



PAN AFRICA CHRISTIAN UNIVERSITY

BACHELOR OF SCIENCE INFORMATION TECHNOLOGY

END OF SEMESTER EXAMINATION

DEPARTMENT: COMPUTING AND INFORMATION TECHNOLOGY
COURSE CODE: BCIT202
COURSE TITLE: OPERATIONS RESEARCH
CAMPUS: ROYSAMBU
EXAM DATE: XXXXX XXXXX/AUGUST, 2021
TIME: XXXXX

INSTRUCTIONS

- This exam script has **TWO (2)** sections.
- Read all questions carefully before attempting.
- Answer All questions in Section **A** and any other Three questions in Section **B**.
- Write only your **student number** on the answer booklet provided.

SECTION A
(Answer ALL questions in this section)

Question 1:

a) Operations Research is sometimes referred to as 'Management Science'. Explain.

[2 Marks]

b) The KICOMI retail store stocks two types of shirts A and B. In one week, the store can sell a maximum of 400 shirts of type A and a maximum of 300 shirts of type B. The storage capacity, however, is limited to a maximum of 600 of both types combined. Type A shirt 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 shirt should be stocked per week in order to maximize the total profit. Formulate the linear programming problem to maximize the total profit.

[4 Marks]

c) The following table gives activities of a construction project and duration

Activity	1-2	1-3	2-3	2-4	3-4	4-5
Duration(Days)	20	25	10	12	6	10

Required:

i. Construct a network diagram for the project.

[2 Marks]

ii. Determine the critical path of the project.

[2 Marks]

SECTION B
(Answer any THREE (3) questions in this section)

Question 2:

Consider the following transportation problem:

	Destinations				
Origins	A	B	C	D	Supply
P	2	3	4	5	6

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Q	5	4	3	1	8
R	1	3	3	2	10
Demand	4	6	8	6	24

Find the initial basic feasible solution using:

- i. North-West Corner Method [5

Marks]

- ii. Least Cost Method [5

Marks]

Question 3:

The following formulated Linear Programming model is provided;

$$\text{Max } Z = x_1 + 2x_2 + 3x_3$$

Subject to

$$2x_1 + x_2 + x_3 \leq 1$$

$$3x_1 + 4x_2 + 4x_3 \leq 4$$

$$5x_1 + 7x_2 + 4x_3 \leq 2$$

$$x_1, x_2, x_3, \geq 0$$

- i. Using Simplex Method give the initial tableau [7 Marks]

- ii. State the pivot element, leaving variable and entering variables at this stage.

[3 Marks]

Question 4:

- a) Explain how Operations Research has impacted on the following, giving an appropriate example from the Kenyan context:- [4 Marks]

- i. Education
- ii. Inventory Management

- b) Find the dual to the following maximization problem [6 Marks]

$$\text{Max } Z = 3x_1 + 2x_2 + 5x_3$$

Subject to:

$$x_1 + 2x_2 + 3x_3 \leq 430$$

$$3x_1 + x_3 \leq 460$$

$$x_1 + 4x_2 \leq 420$$

$$x_1, x_2, x_3 \geq 0$$

Question 5:

A construction company wants cement at three of its project sites P1, P2 and P3. It procures cement from four plants C1, C2, C3 and C4. Transportation costs per tonne, capacities and requirements are as follows:

	P1	P2	P3	Capacity(tonnes)
C1	2	7	4	50
C2	3	3	1	80
C3	5	4	7	70
C4	1	6	2	140
Requirement	70	90	180	340

Use Vogel's Approximation Method to develop an initial feasible solution.

[10 Marks]

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Question 6:

A new pharmaceutical product is to be released on a deadline for which 44 days are left. The activities involved in the product launch with their interdependencies and probabilistic times for completion in days are shown in the table below.

Activity	Time delays			
	Predecessor	Optimistic	Most likely	Pessimistic
A	-	6	10	14
B	A	1	2	3
C	A	16	20	30
D	B	3	5	7
E	D	2	3	4
F	C	7	10	13
G	D	1	2	3
H	G	1	3	5
I	C, G	2	2	2
J	I	2	3	4
K	H	1	1	1
L	J, K	1	2	3

Calculate the expected time for each activity.

[10 Marks]

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