



MACHAKOS UNIVERSITY

University Examinations for 2021/2022

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

THIRD YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)

BACHELOR OF SCIENCE (COMPUTER SCIENCE)

SCO303: SIMULATION AND MODELLING

DATE: 14/12/2021

TIME:

INSTRUCTIONS: Answer Question ONE and any other TWO Questions

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) Define the following terms used in simulation and modelling.
- i. Modeling (2 marks)
 - ii. Simulation (2 marks)
 - iii. Variability (2 marks)
- b) Discuss the three-phase simulation approach for discrete events? (6 marks)
- Task: Mike has been tasked by his organization to source simulation software from a vendor to aid in the simulation of a new airport.
- i. Discuss how Mike would establish the model requirements. (6 marks)
 - ii. Describe the 6 main steps Mike should follow to select the simulation software. (6 marks)
- c) Discuss the key elements in simulation software. (6 marks)

QUESTION TWO (20 MARKS)

- a) Write an algorithm that would generate random numbers between 0.01 and 0.09. (6 marks)
- b) Briefly describe the following concepts
 - i. Trace-driven simulation (2 marks)
 - ii. Empirical distribution. (2 marks)
 - iii. Theoretical (fitting) distribution. (2 marks)
 - iv. Mention one advantage of each of the methods in 2.b. above. (3 marks)
 - v. Mention one disadvantage of each of the methods in 2.b. above. (3 marks)
- c) Differentiate between an exogenous variable and an endogenous variable in conceptual modeling. (2 marks)

QUESTION THREE (20 MARKS)

Suppose that X is a discrete random variable with the probability mass function

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

- a) Plot $p(x)$. (4 marks)
- b) Compute $F(x)$ (6 marks)
- c) Plot $F(x)$ (4 marks)
- d) Compute $E(X)$ (6 marks)

QUESTION FOUR (20 MARKS)

- a) Outline three advantages of a dedicated software package over a programming language for simulation and modeling. (6 marks)
- b) You set out to determine the warm up period in your simulation study. You want to choose between the original time series graphical method and Welch's method.
Describe how and why you would use the one that you select. (4 marks)
- c) Outline two options that are available to you when you want to ensure that you obtain sufficient data in your simulation study. (4 marks)
- d) Outline three ways on how to measure the success of the modeling and simulation undertaking. (6 marks)

QUESTION FIVE (20 MARKS)

- a) Explain the meaning of the term “discrete event modeling”. (2 marks)
- b) State four application markets for modeling and simulation. (4 marks)
- c) In a call centre customer calls arrive every three minutes. Three operator service points A, B and C are set up to process the calls and each call takes 4 minutes to be processed.
 - i. Construct a time slicing table to show what happens. (6 marks)
 - ii. How many operators should be maintained. (2 marks)
- d) Compare and contrast three difficulties that might be encountered in validating a simulation model of an existing manufacturing plant. (6 marks)