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B. Sc. Engg. (CEE)/ 6th Sem. 15 February, 2023 (Afternoon)

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

Mid Semester Examination **Summer Semester: 2021-2022**
Course No.: CEE 4655 **Full Marks: 75**
Course Title: Civil Engineering Data Analysis **Time: 1.5 Hours**

There are 9 (Four) questions. Question No. 1 to 7 are compulsory. Answer any one question between question 8 and question 9. Programmable calculators are not allowed. Do not write on this question paper. The figures in the right margin indicate full marks. The Symbols have their usual meaning. It's an OPEN BOOK exam. Only one Text book is allowed in the exam,

1. A car-hire firm has two cars, which it hires out day by day. The number of demands for a car on each day is distributed as a Poisson distribution with a mean of 1.5. Calculate the proportion of days on which (i) neither car is used, and (ii) the proportion of days on which some demand is refused. (10) (CO1- PO1)

2. It has been claimed that in 60% of all solar heat installations the utility bill is reduced by at least one-third. Accordingly what are the probabilities that the utility bill will be reduced by at least one third in (i) four of five installations? (ii) at least four or five installations? (10) (CO1- PO1)

3. The lifetime of a certain kind of batteries used in an instrument of Environmental Engineering laboratories has a mean life of 400 hours and the standard deviation as 45 hours. Assuming the distribution to be normal, find (i) the percentage of batteries with a lifetime of at least 470 hours, and (ii) the minimum life of the best 5% of batteries. (10) (CO1- PO1)

4. If X is a continuous random variable with probability density function (pdf) (10) (CO1- PO1)

$$f(x) = x^2 \qquad 0 \le x \le 1$$
$$= 0 \qquad \text{otherwise}$$

If $P(a \le X \le 1) = \frac{19}{81}$, find the value of a.

5. In Orange County, 51% of the adults are males and remaining 49% are females. One adult is randomly selected for a survey involving credit card usage. (10) (CO1- PO1)

(a) Find the prior probability that the selected person is a male.

(b) It is later learned that the selected survey subject was smoking a cigar. Also, 9.5% of males smoke cigars, whereas 1.7% of females smoke cigars (based on data from the Substance Abuse and Mental Health Services Administration). Use this additional information to find the probability that the selected subject is a male. Comment on the obtained results

6. A cement company estimates the net profit on a new product, it is launching, to be Rs. 3 million during first year, if it is 'successful', Rs. 1 million if it is 'moderately successful', and a loss of 1million if it is 'unsuccessful'. The company assigns the following probabilities to first year prospects for the product- (10) (CO1- PO1)

Successful: 0.25, Moderately successful: 0.40 and Unsuccessful: 0.35

What are the expected value and standard deviation of the first year net profit for the product?

Also, find the expected value of net profit if there is a fixed cost of Rs. 0.2 million, whatever the success status is.

7. Duncan Jones kept careful records of the fuel efficiency of his car. After the first 100 times he filled up the tank, he found the mean was 23.4 miles per gallon (mpg) with a population standard deviation of 0.9 mpg. Compute the 80 percent confidence interval for his mpg. Comment on your obtained result. (05) (CO2- PO2)

8. The width of bus riders has a population that is normally distributed with a standard deviation of 10. Suppose that before graduation, your first job was to sample 98 bus riders from this population and obtain a mean width of 49.98 and a standard deviation of 10.3386. Using an alpha value of α=0.01, is this observed mean significantly different than an expected width of 52? Conclude your result based on the p-value of the test. (10) (CO2- PO2)

9. A machinist is making engine parts with axle diameter of 0.7 cm. A random sample of 10 parts shows a mean diameter of 0.742 cm with a standard deviation of 0.04 cm. Compute the statistics you would use to test whether work is meeting the specification at 0.05 levl of significance. Conclude your result based on the p value of the test. (10) (CO2- PO2)