FYUG Even Semester Exam., 2024

STATISTICS

(2nd Semester)

Course No. : STADSM–151T

(Statistical Methods and Probability)

Full Marks : 70

Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks for the questions

SECTION—A

Answer any *ten* of the following questions : $2 \times 10 = 20$

1. Define the term 'statistics'. Mention some limitations of statistics.

2. Define qualitative and quantitative data with examples.

3. What are discrete and continuous data? Give examples.

4. Define mode of a distribution. Write down the formula for mode for a continuous frequency distribution.

5. What do you mean by measures of dispersion? What are the different measures of dispersion?

6. What are raw moments and central moments of the rth order?

7. Write the properties of Karl Pearson's correlation coefficient.

8. If $b_{XY} > 1$, then $b_{YX} < 1$, prove it, when b_{XY} is the regression coefficient of X on Y and b_{YX} is the regression coefficient of Y on X.

9. Mention two properties of regression coefficients.

10. Define a random experiment. Give an example.

11. Define the terms 'trial' and 'event'.

12. Give the axiomatic definition of probability.

13. State the addition theorem of probability.

14. If A and B are two independent events and $P(A \cap B) = \cdot 25$ and $P(A) = \cdot 5$, then what is $P(B)$?

15. If A and B are two mutually exclusive events, then $P(A \cup B) = ?$

SECTION—B

Answer any *five* of the following questions : 10×5=50

16. (a) What are the different types of data used in statistics? Define them and cite examples of each. 2+2+1=5

(b) Write a note on graphical representation of statistical data. 5

17. (a) Represent the following data with the help of a histogram : 5

Marks	15–19	20–24	25–29	30–34	35–39
No. of Students	9	11	10	44	45

Marks	40–44	45–49	50–54	55–59	60–64
No. of Students	54	37	26	8	5

(b) What are 'less than' and 'more than' cumulative frequency curves? Describe their construction. 5

18. (a) What are the different measures of central tendency? Write down the requisites of a good measure of central tendency of the different measures of central tendency. Which are amenable for further mathematical treatment? 2+2+1=5

(b) Obtain the relationship between the rth raw and the rth central moments. Hence, find μ_2 in terms of μ_2' and μ_1'. 4+1=5

19. (a) Define range, quartile deviation, mean deviation, standard deviation and variance. 1+1+1+1+1=5

(b) Define skewness and kurtosis. Also give the formula for measuring skewness and kurtosis. 3+2=5

20. (a) What is a scatter diagram? How can you have an idea about correlation from scatter diagram? 2+3=5

(b) Define Karl Pearson's correlation coefficient and Spearman's rank correlation coefficient. Obtain the range of Karl Pearson's correlation coefficient. 1+1+3=5

21. (a) Obtain the equation of the line of regression of X on Y and Y on X. 2½+2½=5

(b) Explain how the principle of least squares is used in fitting a straight line of the form $y = a + bx$ to a set of data (x_i, y_i) $i = 1, 2, \cdots, n$. 5

22. (a) Define the terms 'exhaustive events', 'favourable events', 'mutually exclusive events', 'equally likely events' and 'independent events'. 1+1+1+1+1=5

(b) If A, B and C are any three events, write down the theoretical expressions for the following events : 1+1+1+1+1=5

(i) Only A occurs

(ii) A, B and C all the three occur

(iii) At least two occur

(iv) A and B occur but C does not occur

(v) None occurs

23. *(a)* Give the classical definition of probability. Show that the probability of an event takes values from [0, 1]. Also give two limitations of the classical definition of probability. 2+1+2=5

(b) Give the empirical definition of probability citing its limitations. Find the probability of drawing *(i)* a white ball and *(ii)* a red ball from a bag containing 6 red balls, 8 black balls, 10 yellow balls and 1 green ball. 2+1+2=5

24. *(a)* State and prove the addition theorem of probability. The probability that a student passes an English test is 2/3 and probability that he passes both English and Physics test is 14/45. The probability that he passes at least one test is 4/5. What is the probability that he passes the Physics test? 2½+2½=5

(b) State and prove the multiplication theorem of probability. If two events are independent, then what is the probability of their intersection? 3+2=5

25. *(a)* State Bayes' theorem. The probability of X, Y and Z becoming managers are 4/9, 2/9 and 1/3 respectively. The probabilities that Bonus Scheme will be introduced if X, Y, Z becomes managers are 3/10, 1/2 and 4/5 respectively. What is the probability that if Bonus Scheme was introduced, then X was appointed as manager? 2+3=5

(b) Define pairwise and mutually independent events. Prove that if A, B and C are mutually independent events, then $(A \cup B)$ and C are also mutually independent. 1½+1½+2=5

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