



MACHAKOS UNIVERSITY

University Examinations for 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

THIRD YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)

SCO 303: SIMULATION AND MODELLING

DATE: 23/9/2019

TIME: 8:30 – 10:30 AM

INSTRUCTIONS:

Answer Question One and Any Other Two Questions

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) State FIVE circumstances that can prompt one to use simulations. (5 marks)
- b) Describe TWO various types of systems in simulation and modelling. (4 marks)
- c) List TWO advantages of simulation models as compared to analytical models. (2 marks)
- d) Give the difference between Static model and Dynamic model. (4 marks)
- e) Describe what you understand by model Validation and Verification. (4 marks)
- f) Describe what you understand by system Dynamics. (3 marks)
- g) For an M/M/1 queue we know that 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, derive the mean wait in the system (W), the mean number of customers in the queueing area (Lq), and the mean wait in the queueing area (Wq) as a function of arrival rate and service rate. For full credit, your expressions need to be simplified. (8 marks)

QUESTION TWO (20 MARKS)

- a) Describe the state of a system in the discrete-event simulation process. (3 marks)
- b) State FIVE characteristics of any system. (5 marks)
- c) Using well explained descriptions, give six uses of Simulation Modelling. (6 marks)

- d) Describe THREE types of tests that can be utilized to test for uniformity and independence of random number numbers. (6 marks)

QUESTION THREE (20 MARKS)

- a) Define a model. (2 marks)
- b) Describe how a Machakos Computer Science can simulate a model. (4 marks)
- c) Mention any FOUR components of a system as used in simulation and modelling. (8 marks)
- d) Using simple diagrams, explain the difference between discrete and continuous systems as used in simulation and modelling. (6 marks)

QUESTION FOUR (20 MARKS)

- a) Explain TWO functions of a model. (4 marks)
- b) Mention FIVE application areas of simulation and modelling. (5 marks)
- c) After performing experiments using simulation and modelling, list FIVE major Pitfalls you faced in simulation modelling. (5 marks)
- d) Discuss THREE techniques for verification of simulation computer programs. (6 marks)

QUESTION FIVE (20 MARKS)

- a) Define a random variable. (2 marks)
- b) Explain entities as used in simulation and modelling. (2 marks)
- c) Briefly explain THREE types of models used in simulation and modelling. (6 marks)
- d) Suppose that X is a discrete random variable with the probability mass function given by

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

- i) Plot $p(x)$. (2 marks)
- ii) Compute and plot $F(x)$. (2 marks)
- iii) Compute $P(1.9999 \leq X \leq 4.0001)$. (2 marks)
- iv) Compute $E(X)$. (2 marks)
- v) Compute $\text{Var}(X)$ 15i. (2 marks)