CHUKA   **UNIVERSITY**

UNIVERSITY EXAMINATION
RESIT/SUPPLEMENTARY / SPECIAL EXAMINATIONS
EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF EDUCATION, BACHELOR OF SCIENCE AND BACHELOR OF ARTS

MATH 345: OPERATION RESEARCH I

STREAMS: BSC, BED, B.A   **TIME: 2 HOURS**

DAY/DATE: THURSDAY 04/11/2021   **11.30 A.M - 1.30 P.M.**

INSTRUCTIONS

- **Answer all the questions**

QUESTION ONE

(a) Use the dual-simplex method to solve the linear programming problem

$$Min\ Z=20x_1+16x_2$$
$$s/t$$
$$x_1 \geq 2.5$$
$$x_2 \geq 6$$
$$2x_1+x_2 \geq 17$$
$$x_1+x_2 \geq 12$$
$$x_1 \geq 0,\ x_2 \geq 0$$ [10 marks]

(b) Write the dual of the following primals

(i) $Min\ Z=5x_1-6x_2+4x_3$
$$S/t$$
$$3x_1+4x_2+6x_3 \geq 9$$
$$x_1+3x_2+2x_3 \geq 5$$
$$7x_1-2x_2-x_3 \leq 10$$
$$x_1-2x_2+4x_3 \geq 4$$
$$2x_1+5x_2-3x_3 \geq 3$$
$$x_1 \geq 0,\ x_2 \geq 0,\ x_3 \geq 0$$

[6 marks]

(ii) $Max\ Z=2x_1+5x_2+3x_3$

s/t

$2x_1+4x_2-x_3 \leq 8$
$-2x_1-2x_2+x_3 \geq -7$
$x_1+3x_2-5x_3 \geq -2$
$4x_1+x_2+3x_3 \leq 4$
$x_1 \geq 0,\ x_2 \geq 0,\ x_3 \geq 0$

[6 marks]

(c) Write the L.P in the standard format

$Min\ Z=2x_1+3x_2$

s/t

$x_1+x_2=10$
$-2x_1+3x_2 \leq -5$
$7x_1-4x_2 \leq 6$
$x_1 \geq 0,\ x_2$ unrestricted

[8 marks]

QUESTION TWO

(a) A computer center has got four programmers and the center needs to develop four application programmes. The manager of the center estimates the time(minutes) required by the respective experts to develop the programme as follows

Programmers	Programmes			
	A	B	C	D
1	120	100	80	90
2	80	90	110	70
3	110	140	120	100
4	90	90	80	90

Required

Determine the optimal assignment and total minimum time taken in minutes   [5 marks]

(b) A company is spending Kshs. 1000 on transportation of its from three plants to four distribution centers. The supply and demand of the units cost of transportation are given below

Plants	Centres				Supply
	D_1	D_2	D_3	D_4	
P_1	10	30	50	12	7
P_2	70	30	40	60	10
P_3	40	10	60	20	18
Demand	5	8	7	15	

Required

Obtain the maximum saving by optimal scheduling

QUESTION THREE

Kenya breweries have two bottling plants, one located at point A and the other located at point B. Each plant produces three different types of drinks, whisky, beer and brandy. The number of bottles produced by two plants per day is as follows.

Drink	Plant	
	A	B
Whisky	1,500	1,500
Beer	3,000	1,000
Brandy	2,000	5,000

A Market survey indicates that during the month of July. There will be a demand of 20,000 bottles of whisky, 40,000 bottles of beer and 44,000 bottles of brandy. The operating cost per day for plant A and B are 600 and 400 monetary units respectively. For how many days should each plant be run so as to minimize the production cost while still meeting the market demand

[20 marks]

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