CHRIST UNIVERSITY, BENGALURU - 560029

End Semester Examination October - 2015 Bachelor of Science - CMS / EMS III SEMESTER

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

SECTION A

Answer any 10 questions

10X3=30

- 1 Write the steps for "SORT" and "FILTER" in EXCEL.
- 2 Explain the procedure to generate random sample from different distributions using EXCEL.
- 3 Differentiate between biased and unbiased errors.
- 4 Identify which type of sampling method is used:
 - (i) A market researcher selects 500 people from each of 10 cities.
 - (ii) A tax auditor selects every 1000th income tax return that is received.
 - (iii) A pollster uses a computer to generate 500 random numbers, then interviews the voters corresponding to those numbers.
- 5 Distinguish between statistic and parameter and give examples.
- 6 Write the appropriate statistics for testing the following hypothesis
 - (i) H_0 : the population mean is 20.
 - (ii) H₀: The proportions of both the population are the same.
 - (iii) H_0 : The population proportion is 40%.
- 7 For a Chi Square distribution with variance 16 obtain the Karl Pearson's coefficient of skewness and interpret.
- 8 It is believed that the precision of an instrument is no more than 0.16. Write down the null and alternative hypothesis for testing this belief and state the test which can be used in this context.
- 9 State the relationship between F and t distributions.
- 10 The average drying time of a manufacturer's paint is 20 minutes. Investigating the effectiveness of a modification in the chemical composition of the paint, the manufacturer takes a small sample and obtains its mean. Let μ is the mean drying time of the modified paint. What null and alternative hypotheses should manufacturer use if she wants to make the modification unless it actually increases the drying time of the paint? State the test that can be used in this context.
- Define consistent estimator. Show that the sample mean obtained from a sample $X_1, X_2, ..., X_n$ drawn from $N(u, \sigma^2)$ is consistent.
- A survey of 1000 students concluded that 274 students chose a professional baseball team A as his or her favourite team. In 1991, the same survey was conducted involving 760 students. It concluded that 240 of them also chose team A as their favourite. Compute a 95% confidence interval for the difference between the proportions of students favouring team A between the two surveys. A survey of 1000 students concluded that 274 students chose a professional baseball team A as his or her favourite team. In 1991, the same survey was conducted involving 760 students. It concluded that 240 of them also chose team A as their favourite. Compute a 95% confidence interval for the difference between the proportions of students favouring team A between the two surveys.

SECTION B

Answer any 5 questions

5X6=30

- 13 Explain the steps involved in plotting any three types of bar diagram, pie diagram and line graph.
- 14 A researcher wants to obtain a sample of 100 school teachers from the 800 school teachers in the district. Describe procedures of obtaining sample of each type: random, stratified, systematic, cluster and convenience.
- 15 State and prove central limit theorem for i. i. d. random variables.
- 16 Derive the mode of Chi square distribution and give the formula for Karl Pearson's coefficient of skewness.

- 17 Derive the expression for moments of t distribution with n degrees of freedom.
- 18 Derive the pdf of an F distribution.
- 19 (a) If $X_1, X_2, ..., X_n$ are random observations from 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.
 - (b) Let is a random sample from, obtain the sufficient statistic of (i)(unknown) (ii) (unknown).

SECTION C

Answer any 4 questions

4X10=40

- 20 A population consists of 5 units and the values of a characteristic for these units are 2, 4, 3, 6, 7.
 - (i) List all possible samples of size 3 from the population the sampling being done without replacement
 - (ii) Construct sampling distribution of mean and verify that the mean of the sample mean is exactly equal to the population mean.
 - (ii) Obtain the standard error of the sample mean.
- 21 (a) Write the test procedure for testing the equality of two proportions
 - (b) Past experience at the Crowder Travel Agency indicated the percent of people who wanted the agency to plan a vacation for them to Europe. During the most recent busy season, a sampling of 1,000 plans was selected at random from the files and obtained the following result. Write a suitable null hypothesis for the above problem and describe the procedure used for testing the hypothesis. Has there been a significant shift upward in the percentage of persons who want to go to Europe?

Z test

Known Percent	44%
Z(observed)	2.5482
Z(Critical value) one tailed	2.33
Z(critical Value) two tailed	2.56

- 22 (a) Explain the probability curve of a Chi-square variate.
 - (b) For a Chi square distribution with n degrees of freedom, establish the following recurrence relation between the moments:

 $M_{r+1} = 2r(M_r + n M_{r-1})$, r>0 where M_r is the rth order central moment.

- 23 (a) Derive the chi square test statistic for a 2*2 contingency table.
 - (b) In order to find the relation between the customers choice on hotel a travel agency conducted a survey and asked the customers if they choose the same hotel what they visited before, the test is carried out and the resulting output is given below. Identify the suitable test procedure and interpret based on the result.

Test result

O'Bread I	
Level of significance	0.05
Degrees of freedom	1
Chi-square(observed)	12.742
Chi-square(Critical value)	3.841

- 24 (a) Write the test procedure for testing the equality of two means when samples are dependent.
 - (b) 15 randomly selected mature citrus trees of one variety have a mean height of 14.8 feet with a standard deviation of 1.3 feet while 12 randomly selected citrus trees of another variety have a mean height of 13.6 feet with a standard deviation of 1.5 feet. Test at the 0.01 level of significance whether the difference between the two sample means is significant.
- (a) Let $X_1, X_2, ..., X_n$ be a random sample from $f(x, \theta) = \frac{1}{\theta} e^{-\frac{x}{\theta}}$. Obtain the MLE of θ and variance of $\hat{\theta}$.
 - (b) Let $X_1, X_2, ..., X_n$ be a random sample of size n from a Poisson distribution with mean λ . Find the MLE of λ and variance of $\hat{\lambda}$.