NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGYFACULTY OF COMMERCE

B'COM (HONS) DEGREE

QUANTITATIVE ANALYSIS FOR BUSINESS [CIN 1106]

SUPPLEMENTARY EXAMINATION OCTOBER 2009

Duration 3 Hours

Instructions to Candidates

Please write legibly

Graph paper shall be provided on request

CHOOSE AND ANSWER FOUR (4) QUESTIONS. EACH QUESTION CARRIES 20 MARKS

QUESTION 1

a) A firm has determined that its weekly profit function is given by:

$$P(x) = 95x - 0.05^{2} - 5000 \qquad 0 \leq x \leq 1000$$

Where **P(x)** is profit, in dollars, and **x** is the number of units of product sold. For what value of x does profit reach maximum? What is the maximum Profit? **[4 marks]**

b) A company finds that the revenue realized from selling x units of product per week is given by:

$$R(x) = 10.5x - \frac{x^2}{1000} \qquad 0 \leq x \leq 10\,000$$

The cost function for the firm is :

$$C(x) = 7\,500 + 2.5x \qquad 0 \leq x \leq 10\,000$$

[8 marks]

What output level will result in maximum profit? What is the maximum profit?

c) Given the Average Revenue Function:

AR = 60-3Q, where Q is the quantity of units produced and sold, find:

i) The total revenue if 1000 units were sold.

ii) The revenue attributable to the sale of the 81st unit, using the marginal approach.

[8 marks]

Total [20 marks]

QUESTION 2

a) A local sound company has used, during the last year, the following price schedule($), on three(3) models of stereo systems to wholesalers and retailers:

Wholesalers Retailers

$$P = \begin{bmatrix} 348 & 402 \\ 460 & 500 \\ 490 & 550 \end{bmatrix}$$

Where the first column represents wholesalers, second column represents retailers, and the first, second and third rows represent System I, System II and System III respectively. Now because of increased production costs, prices on all models to both wholesalers and retailers are being increased 15%. Determine the new price schedule, in matrix format. **[6 marks]**

b)

$$\begin{bmatrix} \frac{2}{3} & \frac{-3}{4} & \frac{1}{3} \\ 0 & \frac{5}{12} & \frac{7}{12} \\ \frac{-2}{3} & 1 & \frac{1}{6} \end{bmatrix}$$

You wish to re-write the above matrix as constant times the matrix. Factor out the common factor and give the matrix as constant times the matrix. **[$4\frac{1}{2}$ marks]**

c Find the Inverse, if it exists, of the following matrix.

$$\mathbf{A} = \begin{bmatrix} 3 & 3 & 6 \\ 0 & 1 & 2 \\ 5 & 3 & 2 \end{bmatrix}$$

[$9\frac{1}{2}$ marks]

Total [20 marks]

QUESTION 3

a) Show that the matrix $B = \begin{bmatrix} 0 & 2 & 1 \\ 7 & 0 & 5 \\ 9 & 8 & 0 \end{bmatrix}$ has the matrix $I_4 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ as its identity matrix. [6 marks]

b) Given that matrix $B = \begin{bmatrix} 0 & 2 & 1 \\ 7 & 0 & 5 \\ 9 & 8 & 0 \end{bmatrix}$, show that $[B^t]^t = B$. [6 marks]

c) Using the Gaussian method, find the solution to the following system of equations:

$2x + y = 60$
$x + 3y = 105$ [8 marks]

Total [20 marks]

QUESTION 4

Use the SIMPLEX METHOD to find the solution to the following maximization problem, then use the graphical approach to confirm your answer:

Maximize $z = 2x + 3y$

Subject to:

$x + y \leq 100$

$x + 2y \leq 250$

$x, y \geq 0$

Total [20 marks]

QUESTION 5

Use the graphical method to find the optimal solution to the following Linear Programming minimization problems:

i) Minimize $z = 3x + 2y$

Subject to:

$x + y \geq 20$

$x + 2y \geq 30$

$y \geq 5$

and $x, y \geq 0$

ii) Minimize $z = 2x + 4y$

Subject to:

$4x + y \geq 20$

$3x + 2y \geq 60$

$x + 4y \geq 24$

and $x, y \geq 0$ **[20 marks]**

END OF EXAMINATION