

2115  
B.A./B.Sc. (General) First Semester  
Statistics

Paper – 101: Probability Theory and Descriptive Statistics - I

Max. Marks: 65

Time allowed: 3 Hours

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two question from each Unit. Simple Calculator is allowed not scientific.  
x-x-x

Q1. Attempt the following:

- a) If  $P(A \cup B) = 1$  then the two events A & B are (Choose the correct one).  
(i) mutually exhaustive events (ii) dependent events (iii) mutually exclusive events  
(iv) independent events.
- b) 10 television sets are checked and the number of defective sets are noted write down the sample space for this experiment.
- c) The mean and standard deviation of 100 items are found to be 40 and 10. At the time of calculations two items are wrongly taken as 30 and 72 instead of 3 and 27. Find the correct mean and correct standard deviations.
- d) State which average will be appropriate in the following cases:  
(i) The quantities are in ratios.  
(ii) The distances are fixed but the speeds are varying.  
(iii) Differentiate between the standard deviation and variance.
- f) In a symmetrical distribution, the standard deviation is 4. What should be the value of 4<sup>th</sup> moment about mean so that the distribution is (i) Leptokurtic (ii) Mesokurtic and (iii) Platykurtic?  
(1, 2, 3, 1, 3, 3)

UNIT - I

Q2. (a) State and Prove

(i) Addition theorem on Probability

(ii) Multiplication theorem of Probability.

(b) Three newspapers A, B, and C are published in a certain city. It is estimated from the survey that of the adult population 20% read A, 16% read B, 14% read C, 8% read both A and B, 5% read both A and C, 4% read both B and C, 2% read all three. Find the percentage that read at least one of the papers? Also find the percentage that read both A and B but does not read C? (6, 7)

Q3. (a) Define (i) Axioms of Probability (ii) Event (iii) Independent events

(b) Let A and B be two events defined on a sample space write the expressions for the following events  
(i) at least one occurs (ii) Both occur (iii) none occurs (iv) A occurs but not B.

(c) If  $P(A) = \frac{1}{2}$ ,  $P(B) = \frac{1}{3}$ ,  $P(C) = \frac{1}{5}$ , then find

(i)  $P(A \cup B)$  (ii)  $P(A^c \cap B)$  (iii)  $P(A \cap B^c)$  (iv)  $P(A^c \cap B^c)$  (3, 4, 6)

Q4. (a) Define the mathematical expectation of a random variable. What is the expected value of the sums of points on n unbiased dice?

(b) A random variable X has the following probability distribution:

X:	-2	-1	0	1	2
P:	1/6	m	1/4	m	1/6

(i) Find the value of m (ii) Evaluate  $E[2X^2 + 3X + 5]$  (6, 7)

Q5. (a) Explain the notion of the joint distribution of two random variables. If  $F(x, y)$  be the joint distribution function of X and Y, what will be the distribution functions for the marginal distribution of X and Y?

(b) Two random variables X and Y have the following joint probability density function:

$$f(x, y) = \begin{cases} 2 - x - y; & 0 \leq x \leq 1, 0 \leq y \leq 1 \\ 0, & \text{otherwise} \end{cases}$$

Find (i) marginal probability density functions of X and Y  
(ii) conditional density functions.

(6, 7)

(2)

## UNIT - II

**Q6. (a)** What do you understand by tabulation? State any six points that should be kept in mind while tabulating the data. Draw a format of a table showing all the major functional parts of a statistical table.  
**(b)** State which average will be appropriate in the following cases:

- i. The quantities are in ratios.
- ii. The distances are fixed but the speeds are varying.
- iii. When it is desired that the sampling variability should be least.
- iv. The value changing at a cumulative rate has to be found.
- v. Average intelligence of students in a class.
- vi. Average rate of growth of population per decade.

(7, 6)

**Q7. (a)** What do you understand by coefficient of variation? Discuss the relative advantages of coefficient of variation and standard deviation as a major of variability.

**(b)** Find the median, 7<sup>th</sup> decile, and 85<sup>th</sup> percentile for the following frequency distribution:

Marks in Statistics:	Below 10	10-20	20-30	30-40	40-50	50-60	60-70	Above 70
No. of Students:	8	12	20	32	30	28	12	4

(6, 7)

**Q8. (a)** Discuss the concept of skewness and kurtosis in probability distributions. Explain how skewness indicates the asymmetry of a distribution, while kurtosis measures its tail behavior. Illustrate the differences between positively and negatively skewed distributions, as well as leptokurtic and platykurtic distributions, using graphical representations and practical scenarios.

**(b)** For a frequency distribution the Bowley's coefficient of skewness is 1.2. If the sum of the 1st and 3rd quarterlies is 200 and the median is 76, find the value of the third quartile. (8, 5)

**Q9.** The first four moments of a distribution about  $X = 4$  are 1, 4, 10 and 45 respectively.

- i. Show that the mean is 5, variance is 3,  $\mu_3 = 0$  and  $\mu_4 = 26$ .
- ii. What are the  $\gamma_1$ ,  $\gamma_2$ , moment coefficients of skewness and kurtosis?
- iii. Comment upon the nature of the distribution on the basis of the information obtained. (6, 5, 2)