	1	3568	1
	2006	3584	2	7168	4
Total	10020	16215	0	583	10

The mean of "X" = $\frac{10020}{5} = 2004$

We have $b = \frac{\sum xY}{\sum x^2} = \frac{583}{10} = 58.3$

$a = \bar{Y} = \frac{16215}{5} = 3243$

Therefore the estimating equation is $\hat{Y} = 3243 + 58.3x$ (in thousands rupees)

55.

Answer : (c)

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Reason : The variation in the demand of fast foods can be well explained by seasonal variation. The variations observed in different seasons of a year can be best explained with the help of seasonal variation component. To find a long term forecasting first the time series has to be deseasonalized to get an accurate estimation.

56.

Answer : (d)

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Reason : We now substitute the year 2008 after translating it in the estimating equation. That will be $2008 - 2003.5 = 4.5$. This value is multiplied by 2 will give us 9 half intervals. We have

$$\hat{Y} = 6.4 + 0.2186(9) = 8.367$$

That is, in the year 2008, the working capital requirement is expected to be Rs. 8.367 lakh.

We now substitute the year 2009 after translating it in the estimating equation. That will be $2009 - 2003.5 = 5.5$. This value is multiplied by 2 will give us 10 half intervals. We have

$$\hat{Y} = 6.4 + 0.2186(10) = 8.58$$

That is, in the year 2009, the working capital requirement is expected to be Rs. 8.58 lakh.

57.

Answer : (e)

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Reason :

$$\begin{aligned} \text{The upper control limit} &= \bar{p} + 3 \sqrt{\frac{pq}{n}} = 0.08 + 3 \times \sqrt{\frac{0.08 \times 0.92}{50}} \\ &= 0.08 + 3 \times 0.038 = 0.08 + 0.115 = 0.195 \end{aligned}$$

58. Answer : (b)

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Reason : $\bar{p} = \frac{42}{150} = 0.28 \quad \bar{q} = 1 - \bar{p} = 0.72$

Estimated standard error or proportion, $\hat{\sigma}_{\bar{p}} = \sqrt{\frac{\bar{p}\bar{q}}{n}} = \sqrt{\frac{0.28 \times 0.72}{150}}$
 $= 0.0366$

Z-Values for the upper confidence limit is 2.327

Upper confidence limit $= \bar{p} + (2.327 \times \hat{\sigma}_{\bar{p}}) = 0.28 + (2.327 \times 0.0366) = 0.3651$

59. Answer : (b)

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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:

$$\frac{1}{6} (950 + 945 + 950 + 955 + 965 + 959) = \frac{5724}{6} = 954$$

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

month	Frequency Observed (f_i) Expected (e_i)		($f_i - e_i$) ² e_i
Jan	950	954	16
March	945	954	81
May	950	954	16
July.	955	954	1
Sep	965	954	121
Nov.	959	954	25
Total	5724	5724	0.272537

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

i.e. $\chi^2 = \sum \frac{(f_i - e_i)^2}{e_i} = 0.2725$

60. Answer : (c)

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Reason : In statistical process control, the data set which can take on only two values is called an attribute. Thus, we can conclude that both (a) and (b) have the characteristics of an attribute.

61. Answer : (c)

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Reason : The Lower Control Limit in an R Chart $= \bar{R} - \frac{3d_3 \bar{R}}{d_2}$
 $= 3.2 - \frac{3 \times 0.642 \times 3.2}{3.254}$
 $= 1.306$

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

62. Answer : (b)

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Reason : Upper control limit (UCL) of a p-chart = $p + 3\sqrt{\frac{pq}{n}}$

$$p = \bar{p} = 0.19$$

$$UCL = 0.19 + 3\sqrt{\frac{(0.19)(1-0.19)}{49}} = 0.3581$$

$$\begin{aligned} \text{Lower control limit(LCL)} &= p - 3\sqrt{\frac{pq}{n}} \\ &= 0.19 - 0.1681 = 0.0219. \end{aligned}$$

63. Answer : (a)

[< TOP >](#)

Reason : Since we are given $\bar{\bar{X}}$ and R, we proceed to calculate the grand mean $\bar{\bar{X}}$. It is calculated as shown below.

$$\bar{\bar{X}} = \frac{\sum \bar{x}}{k} = \frac{206}{14} = 14.71$$

At this point $\bar{\bar{X}}$, the center line in the $\bar{x}$ chart is drawn. We compute R, before control limits are

$$\text{calculated. The value of } \bar{R} = \frac{\sum R}{K} = \frac{252.3}{14} = 18.02$$

The upper and lower control limits are calculated as follows:

$$LCL = \bar{\bar{X}} - 3\frac{\bar{R}}{d_2\sqrt{n}} = 14.71 - \frac{3(18.02)}{3.078(\sqrt{10})} = 14.71 - 4.610 = 10.1$$

$$UCL = \bar{\bar{X}} + 3\frac{\bar{R}}{d_2\sqrt{n}} = 14.71 + \frac{3(18.02)}{3.078(\sqrt{10})} = 14.71 + 4.610 = 19.32$$

64. Answer : (c)

[< TOP >](#)

Reason : The number of degrees of freedom for the denominator of the F-ratio

$$= n_T - k \text{ where } (n_T = \text{Total number of elements} = 11 + 9 + 10 = 30)$$

$$(k = \text{Number of samples} = 3)$$

$$= 30 - 3$$

$$= 27.$$

65. Answer : (b)

[< TOP >](#)

Reason : Pooled estimate of the underlying common population variance,

$$s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2} = \frac{(25 - 1)15^2 + (16 - 1)9^2}{25 + 16 - 2} = 169.61$$

$$\text{Estimated standard error of difference between means} = s_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}} = \sqrt{169.61 \left(\frac{1}{25} + \frac{1}{16} \right)} = 4.169$$

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

Reason : Chi square test is used for :

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.

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

Reason : In performing a chi-square test of independence, as the difference between the respective observed and expected frequencies decreases, the probability of accepting the null hypothesis increases.

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

Reason : Degree of freedom for numerator = Number of samples – 1

$$= 2 - 1$$

$$= 1.$$

Degree of freedom for denominator = Total number of elements present in all the samples - Number of samples

$$= 20 - 2$$

$$= 18.$$

From F distribution table, at 0.05 level of significance, and above degrees of freedom, the critical value comes out to be 4.41. Hence from above discussion, we can infer that option (c) is correct.

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

Reason : When performing a chi- square hypothesis test, when expected frequencies in several cells are too small, the value of χ^2 will be overestimated and the null hypothesis will be more likely to be rejected than it should be.

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

Reason : We find the variance within samples with the help of following table:

	x_{1i}	$(x_{1i} - \bar{x}_1)^2$	x_{2i}	$(x_{2i} - \bar{x}_2)^2$	x_3	$(x_{3i} - \bar{x}_3)^2$	x_4	$(x_{4i} - \bar{x}_4)^2$
	75	25	85	4	74	1	78	1
	83	9	84	9	75	0	69	64
	85	25	93	36	70	25	75	4
	79	1	92	25	81	36	82	25
	78	4	81	36	75	0	81	16
Sum	400	64	435	110	375	62	385	110
Mean	80		87		75		77	

Therefore variance within the samples

$$= \frac{\sum (n_j - 1) s_j^2}{n_T - k} = \frac{\sum \sum (x_{ji} - \bar{x}_j)^2}{n_T - k} = \frac{64 + 110 + 62 + 110}{20 - 4} = \frac{346}{16} = 21.625$$

71.

Answer : (d)

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

Number	X_1	$(X_1 - \bar{X}_1)^2$	X_2	$(X_2 - \bar{X}_2)^2$
1	62	-3	84	2
2	59	-6	85	3
3	61	-4	81	-1
4	65	0	90	8
5	78	13	78	-4
6			74	-8
Sum	325		492	
Means	65		82	
Sample Variance		57.5		31.6

$$\text{The test statistic } F = \frac{S_2^2}{S_1^2} = \frac{31.6}{57.5} = 0.5495$$

Since the value of the $F = \frac{S_2^2}{S_1^2} < 1$, so we take F ratio as $\frac{S_1^2}{S_2^2} = \frac{57.5}{31.6} = 1.8196$. [The value of F can never be < 1].

72.

Answer : (d)

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Reason : When carrying out a chi-square test of independence it can be stated in the null hypothesis that the population can be classified on the basis of two criteria which are independent (i.e., not associated)

73.

Answer : (e)

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Reason : It is suitable to analyze large and complex real-life problems which cannot be solved by usual quantitative methods. This is the advantage of simulation.

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