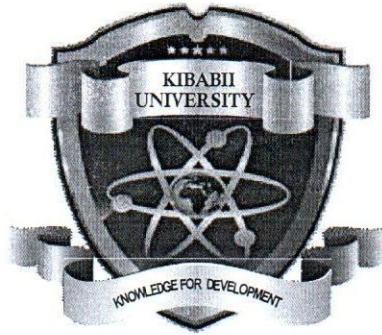


FS



(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS 2021/2022 ACADEMIC YEAR

END OF SEMESTER EXAMINATIONS YEAR FOUR SEMESTER ONE EXAMINATIONS

FOR THE DEGREE OF (COMPUTER SCIENCE)

COURSE CODE : CSC 412

COURSE TITLE : OPERATIONS RESEARCH

DATE: 17/05/2022

TIME: 02:00 P.M – 04:00 P.M

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTIONS ONE AND ANY OTHER TWO.

QUESTION ONE (COMPULSORY) [30 MARKS]

- a) Explain the following terms as used in operation research
- i) Linear programming [1 mark]
 - ii) Basic variable [1 mark]
 - iii) Assignment problem [1 mark]
 - iv) Sensitivity analysis [1 mark]
- b) Solve the following problem using Big M method. [12 marks]

$$\text{Min } Z = 10x_1 + 15x_2 + 20x_3$$

Subject to

$$2x_1 + 4x_2 + 6x_3 \geq 24$$

$$3x_1 + 9x_2 + 6x_3 \geq 30$$

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

- c) Solve the assignment model shown in Table 1 below using hungarian method hence find the minimum total cost. [8 marks]

Table 1

Job

| Worker | 1 | 2 | 3 | 4 | 5 |
|--------|---|----|---|----|----|
| 1 | 3 | 8 | 2 | 10 | 3 |
| 2 | 8 | 7 | 2 | 9 | 7 |
| 3 | 6 | 4 | 2 | 7 | 5 |
| 4 | 8 | 4 | 2 | 3 | 5 |
| 5 | 9 | 10 | 6 | 9 | 10 |

- d) Explain three assumptions of linear programming. [6marks]

QUESTION TWO [20 MARKS]

- a) Define the following terms
- i) Optimal solution [1 mark]
 - ii) Unbounded solution [1 mark]
 - iii) Feasible solution [1 mark]
- b) Obtain the initial basic solution using the following methods in the problem below.
- i) North west corner cell method [5 marks]

- ii) Least cost cell method
 iii) Vogel's approximation method

[6 marks]
 [6 marks]

Table 2

| Source | Destination | | | | Valubility |
|-------------|-------------|----|----|----|------------|
| | 1 | 2 | 3 | 4 | |
| 1 | 10 | 2 | 20 | 11 | 15 |
| 2 | 12 | 7 | 9 | 20 | 25 |
| 3 | 4 | 14 | 16 | 18 | 10 |
| Requirement | 5 | 15 | 15 | 15 | |

QUESTION THREE [20 MARKS]

- a) A company has three factories located in three cities X, Y, Z. This factory supplies consignments to fur dealers A, B, C and D. The dealers are spread all over the country. The production capacity of these factories is 1000, 700 and 900 units per month respectively. The net return by unit is given in the Table 3 below.

Table 3

| Factories | A | B | C | D | Capacities |
|-------------|-----|-----|-----|-----|------------|
| X | 6 | 6 | 6 | 4 | 1000 |
| Y | 4 | 2 | 4 | 5 | 700 |
| Z | 5 | 6 | 7 | 8 | 900 |
| Requirement | 900 | 800 | 500 | 400 | 2600 |

Obtain basic feasible solution using North West corner method.

[10 marks]

- b) Solve the following problem using simplex method.

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

Subject to

$$5x_1 + 2x_2 \leq 40$$

$$6x_1 + 12x_2 \leq 80$$

$$x_1, x_2 \geq 0$$

[10 marks]

QUESTION FOUR [20 MARKS]

A company wants to produce three products A, B and C. The unit profits of these products are K£ 4, K£ 6 and K£ 2 respectively. These products require two types of resources - man power and material. In the following L.P model is formulated for determining the optimal product mix.

$$\text{Max } z = 4x_1 + 6x_2 + 2x_3$$

Subject to

$$x_1 + x_2 + x_3 \leq 3 \text{ (man-power)}$$

$$x_1 + 4x_2 + 7x_3 \leq 9 \text{ (material)}$$

Where x_1 , x_2 , x_3 are the number of products A, B, and C produced.

- a) Find the optimal product mix and the corresponding profit to the company [6 marks]
- b) What happens if C_3 is increased to K£ 12? What is the new optimal product mix in this case? [4 marks]
- c) i) Find the range on basic coefficient C_1 such that the current optimal product mix remains optimal. [4 marks]
- ii) Find the effect when $C_1 = \text{K£ } 8$ on the optimal product mix. [6 marks]

QUESTION FIVE [20 MARKS]

- a) Use the duality method to solve the linear programming problem below. [14 marks]

$$\text{Min } Z = 10x_1 + 8x_2$$

Subject to

$$x_1 + 2x_2 \geq 2$$

$$x_1 + x_2 \geq 5$$

$$x_1, x_2 \geq 0$$

- b) Use graphical method to obtain the optimum solution to the linear programming problem.

$$\text{Max } z = 30x_1 + 40x_2$$

Subject to

$$x_1 + x_2 \leq 50$$

$$2x_1 + x_2 \leq 90$$

$$x_1 + 2x_2 \leq 80$$

$$x_1, x_2 \geq 0$$

[6 marks]