



(Knowledge for Development)

KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS
2020/2021 ACADEMIC YEAR**

**SPECIAL/SUPPLEMENTARY EXAMINATIONS
YEAR FOUR SEMESTER ONE EXAMINATIONS**

**FOR THE DEGREE OF
BACHELOR OF SCIENCE COMPUTER SCIENCE**

COURSE CODE : CSC 412

COURSE TITLE : OPERATIONS RESEARCH

DATE: 11/01/2022

TIME: 08.00 A.M – 10.00 A.M

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTIONS ONE AND ANY OTHER TWO.

QUESTION ONE [COMPULSORY] [30 MARKS]

a) Define the following terms

- i) Infeasible solution [2 marks]
- ii) Unbounded solution [2 marks]
- iii) Feasible solution [2 marks]

b) Obtain an initial basic feasible solution to the following transportation problem using North West corner method. [8 marks]

	W	X	Y	Z	Available (Supply)	
A	15	23	18	30	200	
B	17	32	20	40	300	
C	20	19	27	50	500	
Requirement (Demand)	100	300	200	400	1000	

c) Solve the following problem using simplex method.

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

Subject to

$$2x_1 + 5x_2 + 2x_3 \leq 38$$

$$4x_1 + 2x_2 + 3x_3 \leq 57$$

$$x_1 + 3x_2 + 5x_3 \leq 57$$

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

[10 marks]

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

$$\text{Max } z = 5x + 4y$$

Subject to

$$6x + 4y \leq 24$$

$$x + 2y \leq 6$$

$$-x + y \leq 1$$

$$y \leq 2$$

$$x, y \geq 0$$

[6 marks]

QUESTION TWO [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) A company is producing a single product and selling it through agencies situated in different cities. All of a sudden there is demand for the product in another five cities not having any agencies of the company. The company is faced with the problem of deciding how to assign the existing agencies to distinguish the product. The distance between surplus and deficit cities is given in the following distance matrix.

Surplus/ deficit cities	Programs				
	I	II	III	IV	V
A	160	130	175	190	200
B	135	120	130	160	175
C	140	110	155	170	185
D	50	50	80	80	110

Determine the optimum assignment schedule.

[6 marks]

QUESTION THREE [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 FOUR [20 MARKS]

- a) Explain the following terms
- i) Assignment problem [2 marks]
- ii) Transshipment problem [2 marks]
- b) Write a zero-one programming model for assignment problem. [3 marks]
- c) Consider the following table containing figures that relates to contribution from service engineer and that it is required to maximize contribution (use hungarian method). [13 marks]

	W	X	Y	Z
1	25	18	23	14
2	38	15	53	23
3	15	17	41	30
4	26	28	36	29

QUESTION FIVE [20 MARKS]

Bevco manufactures an orange flavoured soft drink called Oranj by combining orange soda and orange juice. Each ounce of orange soda contains 0.5 oz of sugar and 1 mg of vitamin C. Each ounce of orange juice contains 0.25 oz of sugar and 3 mg of vitamin C. It costs Bevco 2\$ to produce an ounce of orange soda and 3\$ to produce an ounce of orange juice. Marketing department has decided that each 10 oz bottle of Oranj must contain at least 20 mg of vitamin C and at most 4 oz of sugar. Use the Big M method to determine how Bevco can meet the marketing department's requirements at minimum cost.