TECHNICAL UNIVERSITY OF MOMBASA

INSTITUTE OF COMPUTING AND INFORMATICS

DEPARTMENT OF COMPUTER SCIENCE & INFORMATION TECHNOLOGY

UNIVERSITY EXAMINATION FOR:

BSC IT

ICS 2307: SIMULATION AND MODELLING

END OF SEMESTER EXAMINATION

SERIES: SEPTEMBER 2018

TIME: 2HOURS

DATE:Sep 2018

Instructions to Candidates
You should have the following for this examination
-Answer Booklet, examination pass and student ID
This paper consists of **FIVE** questions. Attemptquestion ONE (Compulsory) and any other TWO questions.
Do not write on the question paper.

Question ONE

a) Define what is meant by the term simulation   [2marks]

b) State two reasons why random numbers are used in simulation   [2marks]

c) Differentiate between deterministic and Monte-Carlo models used in simulation [2marks]

d) Explain any 3 characteristics of a good random number generator[6 Marks]

e) A cigarette manufacturer wishes to use a random sample to estimate the average nicotin content[4 Marks].

 f) State and explain three methods used to test the suitability of random numbers. [6marks]

g) Over a period of 60 days demand for training in a specific computer package was recorded by mwambao computer college as follows:

No of inquiry	0	1	2	3	4	5	6
Frequency	5	6	16	14	10	7	2

i) Simulate the daily inquiries for a 15 day period using the random numbers provided below.
84,64,94,89,68,75,21,57,52,15,75,49,84,95,39   [6marks]

 (ii) Calculate average rate of inquiry   [2marks]

Question TWO

a) A carpenter makes tables and chairs. Each table can be sold for a profit of £30 and each chair for a profit of £10. The carpenter can afford to spend up to 40 hours per week working and takes six hours to make a table and three hours to make a chair. Customer demand requires that he makes at least three times as many chairs as tables. Tables take up four times as much storage space as chairs and there is room for at most four tables each week.

Required: Formulate this problem as a linear programming problem and solve it graphically. [10 MARKS]

   i. Define Queuing Theory[1 mark]
   ii. A queuing system has two servers whose service times are independent random variables with an exponential distribution with a mean of 15 minutes. Customer X arrives when both servers are idle. Five minutes later, customer Y arrives and customer X still is being served. Another 10 minutes later, customer Z arrives and both customer X and Y are still being served. No other customer arrived during this 15-minute interval.[9 marks]

    (a) What is the probability that customer X will complete service before customer Y?

    (b) What is the probability that customer Z will complete service before customer X?

    (c) What is the probability that customer Z will complete service before customer Y?

Question THREE

a) **How is probability theory of interest to performance modeling of information systems? [2 MARKS]**
b) **Define probability [2 MARKS]**
c) What are the key advantages of Arena simulation software [4 Marks]
d) Critics of spreadsheets simulation specify many advantages. List and explain the main Disadvantages. Then, give reasons why you think spreadsheets simulation is gaining popularity. Justify[5 marks]
e) **As a part of Christmas advertising a petrol station gives away one of 6 Lego toys to each customer who purchases $20 or more of fuel. Calculate how many visits to the petrol station a customer would need to make on average to collect all 6 Lego toys. Assumption: The likelihood of one Lego toy being handed out is independent of another.**[7marks]

Question FOUR

a) What is an event in a Discrete Event Simulation (DES). What is the result of an event? [1 mark]
b) What is the difference between endogenous and exogenous events? Give at least one example for each?

[2 marks]

c) Explain verification and illustrate how its achieved [4 Marks].

c)

You have simulated two systems for 7 replications each. The sample means for response time for system #1 are 100, 105, 110, 108, 102, 112, and 98 milliseconds. For system #2 they are 100, 105, 110, 108, 100, 110, and 95 milliseconds. Can you state with 95% and/or 90% confidence that one system is better (i.e., has lower response time) than the other system? Show your work. [7 Marks]

d) For the call center case study, what was the performance measure of interest? Give at least three ways that this performance measure can be improved (and that could be evaluated with our model?
[6 MARKS]

Question FIVE

a) State four factors considered when selecting a simulation language. [4marks]

b) Outline six steps that are used for the construction of a simulation process. [6marks]

c) The number of cars serviced at a garage on different days was recorded as follows: Number of cars 0 1 2 3 4 5 6 Number of days 4 8 14 8 3 2 1 Use the below data,

Number of cars	0	1	2	3	4	5	6
Number of days	4	8	14	8	3	2	1

(i) Simulate the following random numbers 68,55,90,50,08,72,44,95,81,93,28,89,60,11,23   [7 marks]

Calculate the expected number of cars serviced every day. Give your answer to the nearest number