

CHUKA



UNIVERSITY

SUPPLEMENTARY / SPECIAL EXAMINATIONS

**THIRD YEAR EXAMINATION FOR THE DEGREE IN AGRICULTURAL
ECONOMICS**

MATH 345: APPLIED STATISTICS

STREAMS: BSC, BED, BA

TIME: 2 HOURS

DAY/DATE: TUESDAY 17/11/2020

2.30 P.M – 4.30 P.M.

INSTRUCTIONS:

- (i) Answer all the questions

QUESTION ONE

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

$$\text{Min } Z = 20x_1 + 16x_2$$

s/t

$$x_1 \geq 2.5$$

$$x_2 \geq 6$$

$$2x_1 + x_2 \geq 17$$

$$x_1 + x_2 \geq 12$$

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

[10marks]

(a) Write the dual of the following primals

$$\begin{aligned}
 (i) \quad & \text{Min } Z = 5x_1 - 6x_2 + 4x_3 \\
 & \text{S/t} \\
 & 3x_1 + 4x_2 + 6x_3 \geq 9 \\
 & x_1 + 3x_2 + 2x_3 \geq 5 \\
 & 7x_1 - 2x_2 - x_3 \leq 10 \\
 & x_1 - 2x_2 + 4x_3 \geq 4 \\
 & 2x_1 + 5x_2 - 3x_3 \geq 3 \\
 & x_1 \geq 0, x_2 \geq 0, x_3 \geq 0
 \end{aligned}$$

[6marks]

$$\begin{aligned}
 (ii) \quad & \text{Max } Z = 2x_1 + 5x_2 + 3x_3 \\
 & \text{s/t} \\
 & 2x_1 + 4x_2 - x_3 \leq 8 \\
 & -2x_1 - 2x_2 + x_3 \geq -7 \\
 & x_1 + 3x_2 - 5x_3 \geq -2 \\
 & 4x_1 + x_2 + 3x_3 \leq 4 \\
 & x_1 \geq 0, x_2 \geq 0, x_3 \geq 0
 \end{aligned}$$

[6marks]

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

$$\begin{aligned}
 \text{Min } Z &= 2x_1 + 3x_2 \\
 \text{s/t} \\
 x_1 + x_2 &= 10 \\
 -2x_1 + 3x_2 &\leq -5 \\
 7x_1 - 4x_2 &\leq 6 \\
 x_1 &\geq 0, x_2 \text{ unrestricted}
 \end{aligned}$$

[8marks]

QUESTION TWO

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]

QUESTION THREE

- (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 [5marks]

- (b) A company is spending Kshs. 1000 on transportation of its products 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 [15 marks]