UNIVERSITY OF SWAZILAND

SUPPLEMENTARY EXAMINATION 2014/2015

BComm. /BEd.

TITLE OF PAPER   :   Quantitative Techniques

COURSE NUMBER   :   MS 202

TIME ALLOWED   :   3 HOURS

SPECIAL REQUIREMENTS :   NONE; **NOT EVEN GRAPH PAPER.**

Instructions

(a) Candidates may attempt:

    (i) ALL questions in Section A and

    (ii) At most THREE questions in Section B.

(b) Each question should start on a fresh page.

SECTION A (40 marks)

Candidates may attempt ALL questions being careful to number them A1 to A5.

A1. Find and classify all stationary points of the function $3x^3 + 3y^3 - 18xy$. [10]

A2. Solve the linear system

$$
\begin{array}{rcrcrcr}
 & & 4x_2 & + & x_3 & = & 2 \\
2x_1 & + & 6x_2 & + & 4x_3 & = & -2 \\
x_1 & - & 2x_2 & & & = & 4
\end{array}
$$

using Cramer's rule. [10]

A3. Solve the Linear programming problem:

$$
\text{Max } P(x,y) = 10x + 5y
$$
$$
\text{subject to } 4x + y \leq 28
$$
$$
2x + 3y \leq 24
$$
$$
x, y \geq 0
$$

using the **Graphical Method**. [10]

A4. Head of Mathematics Department wishes to assign 3 lecturers A, B, C to 3 different courses $1, 2, 3$ based on their their past evaluation % score. The past evaluation % scores are given as follows:

Cost	1	2	3
A	75	68	81
B	83	72	69
C	67	73	85

Determine the assignment schedule that maximizes the mean evaluation score. [6]

A5. A farmer wishes to set up a fund to provide $E85,000$ for the purchase of a second hand tractor at the end of 8 years when she retires. if equal deposits are made at the end of every 6 months in a fund earning 4.6% interest converted semi-annually, determine the value of each deposit. [4]

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SECTION B (60 marks)

Candidates may attempt THREE questions being careful to number them B6 to B10.

B6. A furniture shop sells x desks and y chairs in a week at prices p Emalangeni per kg and q Emalangeni per kg respectively. The demand equations for the company are

$$p = 205 - 2x - y, \quad q = 153 - x - y$$

and its cost function is $5x + 3y + 5000$.

(a) Determine the weekly profit function $P(x, y)$ for the company. [5]

(b) Find the number of desks and chairs the company must sell in order to maximize weekly profit. Show that this is indeed the maximum profit. [10]

(c) Evaluate derivative $P_x(2, 3)$. Intepret your results. [5]

B7. (a) A company produces x bolts and y nuts in a week at a cost of $18x^2 + 9y^2$. If $x + y = 54$, use the method of substitution to determine the number of bolts and nuts that the company should produce in order to minimize the cost of production. [10]

(b) An economy is made up of 2 industries: Agriculture and Mining. E1 worth of output from Agriculture requires 30c of output of own output and 10c of output from Mining. E1 worth of output from Mining requires 20c of output from Agriculture and 40c of output from Mining.

The final demand for the current production period is E1.2 billion and E800 million from Agriculture and Mining respectively. Determine the production schedule for this economy. [10]

B8. Two dietary drinks are used to supply protein and carbohydrates. The first drink provides 1 unit of protein and 3 units of carbohydrates in each litre. The second drink supplies 2 units of protein and 2 units of carbohydrates in each litre. An athlete requires 3 units of protein and 5 units of carbohydrates. The first drink costs E4 per litre and the second costs E2 per litre.

(a) The problem is to find the amount of each drink the athlete should consume to minimize the cost and still meet the minimum dietary requirements. Formulate this as a linear programming problem. [8]

(b) Solve linear programming problem using the **Simplex Method**. [12]

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	A	B	C	Availability
X	5	10	10	35
Y	20	30	20	40
Z	5	8	12	40
Demand	45	50	20	

B9. An clothing company ships cotton from 3 farms, X, Y and Z, to its 3 factories, A, B and C for processing. Shown above are the the demand, availabilities and unit costs of transportation.

Starting with the north-west corner solution and using the stepping-stone method, determine the transportation pattern that minimises the total cost.

What is the minimum total transportation cost?   [20]

B10. (a) A 64 year old man will retire from his place of employment next year. How much should his employer set aside to provide an income of $E1800$ every 3 months for a period of 10 years if the money earns interest at rate 3.9% compounded quarterly?   [4]

  (b) A debt of E1200 is to be paid off by payments of E500 in 45 days, E300 in 100 days and a final payment of E436.92. Interest is at 7% and the Merchant's rule was used to calculate the final payment. In how many days should the final payment be made?   [6]

  (c) A T.V set can be purchased using only one of two options. The first option is to pay $E1100$ cash. The second option requires a down payment of $E450$ followed by payments of $E48$ every month for 18 months. If interest charged is at rate 5% compounded monthly, are the two options equivalent? Justify your answer. [10]

END OF QUESTION PAPER