(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2017/2018 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER

MAIN EXAMINATION

FOR THE DEGREE OF BACHELOR OF EDUCATION AND BACHELOR OF SCIENCE

COURSE CODE: **MAT 322**

COURSE TITLE: OPERATIONS RESEARCH I

DATE: 17/10/18 **TIME:** 2 PM -4 PM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

QUESTION ONE (30 MARKS)

(a) Define the following terms

- (i) Infeasible solution (2mks)
- (ii) Unbounded solution (2mks)
- (iii) Feasible solution (2mks)

(b) Differentiate between balanced and unbalanced transportation problem (3mks)

(c) A manager has three jobs to be assigned to three of his clerical staff. Clerical staff differs in efficiency. The efficiency is a measure of time taken by them to do various jobs. The matrix given below shows the time taken by each person to do a particular job.

JOBS	MEN (Time take to do job in hours)		
	X	Y	Z
A	10	27	16
B	14	28	7
C	36	21	10

- (i) Assign the duty to the staff using Hungarian method (6mks)
- (ii) Find the minimum total time taken by the staff (2mks)

(d) Consider the linear programming problem below maximize $Z = 4x_1 + 3x_2$

Subject to

$$2x_1 + 3x_2 \leq 6$$
$$-3x_1 + 2x_2 \leq 3$$
$$2x_1 + x_2 \leq 4$$
$$3x_2 \leq 5$$
$$x_1, x_2 \geq 0$$

- (i) Solve graphically (4mks)
- (ii) State the type of feasible region displayed (1mk)
- (iii) Label the redundant constraint (1mk)
- (iv) Explain the meaning of redundancy in management (2mks)

(e) Explain four assumptions of linear programming (8mk)

QUESTION TWO (20 MARKS)

(a) Consider the transportation problem represented in the table below. The transport cost is in (dollars)

	Destination				
Origin	A	B	C	D	Supply
1	4	6	8	6	700
2	3	5	2	5	400
3	3	9	6	3	600
Demand	400	450	350	500	1700

Find the initial basic feasible solution using

(i) North west corner method (4mks)

(ii) The Vogel's approximation method (8mks)

(b)

(i) State the duality theorem and explain the importance of duality (4mks)

(ii) Write the dual of the linear programming below (4mks)

Maximize $p = 3x + y + 5z$

Subject to

$$2x + 4y + 3z \leq 80$$
$$x + y + z \leq 40$$
$$x + y + 2z \leq 40$$
$$x, y, z \geq 0$$

QUESTION THREE (20 MARKS)

(a) Use the duality method to solve the linear programming problem below

Minimize $C = 10x_1 + 8x_2$

$$x_1 + 2x_2 \geq 2$$
$$x_1 + x_2 \geq 5$$
$$x_1, x_2 \geq 0$$

(10mks)

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

Maximize $f = 2x + 6y$

Subject to

$$2x + 5y \leq 30$$
$$x + y \leq 25$$
$$x + y \leq 11$$
$$x, y \geq 0$$

(4mks)

(c) Accompany 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 are 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 (6mks)

QUESTION FOUR (20 MARKS)

(a) Use simplex method to

Minimize $w = 3y_1 + 2y_2$

Subject to

$$y_1 + 3y_2 \geq 6$$
$$2y_1 + y_2 \geq 1$$
$$y_1, y_2 \geq 0$$

(10mks)

(b) Accompany has three factories located in three cities X, Y, Z .These factories supplies consignments to four 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 below

Dealers

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 (8mks)

(c) State any two characteristic of a good model (2mks)

QUESTION FIVE (20 MARKS)

(a) Accompany has five jobs V, W, X, Y and Z and five machines A, B, C, D and E. The given matrix show returns in shillings of assigning job to a machine. Using Hungarian techniques assign the jobs to machines so as to maximize total returns.

Jobs	**A**	**B**	**C**	**D**	**E**
V	5	11	10	12	4
W	2	4	6	3	5
X	3	12	5	14	6
Y	6	14	4	11	7
Z	7	9	8	12	5

(8mks)

(b) State three limitation of Operation research (3mks)

(c) A manufacture produces three types of plastic fixtures. The time required for molding, trimming and packaging is given in the table below (times are given in hours per dozen fixtures)

Process	Type A	Type B	Type C	Total time available
Molding	1	2	$\frac{3}{2}$	12000
Trimming	$\frac{2}{3}$	$\frac{2}{3}$	1	4600
Packaging	½	$\frac{1}{3}$	$\frac{1}{2}$	2400
Profit (ksh)	11	16	15	–

(i) Formulate the problem in the form of linear programming model model (3mks)

(ii) How many dozen of each type of fixture should be produced to obtain a maximum profit? (6mks)