



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

Semester: Mid Semester Examination
Course No.: MATH 4453
Course Title: Probability and Statistics

Summer Semester: 2021-2022
Full Marks: 75
Time: 1.5 hours

There are 3 (three) sets of questions. Answer **all** of them. Programmable calculators are not allowed. Do not write on this question paper. The figures in the right margin indicate full marks and corresponding CO and PO. The Symbols have their usual meaning.

- | | Full
Marks | CO | PO | | | | | | | | | | | | |
|---|---------------|-------|-------|-------------------|-------|-------|-------|-------|-------|--------------|---|----|----|----|---|
| 1. a) What is an average? Why is it necessary? How do common people view this measure? Give a broad outline of the statistical averages you are familiar with. | (5) | 1 | 1 | | | | | | | | | | | | |
| b) The breaking strength of 80 test pieces of a certain alloy is given in the following table, the unit being given to the nearest pounds per square inch. | (10) | 2 | 1 | | | | | | | | | | | | |
| <table border="1" style="width: 100%; border-collapse: collapse; margin-left: 20px;"> <thead> <tr> <th style="width: 20%;">Breaking strength</th> <th style="width: 10%;">44-46</th> <th style="width: 10%;">46-48</th> <th style="width: 10%;">48-50</th> <th style="width: 10%;">50-52</th> <th style="width: 10%;">52-54</th> </tr> </thead> <tbody> <tr> <td>No of pieces</td> <td style="text-align: center;">3</td> <td style="text-align: center;">24</td> <td style="text-align: center;">27</td> <td style="text-align: center;">21</td> <td style="text-align: center;">5</td> </tr> </tbody> </table> <p>Calculate the average breaking strength of the alloy and the standard deviation. Calculate the percentage of observations lying between $\text{mean} \pm 2\sigma$.</p> | | | | Breaking strength | 44-46 | 46-48 | 48-50 | 50-52 | 52-54 | No of pieces | 3 | 24 | 27 | 21 | 5 |
| Breaking strength | 44-46 | 46-48 | 48-50 | 50-52 | 52-54 | | | | | | | | | | |
| No of pieces | 3 | 24 | 27 | 21 | 5 | | | | | | | | | | |
| c) A factory produces two types of lamps. In an experiment on the working life of these lamps the following results were obtained: | (10) | 2 | 1 | | | | | | | | | | | | |

Length of life (in hours)	No. of Lamps	
	Type-A	Type-B
500-700	5	4
700-900	11	30
900-1100	26	12
1100-1300	10	8
1300-1500	8	6

Compare the variability using the coefficient of variation.

2. a) Define skewness, kurtosis and moments. Derive relation between central moments and raw moments. (8) 1 1

b) An analysis of electricity consumption resulted in the following distribution: (12) 2 1

Consumption (kw/h)	0-10	10-20	20-30	30-40	40-50
No. of users	6	25	36	20	13

(i) Calculate the first four moments about assumed mean. Convert the result into moments about the mean.

(ii) Compute the coefficient of skewness and kurtosis using the calculated moments. Also, comment on the nature of the distribution.

3. a) An electrical system consists of four components as illustrated in Fig. 1. The system works if components A and B work and either of the components C or D works. The reliability (probability of working) of each component is also shown in Fig. 1. Apply probability theory to compute the probability that (a) the entire system works and (b) the component D does not work, given that the entire system works. Assume that the four components work independently. (12) 2 1

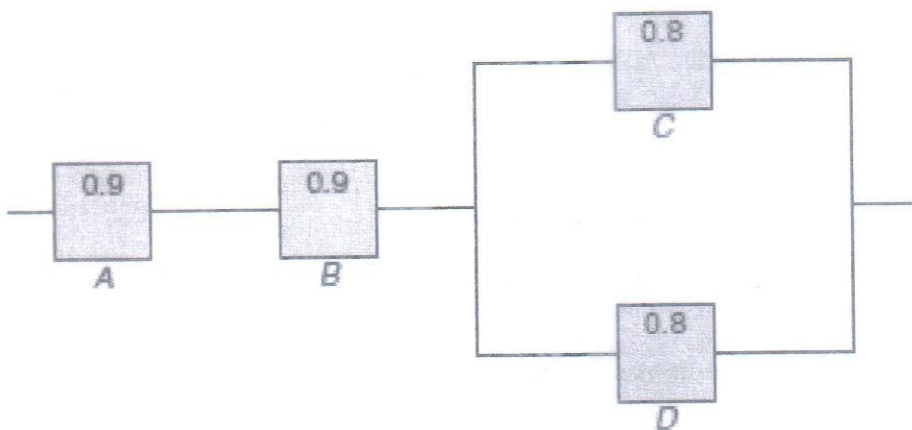


Fig. 1 for Q. 3(a)

- b) Information about product failure based on chip manufacturing process contamination is given below. Find the probability of failure. (6) 2 1

Probability of Failure	Level of Contamination	Probability of Level
0.1	High	0.2
0.005	Not High	0.8

- c) A married couple (husband and wife) appear for an interview for two vacancies against the same post. The probability of husband's selection is $\frac{1}{6}$ (12) 2 1

and the probability of wife's selection is $\frac{2}{5}$. What is the probability that

- i. Both of them will be selected.
- ii. Only one of them will be selected.
- iii. None of them will be selected.
- iv. At least one of them will be selected.