UGANDA MARTYRS UNIVERSITY

NKOZI

UNIVERSITY EXAMINATION

FACULTY OF SCIENCE

DEPARTMENT OF COMPUTER SCIENCE & INFORMATION SYSTEMS

END OF SEMESTER FINAL EXAMINATION

SEM 1, ACADEMIC YEAR 2020/2021

BSC. COMPUTER SCIENCE

MODELLING AND SIMULATION

CSC 2104

DATE: 17TH JANUARY,2022

VENUE: NKOZI

TIME19:30 – 12:30PM

DURATION: THREE HOURS

INSTRUCTIONS:

1. ATTEMPT ALL QUESTIONS IN SECTION A (40 MARKS)
2. ATTEMPT THREE (03) QUESTIONS IN SECTION B (60 MARKS)
3. DO NOT OPEN THIS EXAM UNTIL YOU ARE TOLD TO DO SO
4. ALL ROUGH WORK SHOULD BE IN YOUR ANSWER BOOKLET

SECTION A [40 MARKS]

Consider a business case of Global buses Uganda (GBU). This company provides passengers and cargo services to East Africa countries, namely, Uganda, Ethiopian, Tanzania, Kenya, Rwanda, among other countries on differing blocks. The goal of this case is to analyze sales of the transport company. Sales analysis must be presented based on products breaking down the sales by company and individual dealers and destinations. The transport company would like to know who is buying the aviation services and in what quantities? How do the customers pay for the services? What effect does financing for the purchases have on the sales (method of payment)? How based can staff performance be analyzed? As an expert in modeling and simulation provide solutions to the following queries.

QUESTION ONE

a) Explain the concept of being numerate as used in simulation and modeling [2 Mks]

b) Differentiate between system and synergy as could be considered by the GBU modeling team [2 Mks]

c) Using the case study above formulate an example of a system and state its components [2 Mks]

d) Explain any three characteristics of complex systems that could be considered by the GBU modeling team [3 Mks]

e) Differentiate between static and dynamic systems as could be considered by the GBU modeling team [2 Mks]

f) Explain the concept of simulation as could be considered by the GBU modeling team [2 Mks]

g) Advise GBU modeling team on any two applications of simulation that could be considered [2 Mks]

h) Explain to GBU modeling and simulation team on any two advantages of modeling and simulation [2 Mks]

i) Using a diagram, illustrate the basic cycle of system dynamics could be considered by the GBU modeling team [2 Mks]

j) Identify the two main components systems thinking diagrams that could be considered by the GBU modeling team [2 Mks]

k) Explain the systems thinking diagram below derived from the GBU case study above [2 Mks]

l) Differentiate between polarity and causality as could be used by GBU technical team [2 Mks]

m) Advise the GBU modeling team on the relevance of graphical integration in their works [2 Mks]

n) Given that Time is updated based on two factors. Advise the GBU modeling team on these two factors [2 Mks]

o) Explain the following terms as could be used the GBU modeling team [3 Mks]
(i) Object, (ii) Base model, (iii) Experimental Frame

p) Differentiate between stochastic systems and deterministic systems as could be used the GBU modeling team [2 Mks]

q) Identify the two ways which can be used by the GBU modeling team in applying archetypes [2 Mks]

r) Differentiate between validation and verification as could be used by the GBU modeling team [2 Mks]

s) Using a diagram, illustrate a multi-server queue as could be adopted by the GBU modeling team [2 Mks]

SECTION B [60 Marks]

Considering the case study discussed in section A above, provide solutions to the following questions in section B.

QUESTION ONE

a) Based on the systems approach, explain the two basic components of a complex system as could be considered by the GBU modeling team [4 Mks]

b) Using illustrations differentiate between discrete and continuous systems as could be considered by the GBU modeling team [4 Mks]

c) Explain any four limitations of simulation as could be considered by the GBU modeling and simulation team [4 Mks]

d) With the use of a well labeled diagram, illustrate the queuing system for flight registration, based on the queuing times principle. [5 Mks]

e) With examples, explain the concept of performance metric as could be used by the GBU modeling and simulation team [3 MKS]

QUESTION TWO

a) Given that GBU modeling and simulation team have adopted simulation by hand: (i) calculate average waiting time in queue, (ii) time average number in queue, (iii) utilization of drill press. Consider the following assumptions. Total of times in queue =15.17, number of times in queue is 6, final clock value is 20, area under B (t) curve is 18.34, area under Q (t) curve = 15.8. [6 Mks]

b) Identify any four benefits of system dynamics as could be considered by the GBU team [4 Mks]

c) Explain the following modeling concepts as could be used by the GBU modeling team: (i) Systems thinking, (ii) system dynamics, (iii) Feedback [6 Mks]

d) Using an illustration, discuss the four levels of thinking that could be adopted by the GBU modeling team [4 Mks]

QUESTION THREE

a) Using a diagram, illustrate Anatomy of a Causal Loop Diagram for birth and death of airline clients [6 Mks]

b) With examples differentiate between balancing and reinforcing feedback loops as could be used by the GBU modeling team [4 Mks]

c) Using illustration provide causal loops for the following instances as could be used by the GBU team. Label each of the loop either negative or positive [6 Mks]

(i) INCREASE in population increases births, INCREASE in births increases population.

(ii) Population INCREASES death rate, death rate DECREASES population

d) With examples, differentiate between exogenous rates and endogenous rates as could be used by GBU modeling team [4 Mks]

QUESTION FOUR

a) With explanations, advise GBU modeling team, on any three tests that could be carried out to determine if a quantity is a stock or flow [6 Mks]

b) With examples differentiate between step functions and Ramp functions as could be used by the GBU modeling team [4 Mks]

c) With explanations, advise GBU modeling team, on any three system state variables that could be considered [6 Mks]

d) Explain the two feasible approaches that could be adopted by the GBU modeling team in developing the conceptual model [4 Mks]

QUESTION FIVE

a) With use of an illustration, explain the concept of the predator/prey model as could be considered by the GBU modeling team [6 Mks]

b) With causal loops examples explain any three generally acknowledge archetypes that can be adopted by the GBU modeling team [6 Mks]

c) Explain four approaches that could be used by the GBU modeling team in the process of validating the First Time Model [4 Mks]

d) Describe any four DES elements that could be used by the GBU modeling team [4 Mks]

END