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NJR/KS/18/3061

Bachelor of Science (B.Sc.) Semester-II (C.B.S.) Examination

STATISTICS (PROBABILITY DISTRIBUTIONS)

Compulsory Paper—1

Time : Three Hours] [Maximum Marks : 50

N.B. :— All the **FIVE** questions are compulsory and carry equal marks.

1. (A) State the p.m.f. of Binomial distribution. Find its first three moments about origin. Hence find μ_2, μ_3 and β_1. Comment on skewness of the distribution. 10

OR

(E) State p.m.f. of Poisson distribution. Find its m.g.f. State and prove additive properly of Poisson distribution.

(F) Find mode of Binomial distribution. Comment on the following statement :
"X follows B(n, 05.). The distribution of X is Unimodal or Bimodal according as n is even or odd." 5+5

2. (A) Derive p.m.f. of Hypergeometric distribution. Find mean and variance of this distribution. An Indian Revenue Service (IRS) inspector is to select 3 corporations from a list of 15 for tax audit purposes; of the 15 corporations, 6 earned profits and 9 incurred losses during the year. Find the probability that out of the number of corporations in the selected three, two incurred losses during the year. 10

OR

(E) State p.m.f. of Negative Binomial distribution. Find its mean and variance. In an experiment of throwing a fair die if the face numbered 4 turns up it will be treated as a success otherwise a failure. What is the probability of getting 4^{th} success in the 6^{th} trial ? 10

3. (A) State p.d.f. of normal distribution. Derive recurrence relation for even ordered central moments. Hence find μ_2 and μ_4. Comment on Kurtosis of a distribution. Also show that the distribution is symmetric about its mean by calculating its mean and mode. 10

OR

(E) Define standard normal variable. Write its p.d.f. Find m.g.f. of the distribution. If Z is a standard normal variable, show that :

$F(-z) = 1 - F(z)$ in usual notation.

(F) State the chief characteristics of normal distribution. If X_1 and X_2 are independent normal variables with parameters (μ_1, σ_1^2) and (μ_2, σ_2^2) respectively. Show that $X_1 + X_2$ is a normal variable. Write parameters of the distribution of $X_1 + X_2$. 5+5

4. (A) State p.d.f. of exponential distribution and find its mean and variance.

(B) State and prove lack of memory property of exponential distribution.

(C) State p.d.f. of Beta distribution of second kind. Find r^{th} moment of this distribution.

(D) State and prove additive property of Gamma distribution with one parameter.

2½×4=10

OR

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(E) State p.d.f. of Gamma distribution with two parameters. Find its m.g.f. and hence find mean and variance of the distribution.

(F) State p.d.f. of Beta distribution of first kind. Find its r^{th} raw moment and hence find mean and variance of the distribution. 5+5

5. Solve any **TEN** questions :

(A) Define Bernoulli trial.

(B) Find m.g.f. of Bernoulli distribution.

(C) If m.g.f. of the random variable X is $\left(\frac{1+2e^t}{3}\right)^9$. State the probability distribution of X and state its mean.

(D) Name the discrete distribution which lacks memory and state its p.m.f.

(E) If the r.v. X follows geometric distribution with parameter $\frac{1}{3}$. Find its mean.

(F) State p.g.f. of geometric distribution.

(G) If r.v. X has uniform distribution in the interval (–2, 3) write its p.d.f.

(H) If r.v. $X \sim N(\mu, \sigma^2)$, show that :

$$P(a \le X \le b) = F\left(\frac{b-\mu}{\sigma}\right) - F\left(\frac{a-\mu}{\sigma}\right)$$

where a and b are any constants.

(I) If random variable X follows uniform distribution with parameters (a, b), a < b then find cumulative distribution function of X.

(J) State the p.d.f. of Beta distribution of first kind.

(K) If the r.v. X follows the following probability law :

$$f(x) = \frac{12x^2}{(1+x)^5}, \; x > 0$$

Identify the distribution of X.

(L) If X_1 and X_2 are two independent Gamma variables with parameters 4 and 5 respectively. State the distribution of $X_1 + X_2$. 1×10=10