Department of Computer Systems Engineering
University of Engineering & Technology
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Probability Methods in Engineering
Final-Term Examination, Spring 2021

INSTRUCTIONS
1. The maximum time allowed is 3 hours (11 am to 2 pm).
2. Weightage for this written exam is 30%.
3. Remaining 70% marks have been assigned to an online Viva exam (to be conducted later).
4. Write your name and registration number on every page of your answer sheet(s).
5. **You have to submit your answer sheet(s), physically or by post till 3 August 2021.**

Question 1: **RANDOM VARIABLE AND PMF (CLO 2 / C3 / PLO 3)** **[7 marks]**

In this question, *a*, *b*, *c* and *d* denote any four distinct integers of your choice from interval [1, 9]. A uniform random variable *V* has four possible values such that the set $S_V = \{-a, b, c, d\}$. **Use** the concept of Random Variables and **solve** the problem of finding the mean of *Z*, where $Z = V^3$.

Question 2: **FUNCTIONS OF RANDOM VARIABLE** **[7 marks]**

In this question, *a*, *b* and *c* denote any three distinct integers of your choice from interval [1, 9]. The voltage of a signal is represented by a uniform random variable *V* having three possible values such that $S_V = \{-a, b, c\}$. The signal power is given by random variable *P* such that $P = V^2 / R$ with $R = ½$.

a) Find the mean signal power, i.e. $E[P]$.

b) Find the standard deviation of *P*, i.e. $STD[P]$.

Question 3: **POISSON RANDOM VARIABLE** **[7 marks]**

The number *N* of customers arriving in *t* seconds at a bank is a Poisson random variable with $\alpha = \lambda t$ where λ is the average arrival rate [customers/second]. Assume that the mean arrival rate is 2 customers per minute. Find the probabilities of the following events: (i) more than 1 customer in 30 seconds; (ii) less than or equal to 1 customer in 2 minutes.

Question 4: **RANDOM VARIABLE AND MOMENTS** **[9 marks]**

Find the 2nd moment of the geometric random variable *X* such that $S_X = \{1, 2, 3, \ldots\}$.