



# MURANG'A UNIVERSITY OF TECHNOLOGY

## SCHOOL OF PURE AND APPLIED SCIENCES

### DEPARTMENT OF APPLIED SCIENCES

#### UNIVERSITY ORDINARY EXAMINATION

2017/2018 ACADEMIC YEAR

**FOURTH YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF  
BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY AND  
THIRD YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF  
BACHELOR OF BUSINESS INFORMATION TECHNOLOGY**

ICS 2307/AMS 448 – SIMULATION AND MODELLING

DURATION: 2 HOURS

DATE: 6<sup>TH</sup> DECEMBER, 2017

TIME: 2.00 – 4.00 P.M.

#### **Instructions to Candidates:**

1. Answer **Question 1** and **Any Other Two** questions.
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

## SECTION ONE - COMPULSORY

### QUESTION ONE

- (a) Define the following terms as used in simulation and modelling
- i) Simulate
  - ii) System
  - iii) State of a system (6 marks)
- (b) Outline five areas where simulation is applicable (5 marks)
- (c) Differentiate between the following terms as used in classification of simulation models
- i) Static versus dynamic simulation models (2 marks)
  - ii) Discrete versus continuous simulation models (2 marks)
- (d) List five advantages of using simulation (5 marks)
- (e) Excel bakery maintains sufficient stock for its ever delight cake. Daily demand is as given below:

Daily Demand	0	10	20	30	40	50
Probability	0.01	0.20	0.15	0.50	0.12	0.02

- Use the following sequence of random numbers to simulate the demand for the next ten days 25, 39, 65, 76, 12, 05, 73, 89, 19, 49 (6 marks)
- (f) Give a brief over-view of Monte-Carlo simulation (4 marks)

## SECTION TWO – ANSWER ANY TWO

### QUESTION TWO

- (a) State and explain five components used in discrete event simulation model (10 marks)
- (b) Represent the components in 2(a) above in a flow diagram (10 marks)

### QUESTION THREE

Dr. strong is a dentist who schedules all her patients for 30 minutes appointments. Some of the patients take more than 30 minutes depending on the type of dental work to be done. The following table shows the various categories of work, their probabilities and the time actually needed to complete the work

Category	Time required	Probability
Filling	45 minutes	0.40
Crown	60 minutes	0.15
Cleaning	15 minutes	0.15
Extraction	45 minutes	0.10
Check-up	15 minutes	0.20

Assume that all the patients show up at the clinic at exactly their scheduled arrival time starting at 8.00 a.m.

- i) Calculate the dentists clinic schedule for four hours and determine average waiting time for the patients (17 marks)
- ii) Calculate the time that the doctor would be idle (3 marks)

Use the following random numbers: 40, 82, 11, 34, 25, 66, 17, 79

#### QUESTION FOUR

- (a) A simulation model attempts to describe a business system by a number of equations which are characterized by variables. State and explain these variables (8 marks)
- (b) The Tit-Fit Scientific laboratories is engaged in producing different types of high class equipment for use in science laboratories. The company has two different assembly lines to produce its most popular product 'pressurex'. The processing time for each of the assembly lines is regarded as a random variable and is described by the following distributions

Process time	10	11	12	13	14
Assembly A <sub>1</sub>	0.10	0.15	0.40	0.25	0.10
Assembly A <sub>2</sub>	0.20	0.40	0.20	0.15	0.05

The following random numbers generatre data on process times for fifteen units of the item.

4134	8343	3602	7505	7428
7476	1183	9445	0089	3424
4943	1915	5415	0880	9309

Read the numbers vertically taking the first two digits for A1 and last two digits for A2 hence compute the expected process time for the product (12 marks)

### QUESTION FIVE

- (a) Highlight three limitations of simulation (3 marks)
- (b) A company manufactures 30 units per day. The sales of these items depends upon demand which has the following distribution

Sales (Units)	27	28	29	30	31	32
Probability	0.10	0.15	0.20	0.35	0.15	0.05

The production cost and sale of each unit are Rs40 and Rs50 respectively. Any unused product is to be disposed off at a loss of Rs15 per unit. There is a penalty of Rs5 per unit if the demand is not met. Using the following random numbers: 10, 99, 65, 99, 95, 01, 79, 11, 16, 20

- i) Estimate the total profit/loss for the company for the next ten days (12 marks)
- ii) If the company decides to produce twenty nine units per day, what is the advantage or disadvantage of the company (5 marks)