

PAN AFRICA CHRISTIAN UNIVERSITY

BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY

END OF SEMESTER EXAMINATION

DEPARTMENT: COMPUTING AND INFORMATION TECHNOLOGY
COURSE CODE: BSIT202
COURSE TITLE: OPERATIONS RESEARCH
CAMPUS: ROYSAMBU
EXAM DATE: **FRIDAY, XXXXX/AUGUST, 2023**
TIME: 11:00AM-2:00PM

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 the application of scientific methods to arrive at the optimal solutions to the problems. Justify this statement. **[2 Marks]**

b) A manufacturing company produces two products X and Y. The Company has three machines A, B and C. Product X requires two minutes of Machine A, three minutes of Machine B and one Minute of Machine C. Product Y requires three minutes of machine A, two minutes of machine B and one minute of machine C. The capacity available is 1,500 minutes of machine A, 1500 minutes of machine B and 600 minutes of machine C. Each unit of product X sold gives a profit of ksh.100 and ksh.120 for each of product Y. What is produced is sold immediately.

Formulate the problem as a linear programming problem to maximize the total profit.

[4 Marks]

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

Activity	Preceding Activity	Duration
A	-	2
B	A	3
C	A	5
D	A	8
E	B	6
F	C	1
G	C	2
H	C,D	3
I	E,F	7
J	G,H	4
K	I, J	5

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
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:

A company produces three products A, B, and C. The unit profit contribution of each of the products are Ksh. 5, 10 and 8 respectively. Each unit of product A requires 3kgs of material, 4 machine hours and 2 labour hours; each units of product B requires 5kgs of material, 4 machine hours and 4 labour hours; each unit of product C requires 2kgs of material, 4 machine hours and 5 labour hours. The company has 60 kgs of materials, 72 machine hours and 100 labour hours available everyday. The company wants to maximize its daily profits using the available resources,

Required:

- a) Using Simplex Method, draw the initial tableau form. **[7 Marks]**
- b) State the:
 - i. Entering variable **[1 Mark]**
 - ii. Leaving variable **[1 Mark]**
 - iii. Pivot element **[1 Mark]**

Question 4:

Four jobs are to be assigned to four machines. The table below shows the costs associated with each job- machine combination.

		Machine			
Job		A	B	C	D
	W	8	6	2	4
	X	6	7	11	10
	Y	3	5	7	6
	Z	5	10	12	9

- i. Using Hungarian technique assign the jobs to machines. **[8 Marks]**
- ii. Determine the minimum cost. **[2 Marks]**

Question 5:

You are provided with the following information on the transportation costs per unit from each source to each destination and the availabilities and the demand

Source	X	Y	Z	Capacity
P	5	8	2	200
Q	12	6	5	480
R	9	10	4	320
Demand	400	250	350	

Use Vogel's Approximation Method to develop an initial transportation schedule and compute the minimum cost for your allocation. **[10 Marks]**

Question 6:

- a) Given $MaxZ = 6x_1 + 4x_2$
 Subject to:
 $8x_1 + 4x_2 \leq 200$
 $8x_1 + 6x_2 \leq 360$

Find the maximizing dual problem

[3 Marks]

- b) A project consists of nine tasks A, B, C, D, E, F, G, H and I with the following precedence relations and time estimates.

		Time estimates in days		
		Optimistic	Most likely	Pessimistic
Job	Predecessor(s)	t_o	t_m	t_e
A	-	3	6	15
B	-	2	5	14
C	A,B	6	12	30
D	A,B	2	5	8
E	B	5	11	17
F	D,E	3	6	15
G	C,F	3	9	27
H	D,E	1	4	7
I	G,H	2	5	8

Calculate the expected time of each activity.

[7 Marks]

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