

**PAN AFRICA CHRISTIAN UNIVERSITY
EXAMINATIONS PAPER**



PAN AFRICA CHRISTIAN UNIVERSITY

BACHELOR OF SCIENCE IN INFORMATION TECHNOLOGY

END OF SEMESTER EXAMINATION

DEPARTMENT: COMPUTING AND INFORMATION TECHNOLOGY

COURSE CODE: BCIT202

COURSE TITLE: OPERATIONS RESEARCH

CAMPUS: ROYSAMBU

EXAM DATE: WEDNESDAY, XXXX, DECEMBER, 2022

TIME: 8:00AM -11:00AM

INSTRUCTIONS

- Read all questions carefully before attempting.
- Answer any four questions.
- Write only your **student number** on the answer booklet provided.

SECTION A

(Answer ALL questions in this section)

Question 1:

- a) Explain two examples of Operations Research application in the industry today. **[2 Marks]**
- b) "PERT is more superior to CPM." Explain **[2 Marks]**
- c) A company is involved in the production of two items (X and Y). The resources need to produce X and Y are twofold, namely machine time for automatic processing and craftsman time for hand finishing. The table below gives the number of minutes required for each item:

	Machine time	Craftsman time
Item X	13	20
Item Y	19	29

The company has 40 hours of machine time available in the next working week but only 35 hours of craftsman time. Machine time is costed at Ksh.10 per hour worked and craftsman time is costed at Ksh. 2 per hour worked. Both machine and craftsman idle times incur no costs. The revenue received for each item produced (all production is sold) is Ksh.20 for X and Ksh.30 for Y. The company has a specific contract to produce 10 items of X per week for a particular customer.

Formulate the problem of deciding how much to produce per week as a linear program. **[4 Marks]**

- d) The following table gives activities of a construction project and duration.

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Activity	A-B	A-C	B-C	B-D	C-D	D-E
Duration(Days)	12	15	10	20	5	16

Determine the critical path of the project.

[2 Marks]

SECTION B

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

Question 2:

In the table below; supply level, demands at various destinations, and the unit cost of transportation are given.

Destinations

Origin	P	Q	R	Supply
A	5	7	8	70
B	4	4	6	30
C	6	7	7	50
Demand	65	42	43	150

Compute and obtain an initial feasible solution using:

i. Least Cost Method

[4 Marks]

ii. Vogel's Approximation Method

[6 Marks]

Question 3:

Consider the following data of a project.

Activity	Predecessor(s)	Duration (weeks)		
		t_0	t_m	t_p
A	—	3	5	8
B	—	6	7	9
C	A	4	5	9
D	C	A	4	5
D	B	3	5	8
E	A	4	6	9
F	C, D	5	8	11
G	C, D, E	3	6	9
H	F	1	2	9

- i. Construct the project network. **[5 Marks]**
- ii. Find the expected duration of each activity. **[5 Marks]**

Question 4:

a) Solve the Linear Programming (LP) model given below using the Simplex Method.

[10 Marks]

Maximize $Z = 3X_1 + 2X_2 + X_3$

Subject to

$$\begin{aligned} 2X_1 + X_2 + X_3 &\leq 150 \\ 2X_1 + 2X_2 + 8X_3 &\leq 200 \\ 2X_1 + 3X_2 + X_3 &\leq 320 \\ X_1, X_2, X_3 &\geq 0 \end{aligned}$$

Question 5:

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) Formulate the above problem as a linear programming model. **[4 Marks]**
- b) Write the problem in (a) above in its tableau form. **[3 Marks]**
- c) Draw the initial simplex tableau and show
 - i. The entering variable **[1 Mark]**
 - ii. The leaving variable **[1 Mark]**
 - iii. The pivot element **[1 Mark]**

Question 6:

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

		Machine			
		A	B	C	D
Job	1	8	6	2	4
	2	6	7	11	10

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	3	3	5	7	6
	4	5	10	12	9

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

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