**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI**
**(END SEMESTER EXAMINATION MO 2023)**

**CLASS:** MSc **SEMESTER : IV**
**BRANCH:** MATH **SESSION : MO 2023**

**SUBJECT: MA420 PROBABILITY AND STATISTICAL ANALYSIS**

**TIME:** 03 Hours **FULL MARKS: 50**

**INSTRUCTIONS:**
**1. The question paper contains 5 questions each of 10 marks and total 50 marks.**
**2. Attempt all questions.**
**3. The missing data, if any, may be assumed suitably.**
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
**5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.**

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| Q.1(a) | What do you mean by a random variable and its probability distribution? | [2] | CO=1Mod=1 | BL=1 |
| Q.1(b) | Suppose X is a random variable having the distribution $f(x) = kx(1-x)$, $0<x<1$. Find k. | [3] | CO=1Mod=1 | BL=2 |
| Q.1(c) | When are two random variables called independent? Prove that if X and Y are independent random variables, $E(XY)=E(X)E(Y)$ all symbols having usual meanings. | [5] | CO=1Mod=1 | BL=3 |
| Q.2(a) | Under what limiting conditions do we get normal distribution from binomial? | [2] | CO=2Mod=2 | BL=1 |
| Q.2(b) | If X and Y are Poisson variates such that $P(X=1) = P(X=2)$ and $P(Y=2) = P(Y=3)$, find the mean and standard deviation of X and Y. | [3] | CO=2Mod=2 | BL=3 |
| Q.2(c) | A Binomial variate X has mean 4 and variance 4/3. Find $P(X = 0)$. | [5] | CO=2Mod=2 | BL=2 |
| Q.3(a) | What is a Chi Square distribution and what do you mean by its degrees of freedom? | [2] | CO=3Mod=3 | BL=1 |
| Q.3(b) | Explain the concept of joint, marginal and conditional distribution. | [3] | CO=3Mod=3 | BL=2 |
| Q.3(c) | Given $f(x, y) = 2$, $0< x < 1$, $0< y < x$; find the marginal densities of X and Y. | [5] | CO=3Mod=3 | BL=3 |
| Q.4(a) | Distinguish between a parametric and a non-parametric statistical hypothesis. | [2] | CO=4Mod=4 | BL=1 |
| Q.4(b) | If T is an unbiased estimator of $\theta$, will $T^2$ be an unbiased estimator of $\theta^2$? Justify your answer. | [3] | CO=4Mod=4 | BL=2 |
| Q.4(c) | In a random sample of size 86, 14 are found to be smokers. Is it reasonable to assume the percentage of smokers in the population to be 10%? Test at 5% level of significance. | [5] | CO=4Mod=4 | BL=3 |
| Q.5(a) | Define the terms population and sample as used in statistics. | [2] | CO=5Mod=5 | BL=1 |
| Q.5(b) | Prove that for simple random sampling without replacement, the probability for a unit to be selected in the i-th draw equals the probability that it is selected in the first draw. | [3] | CO=5Mod=5 | BL=3 |
| Q.5(c) | Distinguish between sampling and non sampling errors. | [5] | CO=5Mod=5 | BL=2 |

**::::::29/11/2023::::::E**