



The Co-operative University of Kenya
END OF SEMESTER EXAMINATION AUGUST - 2022
EXAMINATION FOR THE DEGREE BACHELOR OF INFORMATION TECHNOLOGY
(YR III SEM I)
UNIT CODE: BCIT 3163
UNIT TITLE: BUSINESS SYSTEM MODELLING

DATE: 31ST AUGUST, 2022

TIME: 9:00 AM – 11:00 AM

INSTRUCTIONS:

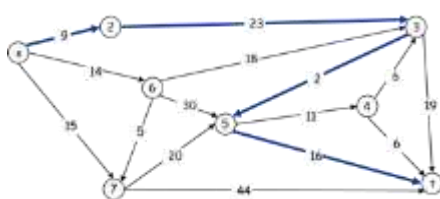
- Answer question **ONE (compulsory)** and any other **TWO** questions

QUESTION ONE

- (a) Define queuing theory **(2 Marks)**
 (b) Generally the type and complexity of the mathematical model dictates the nature of the solution method. Discuss three tools that can be used in business system modelling **(6Marks)**
 (c) Enumerate Four conditions that a problem to be solved through Linear Programming must confirm to: **(4Marks)**
 (d) Discuss Three applications of network models **(3 Marks)**
 (e) Discuss Two advantage and disadvantage of applying net present value (NPV) in determining investments option **(2 Marks)**
 (f) Given: **(3Marks)**

Weighted Directed graph $G = (V, E)$.

Source s , destination t .



Find shortest directed path from s to t .

- (g) Discuss three most important information required to solve queuing problem **(3 Marks)**
 (h) Distinguish between model Validation and Verification. **(4Marks)**
 (i) Discuss the significance of introducing the slack, surplus, and artificial variable in Linear Programming. **(3 Marks)**

QUESTION TWO:

- (a) Discuss the Three Components of Discrete-event simulation model **(6 Marks)**
 (b) There are Seven Jobs to be processed on a single machine. The following tables indicate the jobs and corresponding times in hours. Obtain the optimum sequence of the jobs by shortest processing time (SPT) rule that minimizes mean flow of time **(6 Marks)**

job	A	B	C	D	E	F	G
Processing time	8	3	5	4	3	9	6

- (c) Using Vogel Approximation Method obtain the optimum solution to the following problem to minimize total transport cost **(8marks)**

	D1	D2	D3	D4	
Q1	42	48	38	37	Supply
Q2	40	49	52	51	16
Q3	39	38	40	43	15
Demand	8	9	11	16	19

QUESTION THREE:

- (a) Discuss the Kendal and Lee's notation for representing queuing models **(4 Marks)**
 (b) A Small Project Consist of activities from A to I. The following table indicate the precedence relationship among activities and three time estimates- optimistic, most-likely and pessimistic time for each activities in a day.

Activity	Predecessor Relationship	Optimistic time (t_o)	Most Likely time t_m	Pessimistic time t_p
A	-	2	5	8
B	A	6	9	12
C	A	6	7	8
D	B,C	1	4	7
E	A	8	8	8
F	D,E	5	14	17
G	C	3	12	21
H	F,G	3	6	9
I	H	5	8	11

- i. Draw the project network. Determine the expected time and variance for each activity **(4Marks)**
 ii. Obtain the total expected duration of the project and critical path **(3Marks)**
 iii. Determine the probability of completing the project in 50 days **(3 Marks)**
 (c) A patient consults a doctor to check on his ill health. The Doctor finds him to be having deficiency of two vitamins, A and D. The patient is advised to consume vitamins A and D regularly for some time so as to regain his health. The doctor prescribes tonics I and II, both of which contain vitamins A, and D in certain proportions. He is also advised to consume at least 40 units of vitamin A and 50 units of vitamin D Daily. The costs of tonics I and II and the proportions of vitamins A and D that they contain are given in the table below.

Vitamins	TonicI	Tonic II	Daily Requirements in Units
A	2	4	40
D	3	2	50
Cost per Unit in Kshs	50	30	

Formulate the linear programming model that minimizes the cost of tonic **(6 marks)**

QUESTION FOUR:

- (a) Briefly by use of simple diagrams and providing examples, distinguish between discrete and continuous systems in simulation and modelling. **(4 Marks)**
- (b) Define degeneracy in transportation problem, discuss its consequences and how it is overcome **(4 Marks)**
- (c) Explain the difference between assignment problem and transportation problem **(4marks)**
- (d) The Makini industry manufactures two types of Biscuits A and B, These are packed in attractive packets. In one week the industry can sell a maximum of 400 biscuits of type A and a maximum of 300 biscuits of type B. The storage capacity, however, is limited to a maximum of 600 of both types combined.

Type A biscuit fetches a profit of Kshs. 20/- per unit and type B a profit of Kshs. 50/- per unit. The store wants to establish how many of each type of biscuits they need to stock per week in order to maximize their total profit.

Formulate a mathematical model for this problem **(8 marks)**

QUESTION FIVE:

- (a) Discuss the minimum spanning tree problem **(4 Marks)**
- (b) Describe any THREE components of a system in simulation and modelling. **(6 Marks)**
- (c) Explain in detail the various types of systems in simulation and modelling. **(4 Marks)**
- (d) Discuss THREE types of models used in simulation and modelling. **(6 Marks)**