Seat No. : _______________

AC-135

April-2019

B.Sc., Sem.-II

103 : Statistics
(Probability Theory)
(New Course)

Time : 2:30 Hours] **[Max. Marks : 70**

Instructions : (1) Scientific calculator is permitted
(2) Statistical table is provided.

1. (A) (1) Explain : (i) Mutually exclusive events.
(ii) Independent events
(iii) Union events
(2) Explain Bayes' theorem in detail.

OR

(1) State and prove multiplication rule of probability.
(2) Define classical, relative and axiomatic concept of probability.

(B) Attempt any **four** :

(1) The outcome of tossing coin is a
(a) simple event (b) mutually exclusive event
(c) complementary event (d) compound event

(2) Probability can take values
(a) $-\infty$ to ∞ (b) $-\infty$ to 1
(c) -1 to 1 (d) 0 to 1

(3) The probability of the intersection of two mutually exclusive events is always
(a) infinity (b) zero
(c) one (d) None of the above

(4) If $B \subset A$, the probability $P(A/B)$ is equal to
(a) zero (b) one
(c) $P(A)/P(B)$ (d) $P(B)/P(A)$

(5) Classical probability is also known as

(a) Laplace's probability (b) Mathematical probability

(c) a priori probability (d) All of the above

(6) If A and B are two events, the probability of occurrence of either A or B is given as

(a) $P(A) + P(B)$ (b) $P(A \cup B)$

(c) $P(A \cap B)$ (d) $P(A) \cdot P(B)$

2. (A) (1) Explain random variables with its types and explain probability mass function.

(2) Define mathematical expectation. State properties of it.

OR

(1) Define (a) raw moments, (b) central moments, (c) factorial moments.

(2) State and prove properties of moment generating function.

(B) Attempt any **four** :

(1) Values of a random variable are

(a) always positive numbers (b) always positive real numbers

(c) real numbers (d) natural numbers

(2) If X & Y are independent then

(a) $E(XY) = E(X) \times E(Y)$ (b) $E(XY) = E(X) + E(Y)$

(c) $E(X+Y) = E(X) + E(Y)$ (d) None of the above

(3) Full form of C.G.F. is

(a) Cumulant Generating Function (b) Complete Generating Function

(c) Complete Generating Form (d) Cumulant Generating Format

(4) A discrete variable can take a ____ number of value within its sense.

(a) finite (b) infinite

(c) 0 (d) 1

(5) Kurtosis is denoted by

(a) α (b) β

(c) γ (d) None of the above

(6) In a symmetrical distribution skewness is _____

(a) 1 (b) 0

(c) 2 (d) 3

3. (A) (1) State and prove Boole's inequality.

(2) State and prove Bonferroni's inequality.

OR

(1) State and prove Cauchy – Schwarz inequality.

(2) Explain concept of convex and concave functions.

(B) Attempt any **three** :

(1) Boole's inequality is also known as

(a) Union bound (b) Intersection bound

(c) Both (a) & (b) (d) None of these

(2) Boole's inequality may be generalized to find upper and lower bounds are known as

(a) Bonferroni's inequalities (b) Markov's inequalities

(c) Jensen's inequalities (d) None of these

(3) Jensen's inequality relates the value of a _____

(a) Convex function (b) Concave function

(c) Linear function (d) None of these

(4) Which measure of dispersion is used in Chebyshav's inequality ?

(a) Range (b) Qualitile deviation

(c) Standard deviation (d) Mean deviation

(5) In Markov's inequality which random variable is considered ?

(a) Non-negative (b) Negative

(c) (a) & (b) both (d) None of these

4. (A) (1) The joint probability distribution of two random variables X & Y is given by P (X = 0, Y = 1) = (1/3), P(X = 1, Y = (–1) = (1/3) and P(X = 1, Y = 1) = (1/3). Find marginal distribution of X & Y and also find the conditional probability distribution of X, given Y = 1.

(2) Explain joint probability mass function and Joint probability density function.

OR

(1) Explain marginal and conditional distributions.

(2) For the adjoning bivariate probability distribution of X & Y find

(1) $P(X \le 1, Y = 2)$

(2) $P(X \le 1)$

(3) $P(Y \le 3)$

(B) Attempt any **three** :

(1) Joint distribution function of (X, Y) is equivalent to the probability

(a) $P(X = x, Y = y)$ (b) $P(X \le x, Y \le y)$

(c) $P(X \le x, Y = y)$ (d) $P(X \ge x, Y \ge y)$

(2) The conditional discrete distribution function F X/Y (x/y) is equal to _____

(a) $\sum_{xi \le x} P\ X/Y\ (xi/y)$ (b) $\sum_{xi \ge x} P\ x/y\ (xi/y)$

(c) (a) & (b) both (d) None of these

(3) If X & Y are independent variables, then

(a) $E(XY) = E(x) \cdot E(y)$ (b) $E(XY) = 0$

(c) $Cov(X, Y) = 0$ (d) None of these

(4) If ‘d’ is any constant then E (d) =

(a) 0 (b) d

(c) 1 (d) D

(5) Conditional variance of X given Y is denoted by

(a) $\sigma^2\ x/y$ (b) $\sigma^2\ y/x$

(c) σ^2 (d) None of these

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(Basic Probability Theory – I)
(Old Course)

Time : 2:30 Hours] **[Max. Marks : 70**

Instructions : (1) Scientific calculator is permitted.
(2) Scientific table is provided.

1. (A) (1) State the relative and absolute measures of dispersion and describe the merits and demerits of mean deviation.

(2) What is raw moments and central moments ? Discuss the relationship between raw moments and central moments.

OR

(1) State properties and uses of Skewness.

(2) Write a short note an Kurtosis.

(B) Attempt any **four** :

(1) Range = _____

(a) maximum value – minimum value.

(b) minimum value – maximum value.

(c) maximum value + minimum value.

(d) None of these.

(2) Which one of the given measure of dispersion is considered best ?

(a) Standard deviation (b) Range

(c) Variance (d) None of these

(3) For a leptokurtic curve the B2 = ____

(a) 0 (b) –3

(c) 3 (d) 1

(4) For a negatively skewed distribution the correct inequality is

(a) mode < median (b) mean < median

(c) mean < mode (d) None of these

(5) If the quartile deviation of a series is 60, the mean deviation of this is

(a) 72 (b) 48

(c) 50 (d) 75

(6) Formula for coefficient of variation is

(a) $C.V. = \frac{S.D.}{mean} \times 100$ (b) $C.V. = \frac{mean}{S.D.} \times 100$

(c) $C.V. = \frac{mean \times S.D.}{100}$ (d) $C.V. = \frac{100}{mean \times S.D.}$

2. (A) (1) Explain pair-wise and mutual independence events of conditional probability.

(2) Three machines in a factory produce respectively 20%, 50% and 30% of items daily. The percentage of defective items of these machines are 3, 2 and 5 respectively. An item is taken at random from the production and is found to be defective. Find the probability that it is produced by machine A.

OR

(1) For any three events A, B and C prove $P(A \cup B/C) = P(A/C) + P(B/C) - P(A \cap B/C)$

(2) Explain Bayes' theorem in detail.

(B) Attempt any **four** :

(1) If A is an event, the conditional probability of A given A is equal to

(a) 0 (b) 1

(c) infinite (d) None of these

(2) P(A/B) = _____

(a) $\frac{P(A \cap B)}{P(B)}$ (b) $\frac{P(A \cap B)}{P(A)}$

(c) $\frac{P(A \cap B)}{1}$ (d) None of these

(3) Bayes' theorem is extensively used in _____

(a) Statistical inference (b) Probability

(c) Management (d) None of these

(4) We can say Bayes' theorem as _____

(a) Inverse Probability Rule (b) Multiplication Rule

(c) Addition Rule (d) None of these

(5) If $A \subset B$, the probability P(A/B) is equal to

(a) 0 (b) 1

(c) P(B)/P(A) (d) P(A)/P(B)

(6) If A & B are two independent events, then $P(A \cap B)$ is equal to

(a) $P(A) \cdot P(B)$ (b) $1 - P(A' \cup B')$

(c) All of the above (d) None of these

3. (A) (1) Discuss the components of time series.

(2) Write a note on moving average method.

OR

(1) Explain the principle of least squares.

(2) What is the difference between ratio to trend and ratio to moving average method of measuring seasonal variations in time series.

(B) Attempt any **four** :

(1) Short term variations are classified as

(a) seasonal (b) cyclical

(c) (a) & (b) both (d) None

(2) Which component is associated with recession ?

(a) Trend (b) Cyclical

(c) Seasonal (d) Irregular

(3) Diwali sales in a store is related with

(a) Trend (b) Cyclical

(c) Seasonal (d) None

(4) How many components are there in a time series ?

(a) 5 (b) 3

(c) 4 (d) 6

(5) The trend component is easy to identify by using

(a) moving average (b) exponential smoothly

(c) Regression analysis (d) Delphi approach

4. (A) (1) What is the meaning of Decision theory ? Explain the elements of it.

(2) Write a short note on minimax principle and Laplace principle with illustrations.

OR

(1) Write a short note on expected monetary value with reference to decision theory.

(2) A fruit-seller sells apples. If not sold on the day of delivery, they are useless. One apple cost ₹ 20 and the seller receives ₹ 50 for it. From the following details find his maximum profit, prepare EMV table.

Units sold per day	10	11	12	13
Probability of sale	0.15	0.20	0.40	0.25

(B) Attempt any **three** :

(1) Maximax principle is known as

(a) Optimism (b) Pessimism

(c) Equally likely (d) None

(2) The full form of EMV is _____

(a) Expected Monetary Value (b) Expected Money Value

(c) Expected Mean Value (d) None of these

(3) EOL means _____

(a) Expected Opportunity Loss (b) Expected Opportunity List

(c) Expected Optional Loss (d) None of these

(4) Which formula is used for Hurwicz's principle ?

(a) $(\alpha) \times$ (maximum pay off) +$(1 - \alpha)$ (minimum pay off)

(b) (α) + (maximum pay off) +$(1 - \alpha)$ + (minimum pay off)

(5) EVPI = _____

(a) EPPI – EMV (b) EPPI – Maximum value

(c) EPPI – Minimum value (d) None of these