



**NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY**

FACULTY OF HEALTH AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

QUALIFICATION: BACHELOR OF ECONOMICS	
QUALIFICATION CODE: 07BECO	LEVEL: 5
COURSE CODE: MFE512S	COURSE NAME: MATHEMATICS FOR ECONOMISTS 1B
SESSION: JANUARY 2023	PAPER: THEORY
DURATION: 3 HOURS	MARKS: 100

SUPPLEMENTARY/SECOND OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER	Mr. T. KAENANDUNGE, Mr. F. Ndinodiva, MS Y. NKALLE
MODERATOR:	Mr. I.D.O. NDADI

INSTRUCTIONS	
<ol style="list-style-type: none">1. Answer ALL the questions in the booklet provided.2. Show clearly all the steps used in the calculations.3. All written work must be done in blue or black ink and sketches must be done in pencil.	

PERMISSIBLE MATERIALS

1. Non-programmable calculator without a cover.
ATTACHMENT: Graph paper

THIS QUESTION PAPER CONSISTS OF 3 PAGES (Including this front page)

QUESTION 1

[33]

1.1 If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, $B = \begin{bmatrix} -2 & -5 \\ 8 & -9 \end{bmatrix}$, evaluate $(AB)^{-1}$ without working out the product AB . [10]

1.2 Find the exact value(s) of x which make matrix $M = \begin{bmatrix} 1 & 2 & 3 \\ x & 5 & x+2 \\ 7 & 8 & x+5 \end{bmatrix}$ singular. [6]

1.3 The Ace Novelty company received an order from the Magic World Amusement Park for 1200 "Pink Panthers", 1800 "Giant Pandas" and 1400 "Big birds". The quantity of each type of stuffed animal to be produced at each plant is shown in the production matrix

$$P = \begin{array}{c} \begin{array}{ccc} P.Panthers & G.Pandas & B.Birds \\ L.A. & \begin{bmatrix} 700 & 1000 & 800 \end{bmatrix} \\ Seattle & \begin{bmatrix} 500 & 800 & 600 \end{bmatrix} \end{array} \end{array}$$

Each Pink Panther requires 1.3 square yards of plush, 20 cubic feet of stuffing material and 12 pieces of trimming; each Giant Panda requires 1.5 square yards of plush, 30 cubic feet of stuffing material, and 5 pieces of trimming; each Big Bird requires 2.5 square yards of plush, 25 cubic feet of stuffing material, and 15 pieces of trimming. The plush costs \$4.50 per square yard, the stuffing material costs \$0.10 per cubic foot, and the trimming costs \$0.25 per unit. Represent the given information in matrices and use matrix operations to answer the following questions.

1.3.1 Find the amount of each type of material to be purchased for each of the two plants. [10]

1.3.2 Find the total cost of materials to be incurred at each plant. [5]

1.3.3 Find the total cost of materials incurred by Ace Novelty Company in fulfilling the order. [2]

Question 2

[29]

2.1 A cashier has 15 coins consisting of N\$1s, N\$5s, and 50cs with a value of N\$41-00. If the number of N\$5s is 1 less than twice the number of N\$1s, how many of each type of coin does she have? Use Gaussian elimination. [11]

2.2 A motor company manufacture and sell cars and motorbikes. The cost of manufacturing x motorbikes and y cars is given by $C(x, y) = 800x^2 + 400xy + 2900y^2$. Each motorbike is sold for N\$36 000-00 and each car is sold for N\$180 000-00.

2.2.1 Use Gaussian elimination to determine the number of motorbikes and the number of cars that should be manufactured and sold for a maximum profit P and determine the maximum profit P_{\max} . [8]

2.2.2 Use the Hessian to confirm that the amounts in 2.2.1 will produce maximum profit. [5]

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2.2.3 Use the Jacobian to test for functional dependence between the cost function and the revenue function. [5]

Question 3 [38]

3.1 Malu plans to invest no more than N\$20,000 in two different interest-bearing accounts. Each account is to contain at least N\$5000. Moreover, one account should have at least twice the amount that is in the other account. Find a system of inequalities describing the various amounts that can be deposited in each account, and sketch the graph of the system. (Make a sketch on your answer sheet. Do not use the graph paper.) [10]

3.2 Cassy Finance Company has a total of N\$20 million earmarked for home loans and automobile loans. On the average, home loans will have a 10% rate of return on the loans given out while automobile loans will yield a 12% rate of return on the loans extended. Management has also stipulated that the total amount of home loans should be at least four times the total amount of automobile loans. Use the graphical method to determine the total amount of loans the company should extend to each of the two categories of customers in order to maximise the rate of return on the loans extended. [10]

3.3 A company has budgeted a maximum of N\$600,000 for advertising a certain product nationally. Each minute of television time costs N\$60,000 and each one-page newspaper advertisement costs N\$15,000. Each television advertisement is expected to be viewed by 15 million viewers, and each newspaper advertisement is expected to be seen by 3 million readers. The company's market research department advises the company to spend at most 90% of the advertising budget on television advertisements. How should the advertising budget be allocated to maximize the total audience? Use the simplex method. [10]

3.4 Use the dual method to solve the following minimization problem.

$$\text{Minimise } C = 4x + 2y + 6z$$

$$\text{Subject to } x + 2y + z \geq 4$$

$$2x + y + 2z \geq 2 \quad [8]$$

$$3x + 2y + z \geq 3$$

$$x, y, z \geq 0$$

*****END OF EXAMINATION*****

GOODLUCK!!!!!!!!!!