UGANDA MARTYRS UNIVERSITY

FACULTY OF BUSINESS ADMINISTRATION AND MANAGEMENT

UNIVERSITY EXAMINATION

QUANTITATIVE METHODS

2022/2023

DATE: 13/12/2022

TIME: 3 HOURS (9:30 AM – 12:30 PM)

Instructions:

i. Attempt any four questions
ii. Do not write anything on the question paper
iii. Show all workings and they have to be clear and tidy

Requirement

QUESTION ONE

a) The UMU University kitchen makes three products from four raw materials. it uses 17, 22, 04, and 07 units respectively to make (I) Cakes, it uses 12, 05, 22, and 06 units respectively to make (II) Chapatis, and uses 07,03,14 and 08 units respectively to make a (III) Bread. Show this data as a matrix and obtain the values the total unit production. **(6 marks)**

b) A student's clothing business sells two quality types of Crocs called "Original" and "Copy". Each Croc quality has three brands. The table below shows the selling price of each suit

	Nike	**Adidas**	**Balanciega**
Copy	40,000	60,000	80,000
Original	120,000	160,000	200,000

Three monthly sales in the semester are as follows in the semester 1 2022;

Company	**Copy**	**Original**
September	100	8
October	40	3
November	20	6

Use matrix multiplication to find the income from each month, the amount each company spent and total income. **(9 marks)**

c) Use matrices to solve the following equation **(10 marks)**

$x + y - z = 4$

$2x + 3y + z = 13$

$3x - y + 2z = 9$

QUESTION TWO

(a) Explain the following terms in linear programming with using business knowledge **(2 marks each)**

i) Slack variables

ii) Surplus variables

b) UMU fruit company has 300 ml and 1500 ml fruit juice as its products with profit margin of Shs. 400 and Shs. 750 per unit respectively. Both the products have to undergo process in three types of machine. The following Table, indicates the time required on each machine and the available machine-hours per week.

Available data

Requirement	300 ml Can	1500ml Can	Available machine hours per week
Machine I	3	2	300
Machine II	2	4	480
Machine III	7	3	560

i. Formulate the linear programming problem. **(5 marks)**

ii. Specify the product mix which will maximize the profits within the limited resources using the Graphical Method. **(13 marks)**

iii. Using relevant examples explain 3 ways how coca cola can maximise its profits in the production process.**(3marks)**

QUESTION THREE

A soft drink company is worried about its market share because of a new comer in providing a particular type of service, its facing heavy competition from two well-known old timers. refer to the soft drink companies as **Apex** and its rivals as **Beta** and **Carbs.** assuming that the brand switching data showing the flow of customers in hundreds among the three competitors has been availed to you as in the following table:

			Gains from:			Losses to:				
			A	B	C	A	B	C		
Company	No. of customers as at 1st October, 2022	Market share							No. of customers as at 1st November,2022	Market share
Apex			0	12	20	0	15	9	212	
Beta			15	0	5	12	0	7	417	
Carbs			9	7	0	20	5	0	522	

i. Complete the flow chart **(03 marks)**

ii. Obtain the matrix of transition probabilities **(06 marks)**

iii. Specify what the rows and columns represent **(06 marks)**

iv. Predict the market share as at 1st December 2022 and 1st January 2023 **(06 marks)**

v. Suggest with relevant examples what the firms should do to improve their market share **(04 marks)**

QUESTION FOUR

a) Explain the components of time series and the relevancy in business **(4 marks)**

b) An Apparel company has recorded the total number of T shirts sold annually for the years 2015–2022.

Year	Sales of T-shirts ('000)
2015	27
2016	42
2017	32
2018	44
2019	33
2020	46
2021	32
2022	48

Required

i) Compute three year moving averages. **(05 marks)**

ii) Plot the production and the three-year moving averages on the same graph paper and comment on the average production trend estimates. **(03 marks)**

c) The company has a production series and sales of children shoes and as follows;

Years	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2011
Production units '000	11	9	6	12	8	13	14	7	10	16	18
Sale (Shs '000'000s)	30	23	21	37	26	34	38	24	31	39	37

Required

a) Using linear regression analysis, derive the relationship between the variables (production units and Sales) and interpret the results **(13 marks)**

QUESTION FIVE

a) With valid examples explain the relevance of calculus in business and Economics **(3 marks)**

b) A manufacturer has given you as a consultant the revenue function in shillings $R(x) = -3x^3 + 600x^2$ and the cost function in shillings$(x) = 357x^2 + 1800x$;

Determine:

i. The marginal profit at $x = 10$ units. Interpret the result. **(4 marks)**

ii. The marginal cost at x = 50 units. Interpret the result. **(4 marks)**

(c) The total revenue and total cost for a product are related to production of fruit cakes is as follows:

$TR = 14x - x^2 + 2{,}000$

$TC = x^3 - 15x + 1{,}000$

How many units should the company make to;

(i) Maximise total revenue **(4 marks)**

(ii) Minimise total cost **(4 marks)**

(iii) Maximise profit **(6 marks)**

QUESTION SIX

(a) How much money would you need to deposit today at 9% annual interest compounded monthly to have shs.12, 000, 000 in the account after 2 years? **(03 marks)**

(b) If you deposit shs.5,000,000 into an account paying 6% annual interest compounded monthly, how long until there is 8000 in the account? **(3 marks)**

(c) A student club is considering three alternative projects with initials costs and projected revenues (each in millions of shillings) over the next five years shown below. If the student club has enough resources to start only one project, use a discount rate of 10% to suggest the best.

Project	**Initial cost**	**1**	**2**	**3**	**4**	**5**
1- Poultry farm	1000	500	400	300	200	100
2- Laundry at Student Hostels	1000	200	200	300	400	400
3- Fashion house	500	50	200	200	100	50

Required:

a) If the student club has enough resources to start only one project, use a discount rate of 10% to suggest the best. **(13 marks)**

b) Determine the Payback period for the selected project above **(06 marks)**

GOOD LUCK