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B.Sc. Engg. CSE 8th Semester — 13 August 2018 (Afternoon)

# ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
## ORGANISATION OF ISLAMIC COOPERATION (OIC)
## Department of Computer Science and Engineering (CSE)

**MID SEMESTER EXAMINATION** — **SUMMER SEMESTER, 2017-2018**

**DURATION: 1 Hour 30 Minutes** — **FULL MARKS: 75**

## CSE 4831: Simulation, Modeling and Performance Evaluation

**Programmable calculators are not allowed. Do not write anything on the question paper.**

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. A one-pump gas station is always open and has two types of customers. A police car arrives every 30 minutes (exactly), with the first police car arriving at time 15 minutes. Regular (nonpolice) cars have exponential interarrival times with mean 5.6 minutes, with the first car arriving at time 0. Service time at the pump for all cars are exponential with mean 4.8 minutes. A car arriving to find the pump idle goes right into service, and regular cars arriving to find the pump busy join the end of a single queue. A police car arriving to find the pump busy, however, goes to the front on the line, ahead of any regular cars in the line. [If there are already other police cars at the front of the line, assume that an arriving police car gets in line ahead of them as well.]
Initially, the system is empty and idle, and the simulation is to run until exactly 500 cars (on any type) have completed their delays in queue. The purpose of the simulation is to improve the system in terms of the followings: average delay in queue for each type of car, the time-average number of cars in queue, and the utilization of the pump.

   a) What are the state variables and output variables for the simulation model? 7
   b) Identify the set of events for the simulation model. 5
   c) Write down the state equations and output equations for the simulation model. 10
   d) Write down the state space for the simulation model. 3

2. For the scenario given in Question 1, answer the followings:
   a) Draw a sample path of the system for a few customers showing the change of the state variable(s) over time. 5
   b) Draw separate flow charts of the event routines (i.e., the event handler functions) for each of the events of the system. 12
   c) Draw the flow chart of the function that updates the necessary statistical variables according to the output equations of the simulation model. 8

3. a) Define and differentiate between Random Numbers and Pseudo-Random Numbers 7
   b) Without actually computing any $Z_i's$, determine whether the following to LCGs have full period: 8

      i. $Z_i = (13Z_{i-1} + 13)(mod\ 16)$
      ii. $Z_i = (Z_{i-1} + 12)(mod\ 13)$

   c) Generate 10 random numbers using the midsquare method for $Z_0 = 7367$. Discuss the disadvantages of this method. 10

4. a) A mass is connected to a fixed point by a spring. At time $t = 0$, the mass is displaced from its rest position by an amount $u(0) = u_0 > 0$ and released. The displacement at any time $t > 0$, denoted by $y(t)$ is to be measured. Determine whether an input-output modeling or a state space modeling is appropriate for this system. Justify your answer. 8

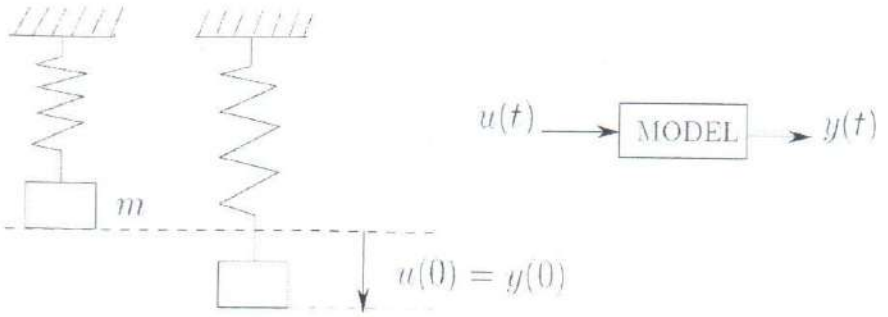


Figure 1: System for Question 4(a)

b) Differentiate between the followings: 9

i. Static and Dynamic Systems
ii. Time-Varying and Time-Invariant Systems
iii. Deterministic and Stochastic Systems

c) Discuss the steps involved in developing the computational model of a system with an appropriate example. 8