Department of Computer Systems Engineering
University of Engineering & Technology
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Probability Methods in Engineering
Mid-Term Examination, Spring 2020

INSTRUCTIONS
1. The maximum time allowed is 3 hours (8 am to 11 am). Total marks for this exam are 50.
2. Write your name and registration number on every page of your answer sheet(s).
3. **You have to submit pictures of your answer sheet, clearly legible and understandable, by email.**

Question 1: **COUNTING METHODS (5 + 5)**

a) Among 9 ICs, 3 are defective. 5 ICs are tested at random. What is the probability that exactly 2 of the tested ICs are defective?

b) A fair die is rolled 5 times and outcomes are recorded. What is the probability that all outcomes are different?

Question 2: **AXIOMS/COROLLARIES OF PROBABILITY (4 + 6)**

a) Select a number X at random between 1 and 3. Let $A = \{X \geq 1.5\}$ and $B = \{X \leq 2.5\}$. Find $P[A \cap B^c]$.

b) Select a number X at random between -1 and 1. Let $A = \{|X| \leq 0.2\}$ and $B = \{0 \leq X \leq 0.4\}$. Find $P[A^c \cap B]$ and $P[A^c \cup B]$.

Question 3: **TOTAL PROBABILITY / BAYES' RULE (CLO 1 / PLO 1) (4 + 6)**

a) In a class, 90% students are Pashto-speakers. Among the Pashto speakers, 80% have learnt English. What is probability that a student is Pashto-speaker and has not learnt English?

b) In a class, 80% students are Pashto-speakers. Among the Pashto speakers, 50% have learnt English. Whereas 70% non-Pashto speakers have learnt English. What is the probability that a student is Pashto-speaker given that he has not learnt English?

Use the concepts of probability and applying analytical methods, to solve the problems.

Question 4: **SEQUENCES OF INDEPENDENT EXPERIMENTS (5 + 5)**

a) Suppose that a dice is rolled 6 times. We assume that the outcomes are independent, and the dice is fair. Find the probability of getting an outcome greater than 4 more than four times.

b) Suppose that three numbers are selected at random from the interval [-1, 2] independently. Find the probability that the first two numbers are less than 0 and the last number is greater than or equal to 0.

Question 5: **SEQUENCES OF DEPENDENT EXPERIMENTS (10)**

A sequential experiment involves repeatedly drawing a ball from one of two urns, noting the number on the ball, and replacing the ball in its urn. Urn 0 contains a ball with the number 1 and a ball with the number 0, and urn 1 contains 2 balls with the number 1 and one ball with the number 0.The urn from which the first draw is made is selected at random by flipping a fair coin. Urn 0 is used if the outcome is heads and urn 1 if the outcome is tails. Thereafter the urn used in a subexperiment corresponds to the number on the ball selected in the previous subexperiment. Draw the corresponding *trellis* diagram. Find the probability of the sequence 1100.