BACHELOR OF COMMERCE(HONS) DEGREE

QUANTITATIVE ANALYSIS FOR BUSINESS CIN 1106

SPECIAL SUPPLEMENTARY EXAMINATION OCTOBER 2004   DURATION: 3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Answer **all** questions in Section A.
2. Choose and answer five(5) out of eight(8) questions in Section B.
3. Graph paper will be provided.
4. Statistical tables will be provided.
5. You may use a non-programmable Scientific Calculator.

SECTION A (ANSWER ALL QUESTIONS) [40 MARKS]

Question 1

a)   Kim operates a pizza parlour. Having studied QAB she finds the cost of operating her shop to be given by:

$C(x) = \dfrac{3x^2}{100} - 12x + 1800$ where $C(x)$ is the daily cost(in $) to make x pizzas.

      i)   what is the marginal cost when x is equal to 500 units?

[3 marks]

      ii)   how many pizzas should she produce to minimize cost?

[3 marks]

b)   Find the 1st partial derivatives of the following:

      $f(x,y) = xy/(x^2-y^2)^2$ **[4 marks]**

c)   Akim wants to start a small business selling drinks to NUST students. His mother says he cannot sell more than 4 litres of drinks. The boy sells lemonade and fruit juice. He sells the lemonade for $ 2,00 per litre and fruit juice for $ 1,50 per litre. The lemonade uses 30 lemon slices per litre and one(1) kg of sugar per litre. The fruit juice uses 10 lemon slices and two(2) kgs of sugar per litre. The boy's mother has only 90 lemon slices and 6kgs of sugar.

      i)   write a linear programming formulation to determine how many litres of each type of drink the boy should make in order to make the most money.

[5 marks]

      ii)   set up the initial TABLEAU and state the initial solution for the "Do nothing" strategy.

[5 marks]

d)   Mr. Bango is trying to buy a house in four years' time. He estimates that the type of house he wants to buy will cost him $ 400 000. If he were to set aside sufficient funds now too be invested at 12% per annum compounded monthly,

      i)   what is the effective annual rate of interest?

      ii)   what sum of money would he need to set aside?   **[8 marks]**

e) If, assuming that investments made during the three years will be at 12% per annum compounded monthly, Mr. Bango decides to invest $ 2 500 at the end of every month, what additional lump sum does he need to set aside now to provide $ 400 000 at the end of 4 years assuming the lump sum is also invested at 12% p.a. compounded monthly? **[8 marks]**

f) If he were to set aside sufficient funds now to be invested at a compound interest rate of 12% p.a. effective, what sum of money would he need to set aside? **[4 marks]**

[Total: 40 marks]

SECTION B(CHOOSE AND ANSWER FIVE(5) QUESTIONS ONLY, OUT OF SEVEN.

QUESTION 2

a) The population of bacteria(in millions) present in a culture at time 't' is given by:

$$N(t) = (t-8)(5t) + 40$$

At what rate is the population changing at time t=3? **(2 marks)**

t=5 **(2 marks)**

b) A firm estimates that the number, 'N' of units of a product sold after spending x dollars on advertising is given by $N(x) = -0,1x^2 + 200x + 60$.

   i) How many units are sold when $ 500,00 is spent on advertising? **(2 marks)**

   ii) What is the instantaneous rate of the number of units sold with respect to the amount spent on advertising? **(8 marks)**

   iii) What is the instantaneous rate of change in sales

   at x= 600? **(3 marks)**

   x=800? **(3 marks)**

[Total: 20 marks]

QUESTION 3

A manufacturer makes motorized and manual hand trucks in a factory that is divided into two shops. Shop 1, which performs the basic assembly operation, must work 5 hours on each motorized hand truck, but only 2 hours on each manual hand truck. Shop 2, which performs finishing operations, must work 3 hours on each motorized and manual hand trucks it produces. Because of the limited number of workers and machines, shop 1 has 180 hours available per week and shop 2 has 135 hours available per week. If the manufacturer makes a profit of $ 300 on each motorized hand truck and $ 200 on each manual hand truck, how many of each should be produced to maximize profit? **(use the simplex method)** **[20 marks]**

QUESTION 4

(a)   Identify the intervals over which the function $f(x)= (x+2)(3x^2+4)$ is:

    i) Increasing   **(2 marks)**
    ii) Decreasing   **(2 marks)**

    and
    ii) Sketch the graph of $f(x)$ **(8 marks)**

(b)   Mrs. Joseph finds that profit (in $) for her Sun Yet Sen shop is given by

    $f(x) = 12x- 0{,}25x^2$ $0\le x \le 50$, where x represents sales in units.

    i) Is profit increasing at x=20?   **(2 marks)**
                   x= 30?   **(2 marks)**

    iii)   Over what intervals of x is profit increasing?   **(2 marks)**
                            decreasing?   **(2 marks)**

                                     [Total: 20 marks]

QUESTION 5

The following is a table of prices and quantities of 4 commodities as shown, in $ mn.

Commodity	TOTAL REVENUE		QUANTITIES	
	2000	2001	2000	2001
1	230	200	500	600
2	440	300	400	500
3	400	240	300	400
4	240	320	200	300

Calculate:

    a) The price Relative for commodity 3   **(2 marks)**
    b) The Unweighted aggregative Index   **(8 marks)**
    c) Fischer's Ideal Index   **(10m arks)**

                                 [Total: 20 marks)

QUESTION 6

Mason's Brick Works manufactures three types of brick- a face brick, a common brick, and a firebrick. The bricks are made chiefly from three types of materials-clay, shale, and concrete. Each batch of face brick processed requires five units of clay, two units of shale, and one unit of concrete. Each batch of common brick processed requires two units of clay, two units of shale, and three units of concrete. Each batch of firebrick processed requires one unit of clay, two units of shale and four units of concrete.

The clay, shale and concrete used at Mason's is unique and available only in limited quantities. Each week's production is planned depending on the quantities of each of

3

these materials that can be secured for the week. If during the coming week 40 units of clay, 36 units of shale, and 53 units of concrete will be available, how many batches of face brick, common brick, and firebrick should be scheduled for production? **[20 marks]**

QUESTION 7

Using the Gauss-Jordan method, find the solution vector for the following system of equations:

$$x_1 + 2x_2 + 3x_3 = 1$$
$$2x_1 + 3x_2 + 4x_3 = 3$$
$$x_1 + 2x_2 + x_3 = 3$$

[20 marks]

QUESTION 8

An Economy is composed of 3 basic Industries: Energy, Steel, and Agriculture. Production of 1 unit of energy requires 1/5 unit of energy, 1/8 unit of steel and 1/10 unit of Agriculture. Production of one unit of steel requires ¼ unit of energy, 1/12 unit of steel and 1/8 unit of Agriculture. Production of 1 unit of agriculture requires 1/6 unit of energy, 1/10 unit of steel and 1/12 unit of Agriculture.

Find the total production necessary to provide for final consumer demand of 500 units of energy, 800 units of steel and 1000 units of Agriculture. **[20 marks]**

END OF EXAMINATION