FYUG Even Semester Exam., 2025

STATISTICS

(2nd Semester)

Course No. : STADSM—151

(Statistical Methods and Probability)

Full Marks : 70
Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks for the questions

UNIT—I

1. Answer any *two* of the following questions : $2\times2=4$

(a) Define the terms 'population' and 'sample'. Give examples of each.

(b) Define nominal and ordinal data citing examples of each.

(c) What are the points to be borne in mind while constructing a frequency distribution table?

2. Answer *either* (*a*) and (*b*) or (*c*) and (*d*) :

Either

(*a*) What are grouped and ungrouped frequency distributions? What are their uses? What are the considerations for deciding the magnitude of class intervals while constructing a frequency distribution table? 2+1+2

(*b*) Explain the method of constructing histogram and frequency polygon. 2½+2½

Or

(*c*) Draw a histogram and frequency polygon for the following data :

Monthly wages (in ₹ '000)	*No. of workers*
11–13	6
13–15	53
15–17	85
17–19	56
19–21	21
21–23	16
23–25	8

Continue

(*d*) Draw the less than and more than ogives for the following data : 5

Class	*Frequency*
0–9	8
10–19	32
20–29	142
30–39	216
40–49	240
50–59	206
60–69	143
70–79	13

UNIT—II

3. Answer any *two* of the following questions : 2×2=4

(*a*) What is meant by measures of central tendency? What are the different measures of central tendency?

(*b*) Define mean deviation about mean. State one merit of mean deviation.

(*c*) Define coefficient of variation and mention one of its uses.

(Turn Over)

4. Answer *either* (*a*) and (*b*) *or* (*c*) and (*d*) : 5+5=10

Either

(*a*) Define arithmetic mean. Show that it is affected by change of origin and scale. Also show that the sum of deviations of observation from their arithmetic mean is equal to zero. 1+2+2=5

(*b*) Define mode. Write down the formula for mode for a grouped frequency distributions mentioning how the model class is determined. Mention some merits and demerits of mode. 1+2+2=5

Or

(*c*) Define standard deviation both for grouped and ungrouped data. Show that standard deviation is not affected by change of origin but it is affected by change of scale. 2+3=5

(*d*) Define moments. Express the first four moments about origin. What is the effect of change of origin and scale on moments? 1+2+2=5

UNIT—III

5. Answer any *two* of the following questions : 2×2=4

(*a*) Define Karl Pearson's correlation coefficient. What is the effect of change of origin and scale on the coefficient of correlation?

(*b*) Given $r_{xy} = 0 \cdot 6$, $\text{cov}(x, y) = 4 \cdot 8$, $SD(x) = 3$. Find $SD(y)$. Symbols hold their usual meanings.

(*c*) Define the two lines of regressions.

6. Answer *either* (*a*) and (*b*) *or* (*c*) and (*d*) : 5+5=10

Either

(*a*) Show that the correlation coefficient r is independent of change of origin and scale. Prove that for two independent variables $r = 0$, the converse may not true, with the help of an example. 3+2=5

(*b*) What are the assumptions underlying Karl Pearson's correlation coefficient? For what type of data is Spearman's rank correlation used? 4+1=5

Or

(*c*) Define regression coefficient and mention two of their properties. Why there are two lines of regression? 1+2+2=5

(*d*) Write a note on the principle of least squares. Write down the normal equations for fitting curves of the form $y = a + bx + cx^2$. 3+1+1=5

UNIT—IV

7. Answer any *two* of the following questions : 2×2

(a) If A, B and C are any three events, write down the theoretical expressions for the following events :

(i) Only A occurs

(ii) $A+B$ occur but C does not occur

(iii) All the events occur

(iv) None occur

(b) State (i) events can be mutually exclusive and exhaustive, (ii) events be exhaustive and independent.

(c) Give the statistical definition of probability.

8. Answer *either* (a) and (b) *or* (c) and (d) : 5+5=10

Either

(a) Two unbiased dice are thrown. Find the probability that (i) both the dice show the same number, (ii) the first die shows 6, (iii) the total of the numbers on the dice is 8 (iv) the total of the numbers on the dice is greater than 8. 5

(Continued)

(b) Four cards are drawn at random from a pack of 5 cards. Find the probability that (i) they are a king, a queen, a jack and an ace, (ii) two are kings and two are queens, (iii) two are black and two are red. 5

Or

(c) Give the axiomatic definition of probability. Also prove the following : 2+(1+1+1)=5

(i) $P(\varphi)=0$

(ii) $P(\overline{A})=1-P(A)$

(iii) $P(A)+P(\overline{A})=1$

(d) For any two events A and B, prove that 5

(i) $P(\overline{A}\cap B)=P(B)-P(A\cap B)$

(ii) $P(A\cap \overline{B})=P(A)-P(A\cap B)$

UNIT—V

9. Answer any *two* of the following questions : 2×2=4

(a) Define pair-wise and mutually independent events.

(b) State the multiplication theorem of probability.

(c) If A and B are independent events, then prove that A and $\overline{B}$ are also independent events.

(Turn Over)

10. Answer *either* (a) and (b) *or* (c) and (d) : 5+5

Either

(a) A problem of statistics is given to 3 students A, B and C whose chances of solving it are $\frac{1}{2}$, $\frac{3}{4}$ and $\frac{1}{4}$ respectively. What is the probability that the problem will be solved?

(b) A box contains 6 red, 4 white and 5 black balls. A person draws 4 balls at random from the box. Find the probability that among the balls drawn, there is at least one ball of each colour.

Or

(c) For any two events A and B, show that
$$P(A \cap B) \leq P(A) \leq P(A \cup B) \leq P(A) + P(B).$$ 5

(d) The contents of urns I, II and III are as follows :

1 white, 2 black and 3 red balls
2 white, 1 black and 1 red balls
4 white, 5 black and 3 red balls

One urn is chosen at random and two balls are drawn. They happen to be white and red. What is the probability that they come from urn I, II or III? 5

★ ★ ★