



(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS 2019/2020 ACADEMIC YEAR

END OF SEMESTER EXAMINATIONS YEAR FOUR SEMESTER ONE SPECIAL /SUPPLIMENTARY EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF SCIENCE COMPUTER SCIENCE

COURSE CODE : CSC 412

COURSE TITLE : OPERATIONS RESEARCH

DATE: 15/02/2021 TIME: 11.00 A.M – 01.00 P.M

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTIONS ONE AND ANY OTHER TWO.

QUESTION ONE [COMPULSORY] [30 MARKS]

- a) Define the following terms
- i) Transportation problem (2 marks)
 - ii) Inventory problem (2 marks)
 - iii) Slack variable (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). (10 marks)

	A	B	C	D
1	25	38	15	26
2	18	15	17	28
3	23	53	41	36
4	14	23	30	29

- d) Solve the following problem using simplex method. (11 marks)

$$\text{Max } Z = 60x_1 + 30x_2 + 20x_3$$

Subject to

$$8x_1 + 6x_2 + x_3 \leq 48$$

$$4x_1 + 2x_2 + 1.5x_3 \leq 20$$

$$2x_1 + 1.5x_2 + 0.5x_3 \leq 8$$

$$x_2 \leq 5$$

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

QUESTION TWO [20 MARKS]

- a) Dorian makes luxury cars and jeeps for high-income men and women. It wishes to advertise with 1 minute spots in comedy shows and football games. Each comedy spot costs \$50K and is seen by 7M high-income women and 2M high-income men. Each football spot costs \$100K and is seen by 2M high-income women and 12M high-income men. How can Dorian reach 28M high-income women and 24M high-income men at the least cost?
- i) Develop and LP model. (4 marks)
- ii) Hence use graphical method to obtain the optimum solution to the linear programming problem. (6 marks)
- b) A foreman had four fitters and has been asked to deal with five jobs. The times for each job are estimated as follows:

	A	B	C	D
1	6	22	12	18
2	12	18	16	14
3	20	15	18	10
4	12	20	15	17

- a) Allocate the men to the jobs so as to minimize the total times taken and identify the job which will not be dealt with (use hungarian method). (10 marks)

QUESTION THREE [20 MARKS]

- a) Solve the following problem using Big M method. (20 marks)

$$\text{Max } Z = 20x_1 + 6x_2 + 9x_3$$

Subject to

$$4x_1 + 3x_2 + x_3 \leq 24$$

$$2x_1 + 4x_2 + 12x_3 \geq 30$$

$$2x_1 + 3x_2 + x_3 = 10$$

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

QUESTION FOUR [20 MARKS]

- a) Solve the following problem

(10 marks)

$$\text{Max } Z = 5x_1 + 12x_2 + 4x_3$$

Subject to

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

$$2x_1 - x_2 + 3x_3 = 2$$

$$2x_1 + 3x_2 + x_3 = 10$$

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

- b) Discuss the effect of changing the requirement vector from $\begin{pmatrix} 5 \\ 2 \end{pmatrix}$ to $\begin{pmatrix} 7 \\ 2 \end{pmatrix}$ on the optimum solution. (4marks)
- c) Discuss the effect of changing the requirement vector from $\begin{pmatrix} 5 \\ 2 \end{pmatrix}$ to $\begin{pmatrix} 3 \\ 9 \end{pmatrix}$ on the optimum solution. (6 marks)

QUESTION FIVE [20 MARKS]

- a) Form the dual of the following LP problem

(4 marks)

$$\text{Min } z = 5x_1 + 8x_2$$

Subject to

$$4x_1 + 9x_2 \geq 100$$

$$2x_1 + 8x_2 \leq 20$$

$$2x_1 + 5x_2 \geq 120$$

$$x_1, x_2 \geq 0$$

- b) Hence solve the LP problem.

(10 marks)

- c) Obtain an initial basic feasible solution to the following transportation problem using North West corner method. (6 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	