

24/02/2016

De Mazenod College – Kandana.

**Buisness Statictics**



Grade 13

Paper1

Two hours

Answer all questions.

Underline the most appropriate answer.

1) Which of the following statement is true?

i. Making decisions about the entire population based on sample information is a major task of Descriptive statistics.

ii. Data which are extracted from the central bank report is an example for primary data.

iii. There is no difference between Questionnaire and a schedule.

iv. Statistics does not study the individuals, It studies only whole information.

v. Defectiveness of an item is a quantitative variable in the production process.

2) Schedule is used by,

i. Respondent.

iv. Data analyst.

ii. Interviewer.

v. Supervisor.

iii. Planner.

3. Which of the following statement is true?

i. Generally personnel interview method is a less costly method.

ii. Success of a personnel interview method mainly depends on the literate level of a respondent.

iii. Editing should be put in to effect before analyzing the data which are gathered from a survey.

iv. When people scattered over a wide geographical area, the most appropriate method is the personnel interview method.

v. We can check the completeness of the Questionnaire in the process of editing.

4. Height of the people of a sample is given below.

65,71,68,58,65,64,66,69,68,65. ( in inches)

Which of the following statement is true?

| Frequency | a         | b     | c         |
|-----------|-----------|-------|-----------|
| 1         | 58.5-61.5 | 58-60 | 57.5-60.5 |
| 0         | 61.5-64.5 | 61-63 | 60.5-63.5 |
| 5         | 64.5-67.5 | 64-66 | 63.5-66.5 |
| 3         | 67.5-70.5 | 67-69 | 66.5-69.5 |
| 1         | 70.5-73.5 | 70-72 | 69.5-72.5 |

- I. a column is true.
- II. b column is true.
- III. c column is true.
- IV. a & c columns are only true.
- V. b & c columns are only true.

5. Which method is the most appropriate one to show the disparity of production in a large scale industry?

- I. Ogive curve.
- II. Pie chart.
- III. Component bar chart.
- IV. Lorenze curve.
- V. Mode diagram.

6. An inquiry into the population of a town showed that the total was 310000 persons of whom 60% were females. 55000 females and 50000 males were aged under 35. the percentages of male and females who lived in rent houses were 60% and 40% respectively. Find the no; of males who permanently lived in their own houses and were aged more than 35.

- I. 20 000.
- II. 29 600.
- III. 30 000.
- IV. 33 000.
- V. 44 400.

7. Statistics marks obtained by 15 students are given below.

16, 28, 28, 36, 40, 44, 52, 60, 60, 60, 68, 68, 76, 76, 80

After calculation mode, median and mean, it revealed that 68 marks were recorded as 60 marks. Which central tendency measure / measures can be affected by this human error?

- I. Mean only
- II. Mode only.

- III. Median only.
- IV. both mode and median.
- V. Mean, Median and Mode.

8. Person who is at 45<sup>th</sup> percentile shows,

- I. He has marked 45% correct answers in a test.
- II. He has 45% knowledge of a given subject.
- III. He has obtained marks equal or greater than 45 students of his class.
- IV. He has obtained marks equal or greater than 45% students of his class.
- V. He has obtained marks equal or greater than 55% students of his class.

9. In a certain population mean and variance are 25 and 0 respectively. Select your conclusion about this population.

- I. Any body had made a calculation mistake.
- II. There is only one observation in this population.
- III. There aren't any observations in this population.
- IV. all values are 25.
- V. Population size is too small.

10. Mean, Median and Mode of a certain distribution are 6, 7, and 9 respectively. This distribution is,

- I. Negatively skewed
- II. Not skewed.
- III. Positively skewed.
- IV. Symmetrical.
- V. Bi mode.

11. To measure the acidity (pH level) , 30 working areas in an industrial area were used. Mean and standard deviation of these values are 4.60 and 1.10 respectively. When rechecked for the accuracy, the pH meter was found to be with errors. They have found that they can recorrect these errors by adding 0.1 pH units for all the values and after multiplying the result from 1.2. Correct mean and standard deviation are,

- I. 5.64 and 1.44.
- II. 5.64 and 1.32.
- III. 5.40 and 1.44.
- IV. 5.40 and 1.32.
- V. 5.64 and 1.20.

12. Data about two herd of bulls (A & B) are given below.

|                           | A      | B      |
|---------------------------|--------|--------|
| Sample size               | 20     | 14     |
| Sample mean               | 454 kg | 363 kg |
| Sample standard deviation | 36 kg  | 32 kg  |

- i. Standard deviation of A is greater than B, therefore variance of A is smaller than B.
- ii. Coefficient of variance of A is smaller than B, therefore relative variance of A is smaller than B.
- iii. Standard deviation of A is smaller than B, therefore variance of A is smaller than B.
- iv. Coefficient of variance of B is smaller than A, therefore relative variance of A is smaller than B.
- v. Sample size of A is greater than B, therefore variance of A is greater than B.

13. Suppose the estimated regression equation is,

$$\hat{y} = 16 - 0.1x \text{ and } R^2 = 0.81$$

- A - b is too small, it shows that X & Y do not slightly correlated .  
B - b is too small, therefore it shows that X would not help to express Y.  
C - Coefficient of correlation ( r ) is 0.9.

Which of the following statement is true?

- i. Only A.
- ii. Only B.
- iii. Only C.
- iv. Only A & B.
- v. Only B & C.

14. Correlation coefficient between X & Y is zero. It indicates that,

- i. Variances of X & Y are equal.
- ii. There is no relationship between X & Y.
- iii. There is no linear relationship between X & Y.
- iv. X & Y are independent.
- v. Means of X & Y are equal.

15. Suppose the estimated equation is,

$$\hat{y} = 2.54 + 3.5x$$

- I. When x is increased by one unit,  $\hat{y}$  also increased by 3.5 units
- II. When x is increased by one unit,  $\hat{y}$  also decreased by 3.5 units.
- III. When x is increased by 3.5 units,  $\hat{y}$  also increased by 3.5 units
- IV. When x is increased by one unit,  $\hat{y}$  also increased by 6 units.
- V. When x is decreased by one unit,  $\hat{y}$  is also decreased by 6 units.

16. A student is tossed a coin two times and he has decided that this coin is a biased one. Under what approach he has decided it?

- I. Classical approach
- II. Relative frequency approach.
- III. Subjective approach.
- IV. Classical & Relative frequency approach.
- V. Relative frequency approach & Subjective approach.

17. A & B are any events.  $P(A) = P(B)$ ,  $P(A) \neq 0$  and  $P(B) \neq 0$ .

Which statement is true according to the above mentioned data.

- I.  $P(A \cap B) = 0$
- II.  $P(A \cap B) = P(A)$
- III.  $P(B/A) = P(A/B)$
- IV.  $P(A) = P(B) = 1/2$
- V.  $P(A \cap B) = P(B)$

18. Statements of three students about the mutually exclusive events are given below.

A – These events are collectively exhaustive at all.

B – These events are independent.

C – These events are dependent.

- I. A's statement is true.
- II. C's statement is true.
- III. B's statement is true.
- IV. Both A's & C's statements are true.
- V. Both A's & B's statements are true.

19. Probability distribution of random variable Y is given below.

|      |        |             |            |   |
|------|--------|-------------|------------|---|
| y    | -1     | 0           | 1          | 2 |
| P(y) | $2C^2$ | $3C^2 + 2C$ | $C^2 - 2C$ | C |

What is the value of C?

- I.  $-1/2$ .
- II.  $1/2$ .
- III.  $1/3$ .
- IV.  $1/6$ .
- V.  $1$

20. Expected value & variance of X are  $E(X) = 0.4$  and  $\text{Var}(X) = 0.84$  respectively, If  $Y = 2X + 3$ , the expected value and variance of Y are,

- I. 3.80 and 6.36 respectively.
- II. 3.80 and 3.36 respectively.
- III. 10.6 and 6.36 respectively.
- IV. 0.40 and 0.84 respectively.
- V. 0.80 and 1.68 respectively.

21. If A & B are Independent events, which of the following statement is not true?

- I.  $P(A \cap B) = P(A) \cdot P(B)$
- II.  $P(A \cap B) = P(A) \cdot P(B/A)$
- III.  $P(A \cap B) = P(A) \cdot P(B)$
- IV.  $P(A \cap B) = 0$
- V.  $P(A/B) = P(A)$

22. 60% of Bulls were contracted with a Disease. Lets consider in a random sample of size 10, Y is the no: of bulls who do not contracted with this disease. What is the most appropriate probability distribution of which can be used to express the random variable Y.?

- I. Y is distributed as Binomial with  $n = 10$  &  $p = 0.6$ .
- II. Y is distributed as Binomial with  $n = 10$  &  $p = 0.4$ .
- III. Y is distributed as Binomial with  $n = 10$  &  $p = 0.5$ .
- IV. Y is distributed as Poisson with  $\lambda = 10$ .
- V. Y is distributed as Poisson with  $\lambda = 4$ .

23.  $3 P(X = 1) = P(X = 2)$  of variable X is in a Poisson distribution. The variance of this distribution is,

- I.  $\sqrt{6}$ .
- II. 6.
- III.  $\sqrt{42}$ .
- IV. 36.
- V. 42.

24. The correlation coefficient is,

- I a measure which has units of original data.
- II a measure which has units of square roots of the original data.
- III a unit less measure.
- IV none of above.

25. In a multiple question paper, two students have scored 88 marks and 64 marks respectively. Standard deviations of these two marks are 08 and 4 respectively. Combined mean and combined standard deviations of these two marks are,

- I 72 and 4.5
- II 72 and 16
- III 72 and 20
- IV 75 and 4
- V 76 and 7

26. Cluster sampling become more effective,

- I When the variation within clusters is small and variation between clusters is large.
- II When the variation within clusters is large and variation between clusters is small.
- III When the intra cluster correlation coefficient within clusters is high.
- IV When both variation within clusters and variation between clusters are small.
- V When both variation within clusters and variation between clusters are large.

27. Systematic sampling become more efficient than simple random sampling,

- I When population is in random order.
- II When population is in cyclical order.
- III When population is in increasing order.
- IV When population size is small.
- V When population variance is small.

28. Which of following statement is not true?

- I Measuring biasness is an example for non sampling errors.
- II In an optimum Research, sampling population is equal to target population.
- III Sampling errors can be minimized by increasing sample size.
- IV In non random sampling, standard error of estimators cannot be measured.
- V If sample size is large, non response error need not be considered.

29. Mean of a sample with size 36 which taken from normal distributiōn with mean 25 and variance 9 is  $\bar{X}$  and mean of a sample with size 40 which taken from a normal distribution with mean 20 and variance 4 is  $\bar{Y}$ . If X and Y are independent, then the sampling distribution of  $\bar{X} - \bar{Y}$  is,

- I A normal distribution with mean 5 and variance 7/20.
- II An approximately normal distribution with mean 5 and variance 7/20.
- III A normal distribution with mean 5 and variance 13.
- IV An approximately normal distribution with mean 45 and variance 8/5.
- V A normal distribution with mean 45 and variance  $\sqrt{14/40}$ .

30. According to central limit Theorem, when the population is not normally distributed and if n is large,

- I Sampling distribution of sample mean is normally distributed.
- II Sampling distribution of sample mean is approximately normally distributed.
- III Variance of sample mean is in a normally distribution.
- IV Sample is approximately normally distributed.
- V Sample median is approximately normally distributed.

31. Mean and standard deviation of a sample with size 14, which taken from a normal distribution are 38.5 and 12.43. In order to develop 99% confidence interval, the value that should be selected from normal distribution table is,

- I 2.33
- II 2.58
- III 2.62
- IV 2.65
- V 3.01



32. When continuously developing 95% confidence interval for population mean  $\mu$ , which of the following statement become more reliable?

- I Approximately in 95 times out of 100 times,  $\mu$  included in the interval.
- II Approximately in 95 times out of 100 times,  $\mu$  is covered by the interval.
- III Out of 100 populations, mean of 95 populations included in the interval.
- IV Approximately in 95 times out of 100 times, sample mean is covered by the interval.
- V In 95 times out of 100 times sample mean  $\bar{x}$  is covered by the interval

33. The diameter of a certain type of bearing is lie in a normal distribution with unknown mean and variance. Mean of a sample with size 25 which taken from this population is 12.5. If the length of 95% confidence interval for mean is 4 cm,

- I Sample variance is 4.85
- II Sample variance is 23.56
- III Sample variance is 23.56
- IV Population variance is 5.10
- V Population variance is 23.56

34. 400 people were selected from large population. Out of them 80 people use vitamins. Width of the 95% confidence interval for true proportion of vitamins uses is,

- I 0.0157
- II 0.0328
- III 0.0392
- IV 0.0656
- V 0.0784

35. Which of the following assumption / assumptions is required to test a hypothesis for a mean  $\mu$  of a population with unknown population variance: by using Normal distribution table and mean of  $X_1, X_2, \dots, X_n$

- A – Data is a random sample.
- B – Population is normally distributed.
- C – Sample size is large.
- D – Population size is small.

- I A and B
- II A and D
- III B and D
- IV C and D
- V A,B and D

36. If the confidence level of a statistical test for population mean  $H_0: \mu = 10$  is  $\alpha = 0.05$ ,

- I In 95% situations we make incorrect inferences
- II In 5% of situations where there is no any difference, we say that there is a difference.
- III In 5% situation where there is a difference, we say that there is no any difference.
- IV In 95% situations, Null hypothesis become correct
- V In 5% situations, we make correct inferences.

37. A says, the current market value of his home is minimum 4 million. He requested from twelve properly valutors to estimate the value of his house independently. The decision of "Reject the  $H_0$ " has made by the hypothesis test which done after the estimation. The statement which present the conclusion correctly is,

- I A is correct – value of the house is 4 million.
- II A is correct – value of the house is less than 4 million.
- III A is incorrect – value of the house is less than 4 million.
- IV A is incorrect – value of the house is more than 4 million.
- V A is incorrect – he should not sell the house.

38. Following are the accidents happened in electric bulb production factory.

| Type of accident<br>Age | Fractures | Burns | Cuts |
|-------------------------|-----------|-------|------|
| Less than 25            | 9         | 17    | 5    |
| 25 or more than         | 61        | 13    | 12   |

If test statistic is 20.78, the conclusion at  $\alpha = 0.05$  is,

- I There is no relationship between type of accident and age of workers.
- II Age of workers is independent from type of accident.
- III Type of accident are not independent from age groups of workers.
- IV There is 20.78% relationship between type of accident and age of workers.
- V According to age groups, fractures, burns and cuts are happened proportionally.

39. Which of following statements can be considered as assumptions which use in variance analysis.

A – Data has obtained from independent random samples.

B – Population variances are not equal.

C – Population means are equal.

D – Population is normally distributed.

E – Population variances are equal.

Which of above statements are true?

I A,B and C

II A,B and D

III A,D and E

IV B,C and D

V B,C and E

40. Following are the ideas on time series.

A – Able to identify the pattern of data which change according to time and able to express ideas relating to future pattern.

B – Able to express cause effect relationships.

C – A function which is based on the time is a time series.

Out of above statements,

I Only A is true.

II Only B is true.

III Only C is true

IV Only A and B are true.

V Only B and C are true.

41. In business field, time series analysis become more important,

I To identify sales progress and to estimate sales of next time period.

II To forecast sales of next year by identifying sales cycle.

III To express a prediction about recession of sales of business due to accidental event.

IV To estimate sales volume of future years.

V To identify trend by deseasonalizing data.

42. The long term trend equation of a time series which includes annual data is  $Y = 48 + 28.9t$ . Here  $Y$  is annual sales in Rupees thousands and origin is 2005. The trend equation after changing origin to year 2006 is,

- I  $Y = 5.3 + 2t$
- II  $Y = 5.3 + 0.2t$
- III  $Y = 63.6 + 2.4t$
- IV  $Y = 19.6 + 2.4t$
- V  $Y = 5.1 + 0.2t$

43. The ideas on index numbers are given below.

A – Understanding only the purpose is sufficient when developing an index number.

B – Paasche index is an index number which use Quantities of base year as weights.

C – All the items included in an index number not equally important. Therefore it is need to select suitable weights to present importance of each item.

Which of above statement is true,

- I Only A
- II Only B
- III Only C
- IV Only A and B
- V only B and C

44. Following are the definitions obtained from three students A,B and C relating to index numbers.

A – An index number is a statistical measure which planned to present changes in group of variables.

B – An index number is a statistical measure which developed to present changes of group of variables related to time or geographical location or any other characteristic.

C – An index number is a statistical measure which is used to select goods and services according to their importance and value.

The most appropriate definition to define an index number is,

- I A
- II B
- III C
- IV B and C
- V A and B

45. In year 2000, salary of a worker was 6500 and cost of living index was 100. If the cost of living index in year 2008 is 250. How much wage should be earned in 2008 to lead the equal satisfaction in 2000,

- I Rs. 2600
- II Rs. 16250
- III Rs. 25000
- IV Rs. 62500
- V Rs. 65000

46. The values of price indices for year 2000 – 2005 which were calculated by taking a base year as year 2000 were as follows.

| Year        | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 |
|-------------|------|------|------|------|------|------|
| Price Index | 100  | 110  | 120  | 130  | 150  | 175  |

If base year change to year 2003, the new price index for year 2002 and 2005 are respectively.

- I 84.6 and 92.3
- II 84.6 and 134.6
- III 92.3 and 115.4
- IV 92.3 and 134.6
- V 115.4 and 134.6

47. Once in every month, number of faults in a product is observed. The most appropriate control chart to check whether this data coming from controlled production process is,

- I  $\bar{X}$  chart
- II np chart
- III c chart
- IV R chart
- V p chart

48. Standard of a product is  $\mu = 55g$ ,  $\sigma = 4.5g$ . If we select random samples with size 12 from production process,  $CL_{\bar{x}}$ ,  $UCL_{\bar{x}}$ ,  $LCL_{\bar{x}}$  control limits for mean chart are, (when  $n=12$  and  $A=0.866$ )

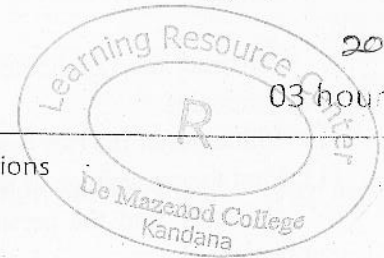
- I 55, 51.5, 59.5
- II 55, 58.6, 50.5
- III 55, 59.5, 51.1
- IV 55, 58.9, 51.1
- V 55, 59.5, 50.5

49. By developing control charts, in statistical quality control,

- I Random variations can be identified.
- II Assignable variations can be identified.
- III Changes in attributes can be identified.
- IV Producer's risk can be identified.
- V Random variations and assignable variations can be identified.

50. In a acceptance sampling plan Lot Tolerance Defective Proportion (LTPD) is 2%. If  $n = 50$  and  $c = 2$ , the producer's risk is,

- I 0.2%
- II 0.26%
- III 0.8%
- IV 2%
- V 8%



Select at least two questions from each part and answer five (5) questions

Part 1

1. a) Particular is regarding information on customer care services of three canteens in an urban area. (in minutes).

|                          | Canteen |     |     |
|--------------------------|---------|-----|-----|
|                          | A       | B   | C   |
| Minimum time             | 90      | 190 | 100 |
| Maximum time             | 200     | 300 | 200 |
| 1 <sup>st</sup> Quartile | 150     | 250 | 130 |
| Median                   | 170     | 275 | 138 |
| 3 <sup>rd</sup> Quartile | 196     | 290 | 146 |

Draw the box plot diagrams on a same graph and interpret the results by comparison.

b) Name most appropriate chart type and giving your justification briefly.

I. General monthly temperature of three years.

II. Annual tea export in Sri Lanka during last four years.

III. Land allocation for major crops in Nuwaraeliya district.

IV. Daily average sales of lotteries which were issued by lottery board and daily sales of lotteries in Colombo district.

c) Following the data regarding the salaries of employees in two companies called A & B. Salaries have categorized under ten scales are given below.

| A                |                                       | B                |                                       |
|------------------|---------------------------------------|------------------|---------------------------------------|
| No: of employees | Money which pay as salaries (In '000) | No: of employees | Money which pay as salaries (In '000) |
| 100              | 75                                    | 50               | 80                                    |
| 100              | 100                                   | 70               | 120                                   |
| 100              | 150                                   | 30               | 60                                    |
| 100              | 225                                   | 25               | 140                                   |
| 100              | 325                                   | 100              | 200                                   |
| 100              | 375                                   | 45               | 200                                   |
| 100              | 450                                   | 30               | 140                                   |
| 100              | 600                                   | 80               | 460                                   |
| 100              | 850                                   | 20               | 120                                   |
| 100              | 1850                                  | 50               | 480                                   |
| 1000             | 5000                                  | 500              | 2000                                  |

1. Construct the Lorenze curves on the same diagram to show the salary distribution of these two companies.

11. Which out of the two companies has high disparity in salary distribution?

111. Find the percentage of salary receiving by 50% employees of each company.

1V. Separately find the percentages of employees receiving 60% out of total salaries of each companies?

2. a) What are limitations of mean in general as a central tendency measure?

b) State the difference between absolute measures of dispersion and relative measures of dispersion.

c) Lives of two models of batteries in a recent survey revealed that,

| Life time(Months): | No: of batteries |         |
|--------------------|------------------|---------|
|                    | Model A          | Model B |
| 0-2                | 3                | 7       |
| 2-4                | 10               | 10      |
| 4-6                | 21               | 11      |
| 6-8                | 9                | 12      |
| 8-10               | 5                | 5       |
| 10-12              | 2                | 5       |

Separately calculate mean and standard deviation of each model.

11. Which model of batteries has long life?

111. Which model of batteries has uniform life?

1V. If prices are the same, which model would you prefer to buy?

d) What do you understand by "Skewness"?

Explain the relative positions of mean, mode and median of positively skewed and negatively skewed distribution.



3. a) Explain the factors to be considered in selecting following items when developing a price index.

i. Base year

ii. Weights

iii. Bulk of commodities

( 03 marks)

b) Following information obtained from a research conducted on median class families live in a city.

|                        | Food | Clothing | Rent | Fuel | Other |
|------------------------|------|----------|------|------|-------|
| Percentage of expenses | 30%  | 15%      | 25%  | 20%  | 10%   |
| Price in 2007 (Rs.)    | 2000 | 1500     | 1000 | 500  | 800   |
| Price in 2008 (Rs.)    | 2500 | 1750     | 1500 | 800  | 1000  |

What kind of change happened in cost of living of these families in year 2008 with compared to year 2007.

(04 marks)

c) Describe semi averages method and moving averages method used in estimating trend in a time series, and mention merits and demerits of each method.

(06 marks)

d) There is a long term increment in annual sales of a garment factory and seasonal variations are also there. Least square trend equation and seasonal indices on annual sales have calculated to analyze variations in sales.

$$\text{Trend equation, } Y = 10.5 + 3.68 X$$

Here X is annual units and X value for year 2007 is 0. Y is quarterly average sales of each year.

Calculated seasonal indices are given below.

| Quarter        | i   | ii  | iii | iv  |
|----------------|-----|-----|-----|-----|
| Seasonal Index | 110 | 108 | 80  | 102 |

Estimate sales for each quarter in year 2010 by using multiplicative model.

(07 marks)

( Total 20 marks)

4. a) Age (T) and annual maintenance cost (C) of lorries used by a certain garment factory for their transportation purposes are given below.

|            |               |     |                  |      |                  |    |                  |    |                      |      |
|------------|---------------|-----|------------------|------|------------------|----|------------------|----|----------------------|------|
| T          | 1             | 2   | 3                | 4    | 5                | 6  | 7                | 8  | 9                    | 10   |
| C (Rs.000) | 3.0           | 6.8 | 10.2             | 12.9 | 16.4             | 20 | 21.4             | 23 | 24.6                 | 26.1 |
| n = 10     | $\sum T = 55$ |     | $\sum C = 164.4$ |      | $\sum T^2 = 385$ |    | $\sum TC = 1117$ |    | $\sum C^2 = 9267.98$ |      |

The relationship between age of vehicles and maintenance cost, basically modeled by calculating single regression line with the use of all above data.

- Draw a scatter diagram for above data
- Present your views on the relationship between two variables.
- Fit the regression line of C on T.
- Consider. An alternative model has proposed by using separate simple line for  $1 \leq t \leq 6$  and separate simple line for  $6 < t \leq 10$ . Draw, simple lines for these alternative models on your scatter diagram without doing any calculation.
- Discuss the suitability of fitting a single simple line for above data. (10 marks)

b) Explain the differences between following concepts.

- Process control and product control
- Random variations and assignable variations. (04 marks)

c) An acceptance sampling scheme consists of taking a sample of 50 from a large batch of components and rejecting the batch if two or more defectives are found.

Draw an OC curve, when the defective probabilities are 1%, 2%, 3%, 4%, 5%, 6%, 8%, and 10%.

Present your ideas on sampling plan. (06 marks)

(Total 20 marks)

## PART II

5.a) Probability of working a certain electrical equipment is 0.95. These type of two equipments were fitted to a machine. This machine works when at least one equipment is working.

i. Write the sample space for this test.

ii. Mention probability of each point in sample space.

iii. What is the probability of working exactly one equipment?

iv. What is the probability of working at least one equipment?

v. How many number of equipments should be used to minimize the probability of not working the machine to 0.0001 level. (08 marks)

b) Prove the total probability theorem and state the Baye's theorem. (06 marks)

c) Certain company buys 70% of equipments from supplier A and 30% of Equipments from supplier B. The percentages of faulty equipments supplied by A and B are 10% and 2% respectively. If you test by selecting an equipment randomly from large lot of equipments, what is the probability that it is supplied by A,

i. when test shows that the equipment is fault one.

ii. when test shows that the equipment is not a fault one. (06 marks)

(Total 20 marks)

6. a) i. Under what conditions poisson distribution can be approximated by a normal distribution.

ii. In a certain town normally motor vehicle accidents are happened once in every two days.

Assuming that the number of accidents happened within a week are lie in a poisson distribution, find the probability of happening exactly two accidents in a given week.

By using a suitable approximation, find the probability oh happening less than 50 motor accidents within 10 weeks. (07 marks)

b) When packing imported apples in boxes, they are grouped as small, median and large size. Apples which are less than 90g are grouped as small and which are more than 150g categorize as large and others are grouped as median. According to past experience, 14% apples are small size and 10% are large size. Assuming that the weights of apples are normally distributed,

- i. Find the mean and variance.
- ii. If it is decided to reject apples which are less than 70g as they are too small. Find the rejected percentage. (8 marks)

c) 5% of goods produced by a production process are defective. If we select a sample with size 40 from this process,

- i. Find the probability of defective units in this sample. <sup>distribution</sup>
- ii. Find the probability of not containing more than three defective items by using a suitable approximation.

7. a) Explain the characteristics of a good estimator.

b)  $X_1, X_2, X_3, X_4$  is a random sample taken from a population with mean  $\mu$  and variance  $\sigma^2$

Following are the three estimators for population mean

$$Z_1 = \frac{X_1 + X_2 + X_3 + X_4}{4} \quad Z_2 = \frac{2X_1 + X_2 + X_3}{4} \quad Z_3 = \frac{X_1 + 2X_2 + 3X_3 + 4X_4}{4}$$

- i. Which of the above estimator is unbiased?
- ii Which is the most efficient estimator?

c) Explain how to select a stratified random sample and systematic sample with size n from population with size N (02 marks)

d) Y values of a population with size 4 is 1, 2, 3, 4

- i. Find the sample mean for all simple random samples without replacement with size  $n$ .
- ii. Write the sample distribution of sample mean  $\bar{y}$  and prove that, sample mean  $\bar{y}$  is an unbiased estimator for population mean  $\mu$
- iii. Prove that variance of sampling distribution of population variance and sample mean  $\bar{y}$ ,

$$\sigma_{\bar{y}}^2 = \frac{\sigma_y^2}{n} \left( \frac{N-n}{N-1} \right) \quad (10 \text{ marks})$$

( Total 20 marks )

8. a) i. Explain the type I error and type II error in hypothesis testing.

ii. Explain the difference between significant level and P- value in hypothesis testing. (04 marks)

b) A government factory which released industrial garbage to a river has <sup>be</sup> faced for some problems. One problem is related with the minimum oxygen limit of aquatics. The following values related to oxygen limit calculated by a random sample with size 11 taken from a certain place.

$$\sum X = 99 \quad \sum X^2 = 892.92$$

Here the oxygen limit is presented by X

- i. Find the 95% confidence interval for mean oxygen limit.
- ii. What are the assumptions to be made in answering part i.
- iii. If environmental standards assigned at least 9.5 oxygen amount, test whether this factory violate the above standard at 0.05 significant level. (10 marks)

c) A medicine manufacturing company is testing two medicines with the purpose of minimizing level of blood pressure. These two medicines gave for two group of animals. Out of 100 animals in first group 71 are having low pressure. And out of 90 animals in second group 58 are having low pressure. Test whether there is a difference between the effectiveness of two type of medicines at 0.05 significant level (06 marks)

(Total 20 marks)