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 QUESTIONS CARRIES 25 MARKS

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Question 1.

1.1 Consider the situation of a mass layoff (i.e., a factory shuts down) where 1200 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 1200]

Suppose that in any given period an unemployed person will find a job with probability 0.7 and will therefore remain unemployed with a probability of 0.3. Additionally, persons who find themselves employed in any given period may lose their job with a probability of 0.1(and will have a 0.9 probability of remaining employed).

a. Set up the Markov transition matrix for this problem. **(6 marks)**
b. What will be the number of unemployed people after 1 period? 2 periods? **(6 marks)**

1.2 Given the input-output matrix **(13marks)**

$$A = \begin{pmatrix} 0.3 & 0.4 \\ 0.2 & 0.6 \end{pmatrix} \text{ and the demand vector } D = \begin{pmatrix} 100 \\ 200 \end{pmatrix}$$

Find the production vector that enable the economy to meet the demand.

Question *2.*

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

$$C = 1/3\,Q^3 - 7Q^2 + 111Q + 50$$
$$Q = 100 - p$$

a. Write out the total- revenue function R in terms of Q. **(4 marks)**
b. Formulate the total –profit function Π in terms of Q. **(4 marks)**
c. Find the profit – maximizing level of output Q. **(4 marks)**
d. What is the maximum profit? **(4 marks)**

2.2 Find the point elasticity of supply E_d from the supply function $Q = p^2 + 6p$,

and determine whether the supply is elastic at p = 3. **(9 marks)**

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 marks)**

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

3.13 The producer is taxed at a rate of 33% 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 marks)**

3.2 A manufacturer produces garden chairs at a cost of E20 a chair while his overhead cost is E 3000 a week. From previous experience he knows that he will sell 2000-40x chairs a week if he charges Ex a chair. What must the price be and how many chairs must he sell a week to maximize his profit? **(10 marks)**

Question 4

4.1 Calculate the definite integrals.

4.11 $\int_0^1 3x^2 + 4x + 2dx$ **(5 marks)**

4.12 $\int_0^2 x^2 - x + 6dx$ **(5 marks)**

4.13 $\int_1^\infty e^{3x}dx$ **(5 marks)**

4.2 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)? **(10 marks)**

Question 5.

5.1 Consider the following differential equation for y(x)

$Y'' - 2y = e^x$

5.11 Find the complementary function **(3 marks)**

5.12 Find the particular function. **(3 marks)**

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

5.2 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.

$Z = 3x - y - xy$, subject to $x + y = 8$. **(8 marks)**

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

$D(P) = -x^2 + 11$ (demand)

$S(P) = x^2 - x + 4$ (supply)

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

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

Question 6.

6.1 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	0.3	0.4	0.2
B	0.24	0.3	0.4

The available production time of the machines I ,II and III is 40 hours,36 hours and 36 hours respectively each week. The profit per item of A and B is E4 and E5 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 marks)**

6.2 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,1200 hours of manpower are available under a union agreement. The firm also has a stock of 5000 pounds of quality redwood. Each bench that outdoor furniture produces requires 4 labor hours and 10 pounds of redwood; each picnic table takes 7 labor and 35 pounds of redwood. Completed benches yield a profit of E9 each ,and tables a profit of E20 each.

a) Formulate the decision variables, objective function, constraints? **(5 marks)**
b) Find the optimal solution. **(5 marks)**

6.3. **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)Use the northwest corner rule to obtain an initial basic feasible solution. (5 marks)

b) Use the transportation simplex method to obtain the optimal solution. (5 marks)