MACHAKOS UNIVERSITY

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND IT

THIRD YEAR SECOND SEMESTER

UNIT NAME: SIMULATION AND MODELLING

UNIT CODE: SCO 303

SEMESTER: JANUARY-APRIL

INSTRUCTION TO CANDIDATES

- SECTION A IS COMPULSORY
- ANSWER ANY TWO QUESTIONS IN SECTION B.

SECTION A (ALL QUESTIONS ARE COMPULSORY)

a) You are given an experimental scenario of simulating and modelling the network of Machakos University. After performing this experiment, discuss in details FIVE major pitfalls that you faced. **(10 Marks)**

b) Washington was simulating a project to present in a conference. He decided to delete the commands on his window that he was working on. Name the commands in Matlab he will use to perform this function and explain why?

(3 Marks)

c) Suppose that X is a discrete random variable with the probability mass function given by

$$p(i) = \frac{i}{15} \qquad i = 1, 2, 3, 4, 5$$

i. Define a discrete random variable and given an example **(2 Marks)**

ii. Plot p(x). **(3 Marks)**

iii. Compute and plot F(x). **(3 Marks)**

iv. Compute P (1.9999 ≤ X ≤ 4.0001). **(3 Marks)**

v. Compute E(X). **(3 Marks)**

vi. Compute Var(X) 15i. **(3 Marks)**

SECTION B (CHOOSE ANY TWO QUESTIONS)

QUESTION 1

a) Maurice decided to use Monte Carlo simulation to design an aeroplane. Describe your understanding of this method and the reasons as to why he might have decided to explore this method. In your answer include THREE main reasons why he found this method ideal and TWO difficulties he faced using this method. **(10 Marks)**

b) There are various techniques for verification of simulation computer programs. Write short notes FIVE main techniques that you are aware of in this process of simulation and modelling. **(10 Marks)**

QUESTION 2

a) You have been chosen as a representative in your class to give a discussion on models that exist in simulation and modelling. Give a write up on what you will include in your discussion and the differences that exist in the models chosen. **(10 Marks)**

b) For an M/M/1 queue, the mean number of customers in the system (L) is equal to the utilization divided by one minus the utilization. Using basic laws and relationships, answer the below questions. (For full credit, your expressions need to be simplified).

i. Define the kind of system described above **(2 Marks)**

ii. derive the mean wait in the system (W) **(2 Marks)**

iii. derive the mean number of customers in the queueing area (Lq), **(3 Marks)**

iv. derive the mean wait in the queuing area (Wq) as a function of arrival rate and service rate. **(3 Marks)**

QUESTION 3

a) Let

$$A = \begin{bmatrix} 11 & -2 & 3 \\ 4 & 0 & 4 \\ 1 & 9 & 5 \end{bmatrix}; \quad B = \begin{bmatrix} 1 \\ 0 \\ -1 \end{bmatrix}; \quad C = \begin{bmatrix} -5 & 12 & 4 \\ 3 & -6 & 2 \end{bmatrix}; \quad D = \begin{bmatrix} 5 & -2 & 0 \\ 8 & 7 & 6 \end{bmatrix};$$

$$E = [1 \;\; 3 \;\; 5 \;\; 7 \;\; 6 \;\; 8 \;\; 0 \;\; 9 \;\; 4 \;\; 2]$$

i. Write a command for matrix Multiplication of CD. **(2 Mark)**

ii. Write a command to arrange the element of the vector E in ascending order. **(2 Mark)**

iii. Write a command to return the smallest element of vector E. **(2 Mark)**

iv. Delete 2nd column from matrix C. **(2 Mark)**

v. Use Left division to solve $X = A^{-1}B$. **(2 Mark)**

b) Discrete Event Simulation is a major component of simulation and modelling. Write short notes on FIVE key features you understood of this component. **(10 Marks)**

QUESTION 4

a) Irene was performing simulation analysis for a project she was given by Machakos University, discuss in detail the steps she needs to follow in performing this task. **(10 Marks)**

b) Using your system give the output of the following MATLAB Commands and include a screenshot of your working. **(10 Marks)**

i. >> a = 3;b = 2; c = a + b

ii. >> d = 1:5; 2*d(3:4)

iii. >> who