THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

Faculty of Business & Social Studies

DEPARTMENT OF BUSINESS STUDIES

BACHELOR OF BUSINESS ADMINISTRATION

HBC 2111: MANAGEMENT MATHEMATICS II

END OF SEMESTER EXAMS

SERIES: APRIL/MAY 2010.

TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES

1.   The paper consists of **TWO** sections **A** and **B**.

2.   Answer **ALL** questions from Section **A** and any **TWO** questions from Section **B**.

Question **ONE** is compulsory.

SECTION A
(Answer **ALL** questions.)

QUESTION ONE

(a)   Find $\dfrac{dy}{dx}$ for the following functions in parametric form:-

(i) $x = t^3, \quad y = t^2$

(ii) $\dfrac{3at}{1+t^3}, \quad y = \dfrac{3at^2}{1+t^3}$ (6 marks)

(b)   The revenue function of a product is given by the relation:

(3 marks)

$y = 4,000,000 - (x - 2000)^2$, where y is the total revenue and x is the
number of units sold.

   (i)   Find the number of units that maximizes the total revenue.

   (ii)   What is the amount of maximum revenue?   (6 marks)

(c)   Find the area bounded by the curve $y = x2 - 4$ and the lines $y = 0$ and
        $y = 5$.   (6 marks)

(d)   A firm selling a Trade Directory has developed a profit function as follows:-

        $P = 18D - 0.001D^2 + 0.12DA - 160A^2 - 10,000$

        Where D =   number of directories sold and
              A =   number of advertising pages.

        How many directories containing how many advertising pages should be
        sold to maximize profit.   (6 marks)

(e)   A firm produces two products, **X** and **Y** with a contribution of sh.8 and
        sh.10 per unit respectively.

        Production data are (Per unit)

	Labour hours	Material A	Material B
X	3	4	6
Y	5	2	8
Total Available	500	350	800

   (i)   Formulate the LP Model in The Standardized manner.

   (ii)   Solve the mode in (i) using the graphic method.

   (iii)   Calculate the shadow prices of the binding constraints and
           interpret.   (6 marks)

SECTION B
(Answer any **TWO** questions)

QUESTION TWO

(a)   In an economy of three industries R, S, T, the input-output data is as
        given below in millions).

	Users			Final	Output
Producers	**R**	**S**	**T**	**Demand**	**Output**
R	80	100	100	40	320
S	80	200	60	60	400
T	80	100	100	20	300

Determine the total output of each industry if the final demand changes to
60 for R, 40 for S and 60 for T. (10 marks)

(b)   A company manufactures two types of novelty souvenirs, made of plywood.
Souvenirs of Type A requires 5 minutes each for cutting and 10 minutes
each for assembling. Souvenirs of Type B require 8 minutes each for cutting
and 8 minutes each for assembling. There are 3 hours 20 minutes available
for cutting and 4 h ours available for assembling. The profit is 50 cents
each for type A and sh.60 cents each for type b souvenirs. How many
souvenirs of each type should the company manufacture in order to maximize
the profit? (10 marks)
(1 sh.=100cts) (answer in shillings)

QUESTION THREE

(a)   A man wishes to make a new fertilizer which is to be a mixture of 2
ingredients A and B. The properties of the 2 ingredients A and B. The
properties of the 2 ingredients are:-

Ingredients	Bonemeal	Nitrogen	Lime	Phosphate	Cost/Kg.
A	20%	30%	40%	10%	12
B	40%	10%	45%	5%	8

It has been decided that:

(a)   The fertilizers be sold in bags containing a minimum of 100Kg.
(b)   It must contain at least 15% of nitrogen.
(c)   It must contain at least 8% of phosphates
(d)   It must contain at least 25% of bonemeal.

The manufacturer wishes to meet the above requirements at the minimum
cost possible.

Required:

(i)   Formulate the LP problem.
(ii)   Using a graphical approach determine the optimum production
plan. (10 marks)

(b)   Solve the following simultaneous equation.

$$2x - y + 3z = -2$$
$$-x + 3y - 2z = 9$$ (10 marks)
$$4x - 2y + z = 1$$

QUESTION FOUR

A fan manufacturing company can sell all the fans of a particular type that
he can produce. The total cost (£) of producing q fans per week is given by
$600q - 4000$.   The demand function (£) is estimated as $1000 - 4q$.   (4 marks)

(a)   Derive the revenue function, R.   (4 marks)

(b)   Obtain the total profit function.   (4 marks)

(c)   How many units per week should be produced inorder to maximize profit?   (4 marks)

(d)   Show that the solution of the equation $\dfrac{dR}{dq} = \dfrac{dC}{dq}$ where C represents the cost
        function, given the same value for q as in part (c).   (4 marks)

(e)   What is the maximum profit available?   (4 marks)

QUESTION FIVE

(a)   XYZ Company Ltd. supplies toolkits for the home handyman. Each
        toolkit comprises a standard plastic box which contains a variable number
        of tools depending on the type of tools, the market, and the wholesalers
        requirements. The firm has derived a profit function which shows that
        their profits are dependent both on the number of tool kits supplied and
        the number of tools in each kit. The profit function is as follows:-

$$P = 16k - 0.0002K^2 + 0.1KT - 155T^2 - 20,000$$

        where   P   =   Profits in £'s
                  k   =   No. of kits
                  T   =   No. of tools in each kit.

        How many tool kits containing how many tools should be sold?   (10 marks)

(b)   Find the area bounded by the curve

$$y^2 = 2y - x   \quad \text{and the } y - axis$$ (10 marks)