CHRIST UNIVERSITY,BENGALURU - 560029

End Semester Examination October - 2017

Bachelor of Science-CMS/EMS III SEMESTER

Code: STA331 **Max.Marks: 100**

Subject: STATISTICAL INFERENCE **Duration: 3Hrs**

SECTION A

Answer any TEN questions **10X3=30**

1 Define good estimator. List the criteria for a good estimator.

2 Define unbiased estimator with example.

3 Define minimum variance unbiased estimator (MVUE) with example.

4 A population has 5 units. Researcher interested to develop a sampling distribution of a sample mean with the sample size 3. Give the possible number of random samples using with and without replacement.

5 State and prove additive property of Chi-square variate.

6 Explain two types of errors in inferential statistics.

7 A department store has a salesperson that it suspects of making more mistakes than the average of all its salespersons. If the department
store decides to let the salesperson go unless he actually makes fewer mistakes than the average of all its salespersons, what null and alternative hypotheses should it use?

8 What is the role of Z-test statistic in test of significance?

9 Discuss the advantages and disadvantages of non-parametric tests.

10 The following arrangement indicate whether 30 consecutive cars which went by a toll booth had local plates 'L' or out of state plates 'O'. Write the null and alternative hypothesis for the test of randomness. Calculate the test statistics for the test procedure.LLOLLLLOOLLLLOLOOLLLLOLOOLLLLL

11 Explain the data types 'Factors' and 'Data Frames' in R programming with examples

12 Explain R code to calculate descriptive statistics: Mean, Median, Mode, Skewness and Kurtosis.

SECTION B

Answer any FIVE questions **5X6=30**

13 (a) Define consistency? List the necessary and sufficient conditions for consistency.

(b) If $X_1, X_2, ..., X_n$ are random observations on a Bernoulli variate X taking the value 1 with probability 'p' and the value '0' with probability (1-p). Show that $\bar{X}$ is a consistent estimator of P.

14 Define sufficient estimator with example. Prove that $\bar{X}$ is a sufficient estimator of the population mean μ of a normal population with the known variance σ^2.

15 If p1 and p_2 are two sample proportions drawn from a normal population, then show that the difference of these sample proportions also follows normal population.

16 Define F-statistic. Derive the p.d.f of F-statistic.

17 (a) Explain the test procedure for testing the equality of two proportions.

(b) A company is interested in knowing if there is any difference in the average salary received by foremen in two divisions. Accordingly samples of 12 foremen in the first division and 10 foremen in the second division are selected at random. Based upon experience, foremen's salaries are known to be approximately normally distributed, and the standard deviations are about the same.

	First Division	Second Division
Sample Size	12	10
Average weekly Salary (Rs)	1050	980
Standard Deviation of Salaries (Rs)	70	74

18 A storekeeper wanted to buy a large quantity of light bulbs from two brands labelled ‘one’ and ‘two’. He bought 100 bulbs from each brand and found by testing that brand ‘one’ had mean lifetime of 1120 hours and the standard deviation of 75 hours; and brand ‘two’ had mean lifetime of 1062 hours and a standard deviation of 82 hours. Examine whether the difference is significant. Prepare (i) null hypothesis (ii) alternative hypothesis (iii) level of significance (iv) R programming code for solving this problem.

SECTION C

Answer any FOUR questions **4X10=40**

19 (a) Let $X_1, X_2, \ldots, X_n$ be a random sample from a Bernoulli population with parameter P. Find the MLE of P and variance of $\hat{P}$.

(b) Let $X_1, X_2, \ldots, X_n$ be a random sample of size n from a Poisson distribution with mean λ. Find the MLE of λ and variance of $\hat{\lambda}$.

20 (a) If $X_1, X_2, \ldots, X_n$ be a random sample from a population $N(\mu, 1)$, then show that the sample mean $T = \frac{\sum X^2}{n}$ is an unbiased estimator of $\mu^2 + 1$.

(b)) Let $X_1, X_2, \ldots, X_n$ be a random sample from a population whose mean and variance are μ and σ^2 respectively. Prove that $T = \frac{2}{n(n+1)} \sum_{k=1}^{n} kX_k$ is a consistent estimator of μ.

21 (a) Prove that for large degrees of freedom, t-distribution tends to standard normal distribution.

(b) Derive the mean and variance of F-distribution.

22 The population is the weight of six pumpkins (in pounds) displayed in a carnival "guess the weight" game booth. You are asked to guess the average weight of the 5 pumpkins by taking a random sample of size 3 without replacement from the population. Also show that the average weight of the sample mean is exactly equal to population mean. Also calculate the standard error of average weight of pumpkins.

Pumpkin	A	B	C	D	E
Weight (in pounds)	19	14	15	9	10

23 (a) Describe the test procedure for testing independence of attributes.

(b) National Healthcare Company samples its hospital employee's attitude towards performance. Respondents are given a choice between the present method of two reviews a year and a proposed new method of quality reviews. The respondents are given below:

	North	South	East	West
Method1	68	77	82	58
Method2	35	86	65	46

Test whether there is any significant difference in the attitude of employees in different regions at 5% level of significance.

24 (a) Describe the Wald-Wolfowitz run test.

(b) The following data represents the reading hours of two groups of students for an end semester examination. Examine whether the two groups of samples came from the same population or not using median test.

Group-A: 12, 10, 6, 8, 6, 14, 5, 9, 7, 10 Group-B: 4, 8, 9, 3, 5, 7, 6, 7, 3, 5