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II/IV B.Tech (Supplementary) DEGREE EXAMINATION

February, 2020

Third Semester

Time: Three Hours

Common to CE, CSE, ECE, EEE and EIE
Probability and Statistics

Maximum: 50 Marks

Answer ALL Questions from PART-A.

(1X10 = 10 Marks)

Answer ANY FOUR questions from PART-B.

(4X10=40 Marks)

Part - A

(10X1=10 Marks)

1. Answer all questions
 - a) Define distribution function.
 - b) Write the mean of the uniform distribution.
 - c) Find the value of k when the Probability density function is given by $f(x) = kx^2$ for $0 < x < 2$, 0 for elsewhere.
 - d) Define joint distribution function.
 - e) Write $(1 - \alpha)$ 100% confidence interval for the one variance.
 - f) Write the test statistic in paired t-test.
 - g) Write maximum error of estimate for Proportion P.
 - h) Write the test statistic for one proportions.
 - i) What is meant by correlation?
 - j) Write $(1 - \alpha)$ 100% confidence interval for β_1 .

Part - B

2. Verify the given function is probability density function or not, If a random variable has the probability density $f(x) = \begin{cases} 2e^{-2x} & \text{for } x > 0 \\ 0 & \text{for } x \leq 0 \end{cases}$ 10M

Find the probabilities that it will take on a value

(a). between 1 and 3

(b). greater than 0.5

(c). less than or equal to 1.

Also find mean and variance.

3. a) Given a random variable having the normal distribution with $\mu = 16.2$ and $\sigma^2 = 1.5625$, find the probabilities that it will take on a value 5M
 - (i) greater than 16.8
 - (ii) less than 14.9
- b) The time to microwave a bag of popcorn using the automatic setting can be treated as a random variable having a normal distribution with standard deviation 10 seconds. If the probability is 0.8212 that the bag will take less than 282.5 seconds to pop, find the probability that it will take longer than 258.3 seconds to pop. 5M
4. A manufacturer claims that the average tar content of a certain kind of cigarette is $\mu = 14.0$. In an attempt to show that it differs from this value, five measurements are made of the tar content (mg per cigarette): 14.5, 14.2, 14.4, 14.3, 14.6
Show that the differences between the mean of this sample $\bar{x} = 14.4$, and the average tar claimed by the manufacturer $\mu = 14.0$ is significant at $\alpha = 0.05$. Assume normality. 10M
Also construct a 95% confidence interval for true population mean.
5. A company claims that its light bulbs are superior to those of its main competitor. If a study showed that a sample of $n_1 = 40$ of its bulbs has a mean lifetime of 1647 hours of continuous use with a standard deviation of 27 hours, while a sample of $n_2 = 40$ bulbs made by its main competitor has a mean lifetime of 1638 hours of continuous use with a standard deviation of 31 hours, does this substantiate the claim at the 0.05 level of significance? 10M
Also construct a 95% confidence interval for difference of population means.

6. a) It is desired to determine whether there is less variability in the silver plating done by Company 1 than in that done by Company 2. If independent random samples of size 12 of the two companies' work yield $s_1 = 0.035$ mil and $s_2 = 0.062$ mil, test the null hypothesis $\sigma_1^2 = \sigma_2^2$ against the alternative hypothesis $\sigma_1^2 < \sigma_2^2$ at the 0.05 level of significance. 5M
- b) A manufacturer of submersible pumps claims that at most 30% of the pumps require repairs within the first 5 years of operation. If a random sample of 120 of these pumps includes 47 which required repairs within the first 5 year, test the null hypothesis $p = 0.30$ against the alternative hypothesis $p > 0.30$ at the 0.05 level of significance. 5M

7. The following are the weight losses of certain machine parts (in milligrams) due to friction when three different lubricants were used under controlled conditions: 10M

Lub A	12.2	11.8	13.1	11.0	3.9	4.1	10.9	8.4
Lub B	10.9	5.7	13.5	9.4	11.4	15.7	10.8	14.0
Lub C	12.7	19.9	13.6	11.7	18.3	14.3	22.8	20.4

Test at the 0.01 level of significance whether the differences among the means can be attributed to chance. Also estimate the parameters of the model used in the analysis of experiment.

8. a) Calculate the coefficient of correlation between age of cars and annual maintenance cost and comment: 5M

Age of cars (years) x	2	4	6	7	8	10	12
Annual maintenance cost (Rupees) y	1600	1500	1800	1900	1700	2100	2000

- b) A chemical company wishing to study the effect of extraction time on the efficiency of an extraction operation obtained the data shown in the following table: 5M

Extraction time (minutes) x	27	45	41	19	35	39	19	49	15	31
Extraction efficiency (%) y	57	64	80	46	62	72	52	77	57	68

Fit a straight line to the given data by the method of least squares and use it to predict the extraction efficiency one can expect when the extraction time is 35 minutes.

9. The following data pertain to the number of computer jobs per day and the central processing unit time required, 10 M

No. of jobs (x)	1	2	3	4	5
CPU Time (y)	2	5	4	9	10

- (a) Fit a least squares line $\hat{y} = \hat{\beta}_0 + \hat{\beta}_1 x$
- (b) Test the null hypothesis $H_0 : \beta_0 = 0.002$ against the alternative hypothesis $H_1 : \beta_0 \neq 0.002$ at 5% level of significance.
- (c) Construct a 95% confidence interval for β_0