2nd SEM. 2012

UNIVERSITY OF SWAZILAND

FINAL EXAMINATION PAPER

PROGRAMME: BSc. in Agricultural Economics and Agribusiness Management Year III

COURSE CODE: AEM 306

TITLE OF PAPER: **Quantitative methods for agribusiness decisions**

TIME ALLOWED: 2: 00 HOURS

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

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Question 1.

1.1 What is quantitative analysis? **(5 points)**
1.2 List the steps of the decision making process. **(5 points)**
1.3 What is linear programming(LP)? **(5 points)**
1.4 List common properties and basic assumptions of linear programming? **(5 points)**
1.5 Determine the level of output which is necessary to meet final demand of 300 and 400 units respectively when the technological coefficients are given by $\begin{pmatrix} 0.2 & 0.3 \\ 0.5 & 0.4 \end{pmatrix}$ **(5 points)**

Question 2

2.1 Consider the situation of a mass layoff (i.e., a factory shuts down) where 2000 people become unemployed and now begin a job search. In this case there are two states; employed(E) and unemployed (U) with an initial vector
x_0 = [E U] = [0 2000]

Suppose that in any given period an unemployed person will find a job with probability 0.6 and will therefore remain unemployed with a probability of 0.4. Additionally, persons who find themselves employed in any given period may lose their job with a probability of 0.2(and will have a 0.8 probability of remaining employed)

2.11 Set up the Markov transition matrix for this problem. **(3 points)**
2.12 What will be the number of unemployed people after 1 period? 2 periods? **(4 points)**

2.2 A firm has the following total- cost and demand functions;

$$C = 1/2\,Q^2 - 3Q + 9$$

$$Q = 50 - p$$

a. Write out the total- revenue function R in terms of Q. **(3 points)**
b. Formulate the total –profit function Π in terms of Q. **(3points)**
c. Find the profit – maximizing level of output Q. **(3points)**
d. What is the maximum profit? **(3 points)**

2.3 Find the point elasticity of supply E_d from the supply function $Q = p^2 + 8p$,

and determine whether the supply is elastic at $p = 5$. **(6 points)**

Question 3

3.1 The income and cost functions of a sugar producer are

$$I(x) = 6x - x^2$$

and $C(x) = x^2 + 2x + 33$ respectively where x is daily production in tons and $I(x)$ and $C(x)$ are measured in E .

3.11 For which value of x will the income be maximized? **(5 points)**

3.12 Determine the gross profit and the value of x which will maximize the gross profit. **(5 points)**

3.13 The producer is taxed at a rate of 25% on the value of x for which it is a maximum. Determine his net profit and the value of x for which it is a maximum. **(5 points)**

3.2 Calculate the definite integrals.

3.21 $\int_0^1 x^2 - 5x + 3dx$ **(5 points)**

3.22 $\int_0^2 5x^2 - 2x + 4dx$ **(5 points)**

Question 4

4.1 The marginal cost function of a producer in terms of production (P) is given by:

$C'(P) = 2P + P^3 + 200$

Where the total cost is in E

If the fixed cost C_F = E38,find the total-cost function C(P)? **(4 points)**

4.2 Consider the following differential equation for y(x)

$Y'' + 3y - 4y = e^x$

4.21 Find the complementary function **(3 points)**

4.22 Find the particular function. **(3 points)**

4.23 Write down the solution to this equation, given the initial condition $y(0) = -1$ and $y'(0) = 3$ **(3 points)**

4.3 Use the Lagrange –multiplier method to find the stationery value of Z and use the bordered Hessian to determine the stationary value of Z is a maximum or a minimum.

$Z = 2x - y - xy$, subject to $x + y = 5$. **(4 points)**

4.4. The demand and the supply for a certain product (in hundreds) in terms of its price (in cents) are given by the following equations:

$D(P) = 16 - x^2$ (demand)

$S(P) = x^2 + 8$ (supply)

Find; a) the consumers surplus **(4 points)**

b) the producers` surplus, when the market is in equilibrium. **(4 points)**

Question 5.

5.1 A firm manufactures two products A and B, the market for each being virtually unlimited. Each product is processed on each of the machines I,II and III. The processing times in hours per item of A or B on each machine are given in the table below.

	I	II	III
A	0.5	0.6	0.4
B	0.3	0.7	0.8

The available production time of the machines I ,II and III is 20 hours,16 hours and 30 hours respectively each week. The profit per item of A and B is E3 and E4 respectively .

The firm wishes to determine the weekly production of items of A and B which will maximize its profit. Formulate this problem as a linear programming problem only. **(5 points)**

5.2 The outdoor furniture corporation manufactures two products: benches and picnic tables for use in yards and parks. The firm has two main resources: its carpenters(labor) and a supply of redwood for use in the furniture. During the next production period,1800 hours of manpower are available under a union agreement. The firm also has a stock of 6000 pounds of quality redwood. Each bench that outdoor furniture produces requires 5 labor hours and 9 pounds of redwood; each picnic table takes 8 labor and 45 pounds of redwood.

Completed benches yield a profit of E8 each ,and tables a profit of E30 each.

a) Formulate the decision variables, objective function, constraints? **(5 points)**

b) Find the optimal solution. **(5 points)**

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

Destination

	1	2	supply
Source 1	20	30	12
Source 2	30	15	20
Demand	16	16	

a)Use the northwest corner rule to obtain an initial basic feasible solution.

(5 points)

b) Use the transportation simplex method to obtain the optimal solution.

(5 points)