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UNIVERSITY OF SWAZILAND

FINAL EXAMINATION PAPER

PROGRAMME: BSc. IN AGRICULTURAL ECONOMICS AND AGRIBUSINESS  
MANAGEMENT YEAR II

COURSE CODE: AEM 206

TITLE OF PAPER: QUANTITATIVE METHODS FOR AGRIBUSINESS  
DECISIONS

TIME ALLOWED: 2: 00 HOURS

INSTRUCTION: 1. ANSWER ANY FOUR QUESTIONS  
2. EACH QUESTIONS CARRIES 25 MARKS

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**Question 1 (25 points)**

Answer the following questions

- 1.1 List the advantage of linear programming in Agricultural economics?
- 1.2 What are the basic assumptions of linear programming?
- 1.3 What is a slack variable in linear programming?
- 1.4 Explain the meaning of shadow price in linear programming?

Choose the best answer and write the letter.

- 1.5 In linear programming, constraints can be represented by
  - a. Equalities
  - b. Inequalities
  - c. ratios
  - d. both a and b
- 1.6 In linear programming objective function and constraints are
  - a. opposite
  - b. linear
  - c. quadratic
  - d. adjacent
- 1.7. In maximization problem, optimal solution occurring at corner point yields the
  - a. mean values of z
  - b. highest value of z
  - c. lowest value of z
  - d. mid values of z

**Question 2 (25 points)**

Consider the following linear programming problem

$$\text{Maximize } Z = 4x + 3y,$$

$$\text{Subject to } 5x + 2y \leq 40$$

$$x + 2y \leq 10$$

$$\text{And } x \geq 0, y \geq 0.$$

- a) Construct the dual problem.
- b) Solve the linear programming problem graphically.



Question 3 (25 points)

3.1 A company has three plants producing a certain product that is to be shipped to four distribution centers. Plants 1, 2 and 3 produce 18, 16 and 14 shipments per month, respectively. Each distribution center needs to receive 12 shipments per month. The distance from each plant to the respective distributing centers is given in miles:

	1	2	3	4
1	45	22	87	67
2	56	33	24	90
3	30	65	70	50

The freight cost for each shipment is E10 per mile.

The company wishes to determine how much should be shipped from each plant to each of the distribution centers to minimize the total shipping costs.

Formulate this problem as a transportation problem by constructing the appropriate cost and requirements table. Use the northwest corner rule to obtain an initial basic feasible solution.

3.2 A construction company wants cement at two of its project sites P1 and P2.

It procures cement from two plants C1 and C2. Transportation cost per ton capacities and requirements are as follows:

	P1	P2		Supply
C1	5	8		300
C2	7	6		600
Demand	200	700		

- Formulate a linear programming problem for the above data.
- Use Northwest rule to obtain an initial basic feasible solution.
- Use MODI or Stepping-stone method to obtain the optimal solution.
- Calculate the minimum cost.

**Question 4 (25 points)**

You work as a sales manager for a Sugar company and you currently have three sales people on the road meeting buyers. Your sales people are in Durban, D, Johannesburg, J, and Cape Town, C. You want them to fly to three other cities: Pretoria, P, Mbabane, M and Free town, F. The table below shows the cost of air tickets in Emalangeni between these cities.

From\ To	P	M	F
D	250	400	350
J	400	600	350
C	200	400	250

- a. Reformulate this problem as equivalent assignment problem.
- b. Use Hungarian method to show where you should send each of your sales people in order to minimize airfare?