ST. JOSEPH'S COLLEGE (AUTONOMOUS), BANGALORE-27
B.Sc. STATISTICS – III SEMESTER
MID-SEMESTER EXAMINATION – AUGUST 2019
ST 318: STATISTICAL INFERENCE – I

Time: 1 Hour Max: 30 marks

This question paper has three parts and 1 printed page

I Answer any five of the following: 5 x 2 = 10

1. What is point estimation? and mention properties of a good estimator
2. Give one example for each of the following
   i) parameter ii) sample space iii) statistic vi) estimator
3. Define minimum variance unbiased estimator
4. Define single parameter exponential family and mention any two members of SPE family
5. If X ~ Poisson (θ), verify that $T = \bar{X}$ is unbiased estimator for θ.
6. Define relative efficiency
7. Give an example for invariance property of consistent estimator

II Answer any two of the following: 2 x 5 = 10

8. Let $X_1 \ldots X_n$ denote a random sample from a Uniform (0, θ) distribution, with θ>0 as the unknown parameter. Let $\bar{X}$ denote the sample mean.
   a) Is $\bar{X}$ unbiased for θ? If not, find an unbiased estimator for θ
   b) Find the variance of the estimator derived in the previous part.

   OR

   The failure times of 23 newly manufactured resistors were observed. The sample mean was found to be 273 hr and the sample variance 849 hr^2. Assuming that the failure time is uniformly distributed, estimate its parameters ***a*** and ***b*** using the method of moments.

9. Define maximum likelihood estimator and write down any three properties of MLE
10. What do you mean by method of moment estimation? Derive an estimator of θ by method of moments when X ~ $NB(1, \theta)$

III Answer any one of the following: 1 x 10 = 10

11. a) Let $X_1, X_2 \ldots X_n$, be a random sample from N(μ, σ^2) verify whether sample variance $s_n^2 = \frac{\sum_i^n (x_i - \bar{x})^2}{n}$ is consistent estimator of σ^2 or not. (6)

    b) Let X_1 and X_2 be two random variables with mean μ, and variance σ^2 = 9,
    If T = $aX_1 + bX_2$ be an estimator of μ, then show that 'T' is an unbiased estimator of μ if, a + b = 1 (4)

12. a) Obtain MLE of θ when X ~ $f(x, \theta)$ (7)

$$f(x,\theta) = \begin{cases} \frac{\theta}{2} x \exp(-\theta x^2), & -\infty \le x < \infty, \\ & \theta > 0, \\ 0, & otherwise \end{cases}$$

    b) If X ~ B(N, P),.Show that $T = \frac{X(X-1)}{N(N-1)}$ is unbiased estimator of P^2. (3)