



UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA
FIRST SEMESTER EXAMINATION, APRIL 2023

COURSE NO: MA 487

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COURSE NAME: MATHEMATICAL PROGRAMMING

CLASS: MA IV

TIME: 3 HOURS

Name: _____ Index Number: _____

Answer all Questions

1. A machine tool company decides to make four subassemblies through four contractors. Each contractor is to receive only one subassembly. The cost of each subassembly is determined by the bids submitted by each contractor and is shown in table below in hundreds of cedis

		Contractors			
		1	2	3	4
Subassemblies	1	15	13	14	17
	2	11	12	15	13
	3	13	12	10	11
	4	15	17	14	16

- Formulate the mathematical model for the problem.
- Show that the assignment model is a special case of the transportation model.
- Assign the different subassemblies to contractors so as to minimize the total cost

[20 Marks]

2. Using the graphical method

Find the minimum value of

$$Z = -X_1 + 2X_2,$$

subject to

$$-X_1 + 3X_2 < 10$$

$$X_1 + X_2 < 6$$

$$X_1 - X_2 < 2,$$

$$X_1, X_2 \geq 0$$

[20 Marks]

Using the simplex method

$$\text{Maximize } Z = 5x_1 - 4x_2 + 3x_3$$

Subject to

$$2x_1 + x_2 - 6x_3 \leq 20$$

$$6x_1 + 5x_2 + 10x_3 \leq 76$$

$$8x_1 - 3x_2 + 6x_3 \leq 50$$

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

$$2x_1 + x_2 - 6x_3 + S_1 = 20$$

[20 Marks]

4. A company has four warehouses and six stores. The warehouses altogether have a surplus of 22 units of a given commodity divided among themselves as follows:

Warehouses	1	2	3	4
Surplus	5	6	2	9

The six stores altogether need 22 units of the commodity. Individual requirement at stores 1, 2, 3, 4, 5 and 6 are 4, 4, 6, 2, 4 and 2 units respectively.

Cost of shipping of one of the commodities from i to store j in cedis is given in the table:

		Stores					
		1	2	3	4	5	6
Warehouses	1	9	12	9	6	9	10
	2	7	3	7	7	5	5
	3	6	5	9	11	3	11
	4	6	8	11	2	2	10

$$-6x_1 + S_2$$

$$-2x_1 + S_1$$

- Formulate the mathematical model for the problem
- How should the product be shipped from the warehouses to the store to minimize the transportation cost

[20 Marks]

5. A salesman wants to visit cities A, B, C, D, E. He does not want to visit any city twice before completing the tour of all the cities and return to his home city, the starting station. Cost of going from one city to another city is given in the table:

	A	B	C	D	E
A	∞	2	5	7	1
B	6	∞	3	8	2
C	8	7	∞	4	7
D	12	4	6	∞	5
E	1	3	2	8	∞

Find the least cost route

[20 Marks]

Examiner: Dr H. Otoo