CHRIST UNIVERSITY, BENGALURU - 560029

End Semester Examination September/October - 2016 Bachelor of ScienceCMS/EMS III SEMESTER

Code: STA331 Max.Marks: 100
Subject: STATISTICAL INFERENCE - I Duration: 3Hrs

SECTION A

Answer any TEN questions

10X3=30

- 1 Distinguish between population and sample with examples.
- 2 Define hypothesis. Explain different types of hypothesis.
- 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?
- 4 What is the role of Z-test statistic in test of significance?
- 5 Twenty people were attacked by a disease and only 18 were survived. Will you reject the hypothesis that the survival rate, if attached by this disease, is 85% in favour of the hypothesis that it is more, at 5% level?
- **6** For a Chi Square distribution with variance 16 obtain the Karl Pearson's coefficient of skewness and interpret.
- 7 Explain the applications of Student's t and F distributions.
- The mean life of a sample of 10 electric light bulbs was found to be 1458 hours with standard deviation of 432 hours. A second sample of 17 bulbs chosen from a different batch showed a mean life of 1280 hours with standard deviation of 365 hours. Is there a significant difference between the means of the two samples? Form a suitable null and alternative hypothesis and give the formula for suitable test statistic.
- 9 Define an unbiased estimator. If X_1, X_2, \ldots, X_n is a random sample from \overline{X} is an unbiased estimator of μ
- 10 Explain briefly the method of moments and method of least squares.
- 11 Explain the data types 'Factors' and 'Data Frames' in R programming with examples.
- Write a R program to create a data frame with the variables emp_Id, Name, Gender, Salary.

SECTION B

Answer any FIVE questions

5X6=30

- 13 Derive the sampling distribution of single proportion when sampling is done with replacement.
- 14 (a) Derive the m. g. f. of a chi-square variate and hence obtain mean and variance.
 - (b) Find the p. d. f. of a chi-square variate when the mean is 4.
- In a survey of buying habits, 400 women shoppers are chosen at random in super market A located in a certain section of Mumbai city. Their average monthly food expenditure is Rs. 250 with a standard deviation of Rs.40. For 400 women shoppers chosen at random in super market B in another section of the city, the average monthly food expenditure is Rs. 220 with a standard deviation of Rs. 55. Test at 1% level of significance whether the average food expenditure of the two populations of shoppers from which the samples were obtained are equal. Use p-value approach to give your conclusion.
- 16 Derive the limiting from of t distribution.
- 17 A random sample X_1, X_2, \ldots, X_n of size 5 is drawn from a population with unknown mean μ . Consider the following estimators of μ .

$$T_1 = (X_1 + X_2 + X_3 + X_4 + X_5)/5$$

$$T_2 = rac{(X_1 + X_2)}{2} + X_3$$

$$T_3 = (2(X_1) + X_2 + \lambda X_3)/3$$

Check if T_1 and T_2 are unbiased. Find λ such that T_3 is an unbiased estimator.

Let X=(1,2,3,4,5) and Y=(2,5,6,7,8,). Write R code to calculate (i) correlation between X and Y (ii) simple regression between X and Y.

SECTION C

19 The following table represents the five cities most African-American owned business in thousands.

City	Number of African- American owned businesses in thousands (X)				
A: New York	40				
B: Washington, D.C.	29				
C: Los Angeles	30				
D: Chicago	39				
E: Atlanta	26				

Construct the sampling distribution for mean of 'X' and calculate the mean for this sampling distribution. Also show that the mean of the sampling distribution of sample mean is equal to population mean.

- 20 Derive the sampling distribution of a chi-square variate.
- 21 (a) Describe the test procedure for Chi-square test for single variance.
 - (b) 200 digits are chosen at random from a set of tables. The frequencies of the digits are as follows:

Digit	0 /	ÍQ	2	3	4	5	6	7	8	9
Frequency	18	19	23	21	16	25	22	20	21	15

Use Chi-square test to assess the correctness of the hypothesis that the digits were distributed in equal numbers in the tables from which they were chosen.

- 22 (a) Explain, stating clearly the assumptions involved, the t-test for testing the single mean.
 - (b) Within a school district, students were randomly assigned to one of two Math teachers Mrs. Smith and Mrs. Jones. After the assignment, Mrs. Smith had 30 students, and Mrs. Jones had 25 students. At the end of the year, each class took the same standardized test. Mrs. Smith's students had an average test score of 78, with a standard deviation of 10; and Mrs. Jones' students had an average test score of 85, with a standard deviation of 15. Test the hypothesis that Mrs. Smith and Mrs. Jones are equally effective teachers. Use a 0.10 level of significance. (Assume that student performance is approximately normal.) Use p-value approach to give your conclusion.
- 23 (a) Explain the test procedure for testing the equality of two population variances.
 - (b) A researcher wanted to know whether the variability of the marks of male and female students is equal or not. To test this a sample of 15 male student marks and 14 female students marks were collected. Clearly state the hypothesis statements and test statistic and use the following output to give your conclusion.

Independent Samples Test

		Levene's Test f Variar	t-test for Equality of Means			
		F	Sig.	t	df	Sig. (2-tailed)
Marks	Equal variances assumed	.033	.857	1.439	27	.162
	Equal variances not assumed			1.437	26.694	.162

- 24 (a) 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 $\hat{\lambda}$.
 - (b) Let X_1, X_2, \ldots, X_n be a random sample of size n from $N(\mu, \sigma^2)$. Find the MLE of μ and $V(\hat{\mu})$.