



(University of Choice)

MASINDE MULIRO UNIVERSITY OF

SCIENCE AND TECHNOLOGY

(MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS

SPECIAL/SUPPLEMENTARY EXAM

2021/2022 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER EXAMINATION

FOR THE DEGREE OF BACHELORS OF SCIENCE IN

**(INFORMATION TECHNOLOGY, MATHEMATICS TECHNOLOGY, STATISTICS
TECHNOLOGY AND ECONOMICS TECHNOLOGY)**

COURSE CODE: BIT 323E

COURSE TITLE: SIMULATION AND MODELING

DATE: TUESDAY 02-08-2022

TIME: 11:00A.M-1:00P.M

INSTRUCTIONS TO CANDIDATES:

ANSWER QUESTIONS ONE AND ANY OTHER TWO.

MMUST observes ZERO tolerance to examination cheating

Paper Consists of 4 Printed Pages. Please Turn Over
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QUESTION ONE (COMPULSORY) [30 MARKS]

QUESTION ONE (COMPULSORY)

[30 MARKS]

- a. Define the following terms and concepts as used in simulation and modelling: **[5 marks]**
- i. System
 - ii. Event
 - iii. Simulation
 - iv. Delay
 - v. Modelling
- b. What is the difference between:
- i. A discrete and a continuous system **[2 marks]**
 - ii. Analytical models and numerical models. **[2 marks]**
- c. Briefly explain the steps followed in the simulation process. **[6 marks]**
- d. Define congestion in a queuing system, and describe its major characteristics. **[4 marks]**
- e. Describe five key components of a Discrete Event simulation **[5 marks]**
- f. Describe the process of model building, verification, and validation in brief. **[6 marks]**

QUESTION TWO

[20 MARKS]

- a. Consider a simple queuing network where customers enter the system with Exponential inter-arrival times with expectation 1 minute. One server then serves the incoming people with a service time uniform between 0.3 and 0.5 minutes. After that service people leave the system with probability 80% whereas with probability 20% they have to join the queue again to wait for another service. The simulation should start with an empty system and last for 4 hours.
- i. What are the entities and what are the resources and what are the events for this simple network? **[6 marks]**
 - ii. What are two variables you can use as state variable for that system? **[2 marks]**
 - iii. Is the system transient or steady state? Explain **[2 marks]**
- b. The average response time for http requests at a web server is 2 minutes. The system busy time was measured to be 50 seconds during a one minute observation interval. Use an M/M/1 model for the system to determine the following.
- i. What is the average service time per transaction **[4 marks]**
 - ii. What is the probability there are more than one http request in the system. **[2 marks]**

- iii. On average, how many requests are in the system [2 marks]
- iv. What is the average time a request spends in the queue? [2 marks]

QUESTION THREE

[20 MARKS]

- a. What is meant by the “System State” in a simulation? What can change the system state in a single server queuing system? [4 marks]
- b. Describe five key components of a Discrete Event simulation [8 marks]
- c. The simulation model-building (or simulation life cycle) can be broken into four phases. Explain briefly the main tasks of each of these phases? [8 marks]

QUESTION FOUR

[20 MARKS]

- a. State and explain when Simulation and modelling is appropriate. [6 marks]
- b. What is world view? Discuss different types of world view. [4 marks]
- c. Discuss the verification process. [4 marks]
- d. Distinguish between the following: [4 marks]
- i Terminating and non-terminating simulation
 - ii Random number and random variate
- e. State the desirable features of simulation software [2 marks]

QUESTION FIVE

[20 MARKS]

- a. Explain briefly any THREE Pitfalls in simulation and modeling. [3 marks]
- b. Explain Monte Carlo simulation pointing out the important characteristics of this method. [3 marks]
- a. What are major simulation software in manufacturing applications? Also discuss modeling system randomness. [5 marks]
- b. Discuss in detail, why validating a model of a computer system might be easier than validating a military combat model. Assume that the computer system of interest is similar to an existing one. [5 marks]
- c. Briefly describe each of the following and their respective application in real life:
- i. Manufacturing and material handling system [2 marks]
 - ii. Acceptance-rejection techniques [2 marks]