UNIVERSITY OF SWAZILAND

MS 202

SUPPLEMENTARY EXAMINATION 2013/2014

BComm. /BEd.

TITLE OF PAPER : Quantitative Techniques

COURSE NUMBER : MS 202

TIME ALLOWED : 3 HOURS

SPECIAL REQUIREMENTS : NONE. **NOT EVEN GRAPH IS REQUIRED.**

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.

(c) **THERE ARE NO SPECIAL REQUIREMENTS FOR THIS PAPER.**

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SECTION A (40 marks)

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

A1. A shop sells x kg of sugar and y kg of salt in a month at prices p Emalangeni per kg and q Emalangeni per kg respectively. The demand equations for the company are

$$x = 300 + p, \quad y = 200 + q,$$

and its cost function is $1000 - 3xy$.

    (a) Determine the monthly revenue function $R(x, y)$ for the company.   [4]

    (b) Evaluate $R_y(40, 10)$ and interpret your results.   [2]

A2. A factory produces x desks and y chairs. Let $C = 12x^2 + 24y^2$ be the joint cost of production of x and y. If $x + y = 90$, use direct substitution to determine values of x and y which minimize C. Verify your results.   [5]

A3. Evaluate the determinant $\begin{vmatrix} 2 & 8 & 5 \\ 1 & 0 & 2 \\ 3 & 4 & 4 \end{vmatrix}$ using cofactor expansion.   [6]

A4. A company manufactures stools and tables. Each stool requires 5 hour of carpentry, 4 hour of painting and 35 hours of finishing. Similarly, a table needs 15 hours of carpentry, 4 hour of painting and 20 hour of finishing. During each production period, the carpentry, painting and finishing departments can only work for up to 480 hours, 160 hours and 1190 hours respectively. The company makes E13 profit per stool and E23 profit per table.

The problem is to determine the number of stools and tables that should be made in order to maximize profits. Formulate this as a linear programming problem.   [8]

A5. A debt of E1300 is to be paid off by payments of E550 in 45 days, E380 in 100 days and a final payment of E440. Interest is at 6.5% and the Merchant's rule was used to calculate the final payment. In how many days should the final payment be made? [5]

Score	A	B	C	D
1	20	16	18	22
2	25	28	15	21
3	27	20	23	26
4	24	22	23	22

A6. A company has 4 employees $1, 2, 3, 4$ to assign to 4 projects A, B, C, D based on the scores shown in the table above.

Determine the assignment schedule that maximizes the total score. [10]

SECTION B (60 marks)

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

B7. (a) Find and classify all stationary points of the function $2x^3 + 2y^3 - 6xy$. [10]

(b) A music producer has been assigned a budget of E60 000 to be spent of advertising and production of a new album. She estimates that spending x thousand Emalangeni in production and y thousand Emalangeni in advertising she can sell $20x^{\frac{2}{3}}y$ albums. If she wants to maximize the sells, how much should she allocate advertising and how much should she allocate to production? [10]

B8. (a) Solve the linear system

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

using Cramer's rule. [8]

(b) An economy is based on 3 industries: mining, energy and clothing.

Each $E1$ in mining requires $25c$ in mining, $10c$ in energy, and $50c$ in clothing. Each $E1$ in energy takes $40c$ in energy and $20c$ in clothing, while each $E1$ in clothing uses $13c$ in mining and 5 in energy.

Find the production schedule for the economy if demand is for $E40$ million in mining, $E30$ million in energy, and $E20$ million in clothing. [12]

B9. Two dietary drinks are used to supply protein and carbohydrates. The first drink provides 2 unit of protein and 3 units of carbohydrates in each litre. The second drink supplies 5 units of protein and 7 units of carbohydrates in each litre. An athlete requires 12 units of protein and 17 units of carbohydrates. The first drink costs E42 per litre and the second costs E3 per litre.

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(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 by maximizing the dual. [12]

B10. (a) A stove can be purchased using only one of two options. The first option is to pay $E1300$ cash. The second option requires a down payment of $E600$ followed by payments of $E80$ every month for 12 months. If interest charged is at rate 4.5% compounded monthly, are the two options equivalent? [7]

(b) A farmer wishes to replace his tractor in 4 years time. He figures that he will need E140 000 then. What sum must he invest the end of each half year in a fund paying 8.5% compounded semi-annually in order to accumulate the price of the boat? [7]

(c) How much should you deposit in an account paying 5% compounded quarterly in order to be able to withdraw E1200 every 3 months for the next 2 years? [6]

B11. A trucking company has a contract to move 120 truckloads of timber from 3 plantations A, B, C to 3 of factories D, E, F for processing. The cost of moving 1 vehicle from A to each of D, E, F is E8, E6, E9 respectively. Similarly, the respective costs of moving 1 vehicle from B are E6, E3, E8, and those from C are E10, E7, E9. Timber available at plantations A, B, C fills up 20, 30, 70 trucks respectively. Truckloads required at D, E, F are 90, 20, 10 respectively.

Determine the optimum distribution strategy for this company to minimize total transportation cost. Evaluate the minimum total transportation cost. [20]

END OF QUESTION PAPER