MACHAKOS UNIVERSITY

University Examinations for 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTING AND INFORMATION TECHNOLOGY

SECOND YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (COMPUTER SCIENCE)

SCO 303: SIMULATION AND MODELLING

DATE: 18/4/2019   **TIME: 8.30-10.30 AM**

INSTRUCTIONS

Answer **question ONE and any other TWO questions.**

QUESTION ONE (COMPULSORY) (30 MARKS)

a) Define the following terms, in the context of modelling and simulation: (3 marks)
   i. Verification
   ii. Validation
   iii. Credibility

b) List five major Pitfalls in simulation modelling.   (5 marks)

c) Define the following terms: (5 marks)
   i. Experiment
   ii. Sample space
   iii. Probability mass function of discrete random variable X
   iv. Joint probability mass function of two discrete random variables X and Y

d) Mention five application areas of simulation and modelling   (5 marks)

e) Using simple diagrams, explain the difference between discrete and continuous systems as used in simulation and modelling   (6 marks)

f) Consider an M/M/1 queuing system with an arrival rate $\lambda=0.4$ and service rate $\mu=0.5$.
   i. Compute the system load and tell if the system is stable or not?   (3 marks)
   ii. Compute the average number of customers in the system?   (3 marks)

QUESTION TWO (20 MARKS)

a)   As a student of Machakos University taking a simulation and modelling experiment, is it possible to verify and validate a simulation model and vice-versa? Investigate your answer with an example for each.   (5 marks)

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

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

  i.   Plot p(x)   (2 marks)

  ii.   Compute and plot F(x)   (5 marks)

  iii.   Compute $P(1.9999 \leq X \leq 4.0001)$ (3 marks)

  iv.   Compute E(X)   (2 marks)

  v.   Compute Var(X) 15i   (3 marks)

QUESTION THREE (20 MARKS)

a)   Briefly describe the following concepts: (6 marks)

  i.   Trace-driven simulation

  ii.   Empirical distributions

  iii.   Fitting (theoretical) distributions

b)   Mention the advantages and disadvantages of each of the above methods in (a) (8 marks)

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

QUESTION FOUR (20 MARKS)

a)   Explain what you understand by the term simulation and modelling   (4 marks)

b)   Briefly explain three types of models used in simulation and modelling   (6 marks)

c)   Discuss five techniques for verification of simulation computer programs.   (10 marks)

QUESTION FIVE (20 MARKS)

a)   Describe the state of a system in the discrete-event simulation   (2 marks)

b)   Briefly describe any four components of a system as used in simulation and modelling

                                                                                                                                 (8 marks)

c)   Discuss five techniques for increasing model validity and credibility.   (10 marks)