



TECHNICAL UNIVERISTRY OF MOMBASA

# Faculty of Engineering & Technology

DEPARTMENT OF COMPUTER SCIENCE & INFORMATION TECHNOLOGY

UNIVERSITY EXAMINATION FOR DEGREE IN:  
BACHELOR OF TECHNOLOGY IN INFORMATION TECHNOLOGY  
(BTIT11M J-FT Y4 S2)

**EIT 4416: SIMULATION & MODELLING**

END OF SEMESTER EXAMINATION  
**SERIES: DECEMBER 2014**  
**TIME: 2 HOURS**

**Instructions to Candidates:**

You should have the following for this examination

- *Answer Booklet*

This paper consists of **FIVE** questions. Attempt question **ONE (Compulsory)** and any other **TWO** questions  
Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed pages

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**Question One (Compulsory)**

- a) Explain advantages and disadvantages of using simulation to investigate business problems compared with the use of Mathematical Formulae **(10 marks)**
- b) State the key factors considered when selecting a simulation language **(10 marks)**
- c) Explain the main steps involved in a simulation study. **(10 marks)**

## Question Two

Production line turns out about 50 trucks per day. Fluctuations in production occur for many reasons. The production can be described by a probability distribution as follows:

Production/Day	Probability
45	0.03
46	0.05
47	0.07
48	0.07
49	0.10
50	0.15
51	0.15
52	0.10
53	0.07
54	0.05
55	0.03

Finished trucks are transported by train at the end of the day. The train capacity is only 51 trucks.

Required:

- a) Using the following random numbers simulate the production for the next 10 days  
(10 marks)  
31, 53, 29, 69, 78, 91, 89, 87, 56, 33
- b) Using a multiplication congruential generation defined by  $Z_0 = 27$ ,  $a = 8$ ,  $c = 4$  and  $m = 100$   
Generate a sequence of 5 random numbers (5 marks)
- c) Outline FIVE characteristics of a good random generator (5 marks)

## Question Three

- a) A drive in banking service is modeled as an M/M/I queuing system with customer's annual rate of 2 per minute. It is desired to have fewer than five customer's line up to 99% of the time. How fast should the service rate be? (5 marks)
- b) A supermarket has a single cashiers, during the rush hours, customers are at the rate of operation. The average number of customers that can be processed by the cashier is 12 per hour on the basis of this information find:  
(i) The probability that the cashier is idle  
(ii) Average time a customer spends in the system  
(iii) Average number of customers in the queue and average time a customer spends in queue (10 marks)
- c) Briefly explain the different methods of generating random numbers (5 marks)

**Question Four**

- a) A salesman arranged to make a call each day for the next 10 working days. Previous experience showed that each average call had a 10% chance of cancellation. When a call was made the expected chances of success in making sales are as shown below.

Results	Probability
No sale	50
1 unit sold	10
2 unit sold	30
3 units sold	10

At the start of the 10 days period, he assumed that 5 units were in stock and a further 5 would be available to dispatch orders on the same day they were placed, if no stock were available orders would be held until the next delivery of stock.

Required:

Use a tabular simulation to cover the 10 day show whether each call was made and its results. Show also the level of stock held at the end of each day. use the following random number

5, 4, 5, 6, 2, 9, 3, 0, 3, 9, 3, 4, 8, 4, 9, 8, 4, 5, 6

**(15 marks)**

- b) Emergency cases are independently at random. Assume awards follow a Poisson input process (exponential interval times) and that the time spent with the ER doctor is exponentially distributed.

Average Annual Rate = 1 patient every ½ hours service rate = 2 patients/hours

(i) Calculate the server utilization rate

(ii) Expected time in ER

**(5 marks)**

**Question Five**

- a) Explain the following queuing system characteristics:

(i) Annual process

(ii) Queue behavior

(iii) System capacity

**marks)**

**(6**

- b) Explain the importance of generating random numbers in a simulation study

**(2 marks)**

- c) The following data are annual time (in minutes) and service times in minutes) for the first six customers arriving a dental clinic with one dentist on duty, upon arrival a customer enters service in the dentist is free or joins the waiting line. When the dentist has finished work on a customer, the next one in line enters service:

Annual Time	12	31	63	95	99	154
Service Time	40	32	55	48	18	50
Probability	0.3	0.0	0.1	0.2	0.2	0.1

Required:

- (i) Assuming a single serve develop a simulation table
- (ii) Calculate the average waiting time for each customer
- (iii) Determine the idle time the dental

**(5 marks)**

**(4 marks)**

Random Numbers for Annual time: 9, 13, 27, 53, 69, 71, 97, 11, 7, 31

Random Numbers for service time: 51, 33, 69, 7, 15, 97, 43, 27, 13, 31