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UNIVERSITY OF SWAZILAND

FINAL EXAMINATION PAPER

PROGRAMME: BSc. in Agricultural Economics and Agribusiness Management Year III (D & T)

COURSE CODE: AEM 307

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)

1. Explain your understanding of the following terms.
   a. linear programming model.
   b. Write the basic steps in the algorithm of simplex methods.
   c. shadow price
   d.. dual theorem
   e. Vogel's approximation method

Question 2. (25 points)

Consider the following problem,

Maximize $Z = 2x_1 + 3x_2$,

Subject to $x_1 + x_2 \le 10$ (resources 1)

$3x_1 + x_2 \le 15$(resources 2)

$x_2 \le 4$. (resources 3)

and $x_1 \ge 0$, $x_2 \ge 0$.

a) Solve this problem graphically.
b) Solve by the simplex method.
c) Identify the shadow prices for the three resources from the final tableau for the simplex method.

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Question 3. (25 points)

Consider the problem

Maximize Z = 15x1 + 10x2

Subject to 2x2 + 4x2 <=44

-x1 + 4x2<= 20

2x1 – x2 <= 2

x1 - 3x2 <= 2

and x1 >=0, x2 >=0.

a) Solve this graphically. Identify the corner-point feasible solutions.
b) Develop a table giving each of the corner-point feasible solutions and the corresponding defining equations ,basic feasible solution, and nonbasic variables Use just this information to identify the optimal solution.

Corner-point Feasible solution	Defining equations	Basic feasible solution	Non-basic variables

c. construct a corresponding dual problem and solve it?

Question 4 (25 points)

Consider the problem

Maximize Z = 2x1 – x2 + x3,

Subject to 3x1 – 2x2 + 2x3 <= 15

-x1+ x2 + x3 <= 3

x1 – x2 + x3 < = 4

and x1 >=0,x2>=0,x3>=0.

Letting x4,x5 and x6 be the slack variables for the respective constraints, the simplex method yields the following final set of equations:

(0)	z	+ 2x3 + x4 + x5		= 18
(1)		x2 +5x3 + x4 + 3x5		= 24
(2)		2x3	+ x5 +x6	= 7
(3)	x1	+4x3 + x4 + 2x5		= 21.

You are now to conduct sensitivity analysis by independently investigating each of the eight changes in the original model indicated below. For each changes, use the sensitivity analysis procedure to convert this set of equations (in tableau form) the proper form for identifying and evaluating the current basic solution , and then test this solution for feasibility and for optimality.

a Change the right – hand side of constraint 1 from b1=15 to b1 =20.

b. Change the right- hand side of constraint 2 from b2 =3 to b2 = 5

Question 5 (25 points)

Consider the transportation problem having the following cost and requirements table:

Destination

	1	2	supply
Source 1	30	20	10
Source 2	40	25	20
Demand	15	15	

a) Solve this problem by the transportation simplex method.

b) Reformulate this problem as a general linear programming problem and then solve it by the simple method .

FORMULAE:

- **Property for row 0:** $R_0 = R_0^{b} + \sum R_i^{b} y_i$ **,for i= 1,2,...,m;**
- **Property for** $R_k^{\bullet} : R_k^{\bullet} = \sum R_i^{b} s_{ki}^{\bullet}$ **,for i= 1,2,...,m; and k= 1,2,...,m**

$\Delta y^*_0 = \sum \Delta b_i y_i$,
$\Delta b^*_k = \sum \Delta b_i s_{ki}$,   for i = 1,2,3,...,m and j = 1,2,3,...n.
$\Delta(z^*_j - c_j) = -\Delta c_j + \sum \Delta a_{ij} y_i$, for i =1,2,3,...m and j = 1,2,3,...,n.
$\Delta a^*_{kj} = \sum \Delta a_{ij} s_{ki}$