CHUKA UNIVERSITY

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF EDUCATION (SCIENCE), BACHELOR OF SCIENCE IN MATHEMATICS

MATH 345: OPERATIONS RESEARCH I

STREAMS: **TIME: 2 HOURS**

DAY/DATE: THURSDAY 08/07/2021 **8.30 A.M – 10.30 A.M**

INSTRUCTIONS:

QUESTION ONE (30 MARKS)

(a) (i) State and explain three applications of operations research. [3 marks]

(ii) State and explain two limitations of operations research. [4 marks]

(b) Define the following terms as used in operations research.

(i) Linear programming problem [2 marks]

(ii) Transportation problem [2 marks]

(iii) Assignment problem [2 marks]

(c) Use graphical method to obtain the optimal solution for [8 marks]

Minimize C = $11y_1 + 7y_2$

Subject to $y_1 + 2y_2 \geq 10$

$3y_1 + y_2 \geq 15$

$y_{1,}y_2 \geq 0$

(d) Solve the following infeasible assignment problem. [9 marks]

		Jobs				
		1	2	3	4	5
	1	70	30	X	60	30
Computer	2	X	70	50	30	30
	3	60	X	50	70	60
	4	60	70	20	40	X

5	30	30	40	X	70

QUESTION TWO (20 MARKS)

(a) Use Northwest corner rule to find the feasible solution of the following transportation problem. Hence obtain the optimal solution by stepping stone method. [12 marks]

From \ To	1	2	3	4	Supply
1	10	30	25	15	14
2	20	15	20	10	10
3	10	30	20	20	15
4	30	40	35	45	13
Demand	10	15	12	15	

(b) Solve the following unbalanced assignment problem of minimizing the total time for performing all the jobs. [8 marks]

		Jobs				
		1	2	3	4	5
	A	5	2	4	2	5
Workers	B	2	4	7	6	6
	C	6	7	5	8	7
	D	5	2	3	3	4
	E	8	3	7	8	6
	F	3	6	3	5	7

QUESTION THREE (20 MARKS)

(a) A head of department has four lecturers to assign to pure maths (1) mechanics (2) statistics (3) and quantitative techniques (4) . All the lecturers have taught the courses in the past and have been evaluated with a score from 0 to 100 as shown in the table below.

	1	2	3	4
Peter	80	55	45	45
Esther	58	35	70	50
David	70	50	80	65
Jane	90	70	40	80

Use the Hungarian algorithm to solve the problem. [12 marks]

(b) Use the least cost method stepping stone method to obtain the minimum transportation cost given the following information. [8 marks]

	Retail agency					
Factories	1	2	3	4	5	Capacity
1	1	9	13	36	51	50
2	24	12	16	20	1	100
3	14	33	1	23	26	150
Requirement	100	60	50	50	40	300

QUESTION FOUR (20 MARKS)

(a) Maximize P= $19x_1 + 13x_2 + 12x_3 + 17x_4$

Subject to

$3x_1 + 2x_2 + x_3 + 2x_4 \leq 225$

$x_1 + x_2 + x_3 + x_4 \leq 117$

$4x_1 + 3x_2 + 3x_3 4x_4 \leq 420$

$x_1, x_2, x_3, x_4 \geq 0$ [10 marks]

(b) Use the vogel approximation method and MODI method to find the optimal solution for the problem. [10 marks]

	Destination				
Origin	1	2	3	4	ai
1	20	22	17	4	120
2	24	37	9	7	70
3	32	37	20	15	50
bj	60	40	30	110	240

QUESTION FIVE (20 MARKS)

(a) Given ;

Minimize $18y_1 + 12y_2 = C$

Subject to $2y_1 + y_2 \geq 8$

$6y_1 + 6y_2 \geq 36$

$y_{1,}y_2 \geq 0$

(i) State the dual of this minimization problem. [4 marks]

(ii) Solve the dual problem for the optimal solution. [6 marks]

(b) Find the optimum solution of the following problem using North West corner rule MODI method. [10 marks]

	Destination			
Source	1	2	3	Capacity
A	8	9	10	42
B	9	11	11	30
C	10	12	9	28
Demand	35	40	25	100
