



DEDAN KIMATHI UNIVERSITY OF TECHNOLOGY

University Examinations 2013/2014

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

ICS 2307 : SIMULATION AND MODELLING

DATE: 17TH DECEMBER 2013

TIME: 11.00AM – 1.00PM

Instructions:

1. Answer **QUESTION ONE** and any other **TWO QUESTIONS**.
2. Show clearly your work and the number of questions attempted.

QUESTION ONE (30 MARKS)

- a. Define the term simulation and state the two major reasons for using simulation to solve a problem. (4 marks)
- b. Explain the concept of Monte Carlo simulation, outlining its chronological steps. Explain the essential feature of this type of simulation (6 marks)
- c. Explain Why is the concept of a model basic is important to the technique of simulation (3 marks)
- d. Briefly explain the fixed increment time advance mechanism giving the circumstances under which it is valid. (5 marks)
- e. A company manufactures around 150 mopeds. The daily production varies from 146 to 154 depending upon the availability of raw material and other working conditions.

<i>Production per day</i>	146	147	148	149	150	151	152	153	154
<i>probability</i>	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.1	0.0

	4	9	2	4	1	0	0	2	8
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The finished products are transported in a specially arranged lorry accommodating only 150 mopeds. Using the following random numbers 80, 81, 76, 75, 64, 43, 18, 26, 10, 12, 65, 68, 69, 61, 57, simulate the process for 15 days. (7 marks)

Calculate:

- The average number of mopeds waiting in the factory
- The average number of empty spaces on the lorry.

QUESTION TWO (20 MARKS)

- How can a queuing system be simulated given distributions of the arrival time and the service time in an attempt to obtain the operating characteristics of the system? (6 marks)
- A small grocery store has only one checkout counter. Customers arrive at this checkout counter at random from 1 to 8 minutes apart. Each possible value of inter arrival time has the same probability of occurrence, as shown in table below.

<i>Time between arrivals</i>	1	2	3	4	5	6	7	8
<i>probability</i>	$\frac{0.12}{5}$	$\frac{0.12}{5}$	$\frac{0.12}{5}$	$\frac{0.12}{5}$	$\frac{0.12}{5}$	$\frac{0.12}{5}$	$\frac{0.12}{5}$	$\frac{0.12}{5}$

The service times vary from 1 to 6 minutes with the probabilities shown in the table below

<i>Service time (minutes)</i>	1	2	3	4	5	6
<i>probability</i>	$\frac{0.1}{0}$	$\frac{0.2}{0}$	$\frac{0.3}{0}$	$\frac{0.2}{5}$	$\frac{0.1}{0}$	$\frac{0.0}{5}$

Analyze the system by simulating the arrival and service of 20 customers. (14 marks)

Use the random number tables provided.

QUESTION THREE (20 MARKS)

- Explain the role of computers in carrying out simulations. (3 marks)

- b. How can an inventory system be simulated in an attempt to determine the appropriate re-order level and re-order quantity, given the probability distributions of demand and lead time along with necessary cost data. (5 marks)
- c. A dealer of electrical appliances has a certain product for which the probability distribution of demand per day and the probability distribution of the lead-time, developed by past records are as shown in tables below.

Probability distribution of demand

<i>Demand (units)</i>	2	3	4	5	6	7	8	9	10
<i>probability</i>	0.05	0.07	0.09	0.15	0.20	0.21	0.10	0.07	0.06

Probability distribution of lead time

<i>Lead time (days)</i>	1	2	3	4
<i>probability</i>	0.20	0.30	0.35	0.15

The various costs involved are,

Ordering Cost = Rs. 50 per order

Holding Cost = Rs.1 per unit per day

Shortage Cost = Rs. 20 per unit per day

The dealer is interested in having an inventory policy with two parameters, the reorder point and the order quantity, i.e., at what level of existing inventory should an order be placed and the number of units to be ordered. Evaluate a simulation plan for 20 days, which calls for a reorder quantity of 35 units and a re-order level of 20 units, with a beginning inventory balance of 45 units.

Use the random number tables provided.

(12 marks)

QUESTION FOUR (20 MARKS)

- a. ENUMERATE the key areas of difference and key standard capabilities of simulation languages. (8 marks)
- b. Explain the quantitative technique of solving management problems showing how it differs with simulation method. (5 marks)
- c. Distinguish between pseudo-random numbers and random numbers hence generate a stream of 10 u (0, 1) random numbers using the mid square method. (7 marks)

QUESTION FIVE (20 MARKS)

- a. Explain the four phases of simulation (8 marks)
- b. Using the random digits 659,930 take a random sample of 2 from the continuous distribution with probability distribution $y = \frac{3}{8}x^2$ for $0 \leq x \leq 2$. (6 marks)
- c. State and briefly explain three factors to consider when selecting a discrete simulation language. (6 marks)