(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER

MAIN EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE

COURSE CODE: MAA 222

COURSE TITLE: OPERATIONS RESEACH 1

DATE: ~~12/05/2022~~ 10th   **TIME:** 9:00 AM – ~~11::00 AM~~ 2pm

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INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

QUESTION ONE (30 MKS)

a) Define Operations research and give reasons why it is necessary   [4mks]

b) Distinguish between primal and duality as used in operations research   [4mks]

c) Express the LP problem in standard form

$$\text{Maximize } Z = 3x_1 + 2x_2 + 5x_3$$
$$\text{s.t } 2x_1 - 3x_2 \leq 3$$
$$x_1 + 2x_2 + 3x_3 \geq 5$$
$$3x_1 + 2x_3 \leq 2$$

$$x_1, x_2 \geq 0$$ [5mks]

d) Solve the following LP using simplex method   [8mks]

$$\text{Maximize } Z = 2x_1 + 5x_2$$

$$\text{s.t } x_1 + 4x_2 \leq 24$$

$$3x_1 + x_2 \leq 21$$

$$x_1 + x_2 \leq 9$$

$$x_1, x_2 \geq 0$$

e) Find the dual of the LP problem in (d) above.   [5mks]

f) Briefly describe transportation problem as used in OR giving relevant examples   [4mks]

QUESTION TWO (20MKS)

a) Explain any four characteristics of operations research   [4mks]

b) Briefly describe the rules that form a dual problem from the primal problem   [2mks]

c) Explain the advantages of duality in operations research   [6mks]

d) Abdala, a retired government officer has recently received his retirement benefits, he is contemplating how much money he should invest in various alternatives open to him so as to maximize return on investment. He decided that risk≤ 4, the funds should be locked up ≤ 15 years. He should invest at least 25% in house construction. Formulate this problem as a L.P.P. model and solve it by graphical method.
(8mks)

Investment	Returns %	Number of years	Risk
Government securities	6	15	1
Company deposits	13	3	3
Time deposits	10	5	2
Equity stores	20	6	5

House construction	25	10	1

QUESTION THREE (20 MKS)

a) A marketing manager has 5 sales districts. Considering the capabilities of the salesmen and the nature of the sales districts, the marketing manager estimates that the sales per month for each salesman in each district would be as follows. Find the assignment to districts to maximize sales   (12 mks)

SALESMAN	DISTRICT I	DISTRICT II	DISTRICT III	DISTRICT IV	DISTRICT V
A	32	38	40	28	40
B	40	24	28	21	36
C	41	27	33	30	37
D	22	38	41	36	36
E	29	33	40	35	39

b) Find the optimum transportation schedule by the least cost cell method (8mks)

	A	B	C	SUPPLY
1	6	8	10	150
2	7	11	11	175
3	4	5	12	275
DEMAND	200	100	300	

QUESTION FOUR (20MKS)

Consider the following L.P.P and answer the following questions,

$$\text{Minimize } Z = x_1 - 3x_2 + 3x_3 \text{ subject to;}$$

$$3x_1 - x_2 + 2x_3 \leq 7$$

$$-4x_1 + 3x_2 + 8x_3 \leq 10$$

$$2x_1 + 4x_2 \geq -12$$

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

a) Find the dual of the problem   (4mks)

b) Give the standard form of the L.L.P   (2mks)

c) Solve the L.L.P using;

    i)   Graphical Method   (4mks)

    ii)   Simplex Method.   (10mks)

QUESTION FIVE (20MKS)

a) Define a feasible solution in LLP   (2mks)

b) List any two methods used in solving LP problems   (2mks)

c) Define optimization as used in operations research   (2mks)

d) Explain three applications of operations research   (6mks)

e) Assign the following to minimize the time taken using the Hungarian method   (8mks)

	I	II	III	IV	V
1	11	17	8	16	20
2	9	7	12	6	15
3	13	16	15	12	16
4	21	24	17	28	26
5	14	10	12	11	13