CHUKA UNIVERSITY

UNIVERSITY EXAMINATIONS

SECOND YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE (GEN)

MATH 229: INTRODUCTION TO LINEAR PROGRAMMING

STREAMS: BSC. GEN. **TIME: 2 HOURS**

DAY/DATE: WEDNESDAY 18/04/2018 **2.30 P.M. – 4.30 P.M.**

INSTRUCTIONS:

- **Answer question ONE (compulsory) and any other TWO questions.**

QUESTION ONE (COMPULSORY) (30 MARKS)

(a) List 5 limitations of linear programming models. (5 marks)

(b) Explain the following 3 solutions in LPP. (6 marks)

(i) Solution of LP
(ii) Feasibility solution
(iii) Optimal solution

(c) Consider the LPP

Maximize: $z=3x+2y+5z$

Subject to

$x+y+z\geq 430$

$3x+2z\geq 460$

$x+4y\geq 420$

$x, y, z\geq 0$

(i) Explain why the LPP cannot be solved graphically. (2 marks)

(ii) Write down the standard form of the LPP. (3 marks)

(iii) Write the dual form of the LPP. (3 marks)

(d) (i) What is redundancy in LPP? (2 marks)

(ii) Explain the meaning of redundancy in management. (2 marks)

(e) Briefly explain how a minimization problem is solved using the simplex method. (3 marks)

(f) A manufacturer makes two products P and Q. Each product requires processing time on each of the four machines A, B, C and D. Each machine is available for 24 hours per day. P requires 20 min on Machine A, 12 min on B, 15 min on C and 10 min on D. Q on the other hand requires 10 min on machine A, 28 min on B, 6 min on C and 15 min on D. P brings a profit of \$ 45 per unit and Q \$ 60 per piece. The maximum demands for these products are 100 of P per day and 40 per day for Q. Formulate the line PLL for this manufacturer

QUESTION TWO (20 MARKS)

(a) A small bakery bakes short cakes and black forest cakes To make a short cake 5 kg of sugar, 4 Kg of Margarine and 35 Kg of flour are required. 15 Kg of sugar 4Kg of Margarine and 20 Kg of flour are required for black forest. The bakery makes a profit of \$ 13 for each Kilogram of short cakes and \$ 23 for each Killogram of black forest. Suppose that only 480 Kg of sugar, 160 Kg of margarine and 1190K of floor are available, how many short cakes and black forest cakes should the bakery bake in order to maximize the profit. Solve using graphical method. (10 marks)

(b) (i) Explain the meaning of operation research. (2 marks)

(ii) State and explain the seven steps of operation research study. (8 marks)

QUESTION THREE (20 MARKS)

(a) Use the simplex method to solve the LPP. (11 marks)

Maximize: $P = x + 4y$

Subject to:

$-x + 2y \leq 6$

$5x + 4y \leq 40$

$x, y \geq 0$

(b) State the following and explain their significance.

(i) Optimality condition. (2 marks)

(ii) Duality theorem. (3 marks)

(iii) Feasibility condition. (3 marks)

QUESTION FOUR (20 MARKS)

(a) Discuss the assumptions of proportionality, addivity, continuity, Divisibility, certainty and finite choices in the context of LPP. (10 marks)

(b) Study the final simplex tableau for LPP.

Basis	x	y	s_1	s_2	s_3	B
x	0	1	1	$\frac{-1}{6}$	0	4
y	1	0	-1	$\frac{1}{3}$	0	2
s_3	0	0	4	-2	1	8
z	4	5	1	$\frac{1}{2}$	0	28

(i) Discuss the final simplex tableau in terms of the optimal solution and resources. (6 marks)

(ii) State the resources that should be increased. (2 marks)

(iii) Explain why the resources in b (ii) above should be increased. (2 marks)

QUESTION FIVE (20 MARKS)

(a) Holiday Meal Turkey Ranch is buying two different feeds. Each type contains a varying proportion on all of the 3 nutritional ingredients essential for fattening Turkeys as shown in the table below Brand P costs $ 0.02 per Kg and Q $ 0.03 per Kg.

INGREDIENT	BRAND A	BRAND B	MINIMUM MONTHLY REQUIREMENTS
A	5	10	90
B	4	3	48
C	0.5	0	1.5

COST/KG IN $	0.02	0.03	

(i) Formulate the LPP to minimize the cost. (4 marks)
(ii) Graphically solve the LPP using ISO profit search. (4 marks)
(iii) What is the monthly cost? (2 marks)

(b) State and explain the four special cases in solving of LPP by the simplex method. (10 marks)
