MULTIMEDIA UNIVERSITY OF KENYA

FACULTY OF BUSINESS AND LAW

UNIVERSITY EXAMINATIONS 2015/2016

SECOND YEAR FIRST SEMESTER EXAMINATION FOR THE

DEGREE OF BACHELOR OF BUSINESS INFORMATION TECHNOLOGY

BMS 2122:   MANAGEMENT MATHEMATICS

DATE: MONDAY 14TH DECEMBER, 2015   **TIME 2 HOURS**

INSTRUCTIONS:

ANSWER YOUR QUESTIONS IN ANSWER BOOKLET PROVIDED.

ANSWER QUESTION ONE [COMPULSORY] AND ANY OTHER TWO QUESTIONS.

QUESTION ONE (30 MARKS)

[a] Given the following input-output matrix and final demand vector of shoes S, rubber R and glue G industries, determine the total output.   **(15 marks)**

$$
\text{Input-output matrix} \quad
\begin{array}{c}
\\ S \\ R \\ G
\end{array}
\begin{array}{ccc}
S & R & G \\
\left(\begin{array}{ccc}
0.3 & 0.2 & 0.1 \\
0.1 & 0.4 & 0.2 \\
0.2 & 0.3 & 0.4
\end{array}\right)
\end{array}
$$

$$
\text{Final demand vector} \quad
\begin{array}{c}
S \\ R \\ G
\end{array}
\left(\begin{array}{c}
40 \\
50 \\
60
\end{array}\right)
$$

[b] A retired person wants to invest up to an amount of £30,000 in fixed-income securities. His broker recommends investing in two bonds: Bond A yielding 7% and Bond B yielding 10%. After some considerations, he decided to invest at most £12,000 in Bond B and at least

£6,000 in Bond A. He also wants the amount invested in Bond A to be at least equal to the amount invested in Bond B. If the investor wants to maximize his return investment.

Required:

(i) Formulate this as linear programming problem.   **(6 marks)**

(ii) Solve graphically.   **(9 marks)**

QUESTION TWO (TWENTY MARKS)

[a] Briefly explain any four assumptions underlying Markov analysis.   **(8 marks)**

[b] The manufacturer of Tamu Soft drinks has been facing stiff competition on its main brand Tamu-cola soda. The management is considering an extensive advertising and rebranding campaign for Tamu-cola soda. If the current branding remains, the transition matrix of consumers between Tamu-cola and other brands will be as follows.

		To Tamu-cola	Others
	Tamu-cola	0.85	0.15
From	Others	0.25	0.75

After the advertising and rebranding campaign the transition matrix is expected to change as follows:-

		To Tamu cola	Others
From	Tamu-cola	0.90	0.10
	Others	0.30	0.70

The advertising and rebranding campaign is expected to cost sh 20 million each year. There are 40 million consumers of soft drinks in the market and for each consumer the average profitability is Sh 5 annually.

Required:

(i) The equilibrium state proportion of consumers using Tamu-cola before the advertising campaign.   **(4 marks)**

(ii) The equilibrium state proportion of consumers using Tamu-cola after the advertising campaign.   **(4 marks)**

(iii)The expected annual profit increase or decrease after the advertising campaign. Would you recommend the advertising campaign? Why?   **(4 marks)**

QUESTION 3 (TWENTY MARKS)

A firm owns three machines in the manufacture of three products. Each unit of A requires 3 hours on machine 1, 2 hours on machine II and one hour on machine III. Each unit of product B requires 4 hours on machine I, one hour on machine II, and 3 hours on machine III, while each unit of product C requires 2 hours on each of the three machines. The contribution margin of the three products is Sh.30, Sh 40 and Sh 35 per unit respectively. The machine hours available on each of the three machines are 90, 54 and 93 respectively.

Required:

(i) Formulate the above problem as a linear programming problem.   **(6 marks)**
(ii) Obtain optimal solution to the problem using the simplex method.   **(10 marks)**
(iii) Calculate the percentage of capacity utilization in the optimal solution.   **(2 marks)**
(iv) What are the shadow prices of the machine hours?   **(2 marks)**

QUESTION FOUR (TWENTY MARKS)

[a] Briefly explain any four applications of calculus in Business.   **(8 marks)**

[b] Super Toys Ltd (STL) manufactures and sells toys. "Super car" is one of their popular model. The marketing department has estimated the demand function for the model to be linear. If the price was fixed at sh. 570, the sale of the model will be 400 toys, whereas if the price was increased to Sh 820, the daily sales would drop to 200 toys.

Data from the production indicate that the incremental cost of producing q toys of the model is given by the equation.

a) $\triangle c(q) = 2q - 570$ And that the daily fixed is sh. 1,100

Required

   (i) The revenue function if q are sold.   **(4 marks)**
   (ii) The total cost function.   **(4 marks)**
   (iii) The daily break-even number of toys.   **(4 marks)**