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BACHELOR OF TECHNOLOGY (C.B.C.S.) (2020 COURSE)
B.Tech.Sem - III E&C : : SUMMER - 2022
SUBJECT : PROBABILITY & STATISTICS

Day : Monday
Date : 30-05-2022

S-24592-2022

Time : 02:30 PM-05:30 PM
Max. Marks : 60

N.B.

1) All questions are **COMPULSORY**.
2) Figures to the **RIGHT** indicate **FULL** marks.
3) Use of non-programmable calculator is **allowed**.
4) Assume suitable data **WHEREVER** necessary.
5) Statistical tables will be provided, if required.

Q.1 **a)** A box contain 10 transistors of which 2 are defective. A transistor is selected from the box and tested until a non-defective one is chosen. Find the expected number E at transistors to be chosen. **(05)**

b) A pair of dice is thrown . Let x denote the minimum of the two numbers which occur. Find the distribution and expectation of x. **(05)**

OR

Q.1 A random sample with replacement of size n=2 is chosen from the set {1,2,3},yielding the 9-element equi-probable space **(10)**
S = {(1,1), (1,2), (1,3), (2,1), (2,2), (2,3), (3,1), (3,2), (3,3)}

a) Let x denote the sum of the two numbers. Find the distribution of x and find the expected value E (x).

b) Let y denote the minimum of the two numbers. Find the distribution of y and find the expected value E(y).

Q.2 In a sample of 1000 cases, the mean of certain test is 14 and S.D. is 25. Assuming the distribution is normal. Find : **(10)**

i) How many students score between 12 & 15?
Given A (z = 0.08) = 0.0319
A (z = 0.04) = 0.0160

ii) How many scores above 18?
Given A (z = 0.16) = 0.063

iii) How many scores below 8 ?
Given A (z=0.24) = 0.0948

iv) How many scores exactly 16 ?
Given A (z=0.06) = 0.0239
A (z=0.1) = 0.0398

OR

Q.2 **a)** Six coins are tossed 6400 times, using the Poission distribution determine the approximate probability of getting six heads x times. **(05)**

b) Assume the mean height of soldiers to be 68.22 inches with a variance of 10.8 inches (square). How many soldiers in a regiment of 10,000 would you expect to be over 6 feet tall? Given A (z=1.15) = 0.3749. **(05)**

Q.3 **a)** Two fair dice are thrown. Consider a bivariate r.v. (x,y). let x = 0 or 1 according to whether the first die shows an even number or an odd number of dots. Similarly, let y = 0 or 1 according to the second die **(05)**

i) Find the range R_{xy} at (x,y).

ii) Find the joint Pmf's of (x,y).

b) The joint pmf of a bivariate r.v. (x,y) is given by **(05)**

$$P_{xy}(x_i, y_j) = \begin{cases} K(2x_i + y_j) & x_i = 1,2 \;;\; y_j = 1,2 \\ 0 & \text{otherwise} \end{cases}$$

Where K is a constant.

i) Find the value of k.

ii) Find the marginal pmf's of x and y.

iii) Are x and y independent?

OR

Q.3 Consider an experiment of tossing two coins three times. Coin A is fair, but coin B is not fair, with $P(\text{H}) = \frac{1}{4}$ and $P(\text{T}) = \frac{3}{4}$. Consider a bivariate r.v. (x,y), where x denotes the number of heads resulting from coin A and y denotes the number of heads resulting from coin B. **(10)**

i) Find the range of (x,y).

ii) Find the joint pmf's of (x,y).

iii) Find P(x=y), P (x>y) and P ($x+y \leq 4$).

Q.4 Let S = {1,5,6,8}. Find probability distribution of the sample variance S^2 without replacement and also compute the mean μ_{s^2} & standard deviation σ_{s^2} of the sample variance S^2. **(10)**

OR

Q.4 Thirty-three percent of the first year students at an urban university live in university housing. What are the mean and standard deviation of the proportion $\hat{P}$ of first year students in university housing for all samples of size 50, drawn with replacement, from the population of first year students? **(10)**

Q.5 **a)** Let $x_1, x_2, \ldots\ldots x_{16}$ be random sample from a $N(\mu, \sigma^2)$ with $\sigma^2 = 25$ and sample mean $\bar{x} = 60$. Find 95% confidence interval for μ. **(05)**

Given : $Z_{0.05}$=1.645, $Z_{0.025}$=1.96, $Z_{0.005}$ = 2.58.

b) Suggest the possible moment estimator of variance for a Poisson distribution. **(05)**

OR

Q.5 If T_1 and T_2 are two unbiased estimators of $\psi(\theta)$ with variances σ_1^2 and σ_2^2 respectively; then for what value at λ & μ the static $T = \lambda T_1 + \mu T_2$ will also be unbiased estimator of $\psi(\theta)$. Given that ρ is the correlation coefficient between T_1 and T_2. **(10)**

Q.6 A pharmaceutical company claims that 90% of smokers that use their anti-tobacco product, kickit, break the smoking habit in two months. In a random sample of 100 smokers who used kickit as prescribed 84 stopped. Smoking in two months. Determine the p-value of the test at the null hypothesis. H_0 = P = 0.9 against the alternative hypothesis Ha : P < 0.9 is the sample proportion $\hat{P} = \frac{84}{100}$ statistically significant at the 0.01 . (Given : $P(z \leq -2) = 0.0228$). **(10)**

OR

Q.6 The 9th grade algebra scores in a school district have been normally distributed with mean of 75 and standard deviation of 8.25. A new teaching system is introduced to a random sample at 25 students and in the first year under the new system the average score is 78.2 what is the probability that an average this high would occur for a random sample of 25 students in a given year under the old system? What is the critical region at the 0.05 significance level? **(10)**

Given : A(z=1.94) = 0.0262.

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