

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

Mid Semester Examination

Summer Semester: 2022-2023

Course No.: CEE 4655

Full Marks: 75

Course Title: Civil Engineering Data Analysis

Time: 1.5 Hours

There are 9 (Nine) 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. It is estimated that 50% of emails are spam emails. Some software has been applied to filter these spam emails before they reach your inbox. A certain brand of software claims that it can detect 99% of spam emails, and the probability for a false positive(a non-spam email detected as spam) is 5%. Now if an email is detected as spam, then what is the probability that it is in fact a non-spam email? (10)
(CO1- PO1)

2. Most graduate schools of engineering require applicants for admission to take the Graduate Management Admission Council's GMAT examination. Scores on the GMAT are roughly normally distributed with a mean of 527 and a standard deviation of 112. What is the probability of an individual scoring above 500 on the GMAT? How high must an individual score on the GMAT in order to score in the highest 5%? (10)
(CO1- PO1)

3. The number of industrial injuries in transportation sector per working week in a particular factory is known to follow a Poisson distribution with mean 0.5. Find the probability that (10)
(CO1- PO1)
 - (a) in a week there will be:
 - (i) less than 2 accidents,
 - (ii) more than 2 accidents;
 - (b) in a three-week period, there will be no accidents.

4. X is a random variable with distribution function (10)
(CO1- PO1)

$$F(x) = \begin{cases} 0 & x < 0 \\ 0.05 & 0 \leq x < 1.3 \\ 0.30 & 1.3 \leq x < 1.7 \\ 0.85 & 1.7 \leq x < 1.9 \\ 0.90 & 1.9 \leq x < 2 \\ 1.0 & 2 \leq x \end{cases}$$

Determine the probability mass function of X at 0, 1.3, 1.7, 1.9 and 2

5. The lengths of telephone conversations, in minutes, by sales rep of a certain car company are modelled by the continuous random variable T . (10)
(CO1- PO1)
The probability density function of T is denoted by $f(t)$, and is given by

$$f(t) = \begin{cases} kt & 0 \leq t \leq 12 \\ 0 & \text{otherwise} \end{cases}$$

- a) Show that $k = \frac{1}{72}$
b) Determine $P(T > 5)$
c) Show by calculation that $E(T) = \text{Var}(T)$
d) Sketch $f(t)$ for all t .

6. The probability of a boy guessing a correct answer is $\frac{1}{4}$. How many questions must he answer so that the probability of guessing the correct answer at least once is greater than $\frac{3}{4}$? (10)
(CO1- PO1)

7. A type company claims that the lives of tires have mean 42000 km with standard deviation of 4000 km. A change in the production process is believed to result in better product. A test sample of 81 new tires has a mean life of 42500 km. Test at 5% level of significance that the new product is significantly better than the old one. Draw your conclusion based on the p -value of the test. (05)
(CO2- PO2)

8. A user of a certain gauge of steel wire suspects that the standard deviation of its breaking strength, in newtons (N), is different from the value of 0.75 as specified by the manufacturer. Consequently, the user tests the breaking strength of each of a random sample of nine lengths of wire and obtains the following results. (10)
(CO2- PO2)

72.1 74.5 72.8 75.0 73.4 75.4 76.1 73.5 74.1

Assuming breaking strength to be normally distributed, test, at the 10% level of significance, the manufacturer's specification.

9. Company A proposes the take-over of Company B. The latter's Chief Executive claims that her Company's shareholders are equally divided for and against the take-over on the basis of the terms offered. However, the Chairman of Company A claims that more than half of Company B's shareholders are in favor of accepting his Company's offer. To investigate these two rival claims, the view of each of 400 randomly selected shareholders of Company B is sought. A subsequent count reveals that 219 are in favor of the offer; the remainder are against. Does this provide evidence, at the 1% significance level, that the claim made by Company B's Chairman is valid? (10)
(CO2- PO2)