GARISSA UNIVERSITY COLLEGE

(A Constituent College of Moi University)

UNIVERSITY EXAMINATION **2016/2017** ACADEMIC YEAR **THREE**
SECOND SEMESTER EXAMINATION

SUPPLEMENTARY/SPECIAL EXAMINATION

SCHOOL OF BUSINESS AND ECONOMICS

FOR THE DEGREE OF BACHELOR OF BUSINESS MANAGEMENT

COURSE CODE: BBM 355

COURSE TITLE: OPERATIONS RESEARCH

EXAMINATION DURATION: 3 HOURS

DATE: 29/09/17 **TIME: 09.00-12.00 PM**

INSTRUCTION TO CANDIDATES

- **The examination has SIX (6) questions**
- **Question ONE (1) is COMPULSORY**
- **Choose any other THREE (3) questions from the remaining FIVE (5) questions**
- **Use sketch diagrams to illustrate your answer whenever necessary**
- **Do not carry mobile phones or any other written materials in examination room**
- **Do not write on this paper**

This paper consists of SIX (6) printed pages ***please turn over***

QUESTION ONE (COMPULSORY)

(a) Define the following terms as used in Operations Research:

i. A feasible solution **[1 mark]**

ii. Infeasible solution **[1 mark]**

iii. Feasible region **[1 mark]**

iv. Optimal solution **[1 mark]**

v. Linear Programming **[1 mark]**

(b) Solve the inequality $14 - 2x \leq 6$ **[2 marks]**

(c) A shopkeeper wishes to purchase not less than 10 items comprising books and pens only. A book costs sh 10 and a pen costs sh7. Number of books is x and number of pens is. If the shopkeeper has sh 200 to spend, form all the inequalities from the given conditions **[3 marks]**

(d) A patient consults a doctor to check on his health. The doctor finds him to be having deficiency of two vitamins, A and D. The patient is advised to consume the two vitamins regularly for some time so as to regain his health. The doctor prescribes tonics I and II both of which contain vitamins A and D in certain proportions. He is also advised to consume at least 40 units of vitamin A and 50 units of vitamin D daily. The costs of tonics I and II and the proportions of vitamins A and D that they contain are given below: Formulate the Linear programming model that minimizes the cost of tonics

vitamins	Tonic I	Tonic II	Daily requirements(in units)
A	2	4	40
D	3	2	30
Cost per unit (Ksh)	50	30	

Let x *represent tonic I and* y *represent tonic II* **[4 marks]**

(e) A small company manufactures three different electronic components A, B, and C for computers. A requires 2 hours of fabrication and 1 hour of assembly, B requires 3 hours of fabrication and 1 hour of assembly while C requires 2 hours of fabrication and 2 hours of assembly. The company has up to 1000 labour hours of fabrication time and 800 hours of assembly time available per week. The profit of each component A, B, C is sh 7, sh8, andsh 10 respectively. Formulate this scenario as a Linear Programming model

i. Number of units of A = x

ii. Number of units of B $= y$

iii. Number of units of C $= z$ **[5 marks]**

(f) The following matrix of transition probabilities relate to a market dominated by two firms

$$T = \begin{bmatrix} 0.70 & 0.30 \\ 0.25 & 0.75 \end{bmatrix}$$

Assume firm A currently has 70% of the market and firm B has the remaining 30 % ,

i. Predict market shares in the next period **[2 marks]**

ii. What are the expected equilibrium shares? **[5 marks]**

QUESTION TWO

A company produces two products A and B from two raw materials C and D. The following table provides the basic data

	Tons of raw material A	Tons of raw material B	Max daily available
Raw material C	6	4	24
Raw material D	1	2	6
Profit per ton (sh1000)	5	4	

A market survey indicates that the daily demand for B cannot exceed that of A by more than 1 ton. The maximum daily demand for B is 2 tons. The company wants to determine the optimum product mix for A and B that maximizes the daily profit.

i. Formulate a Linear Programming model for this scenario **[6 marks]**

ii. By graphing your inequalities, find how many tons of each product the company needs to produce in order to make maximum profit **[7 marks]**

iii. Find the maximum profit **[2 marks]**

QUESTION THREE

A firm uses three machines in the manufacture of three products. Each unit of product A requires 3 hours on machine I, 2 hours on machine II and one hour on machine III. Each unit of product B requires 4 hours on machine I, 1 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 contributions per unit of these three products are sh30, sh40 and sh35 respectively. The machine hours available on the three machines are 90, 54 and 93 respectively.

i. Formulate the above problem as a Linear Programming problem **[3 marks]**

ii. Obtain an optimal solution to the problem by using a simplex method **[12 marks]**

QUESTION FOUR

(a) Describe the steady – state of a Markov process **[3 marks]**

(b) The state – transition matrix for retentions, gains and losses of three firms A, B and C is given as follows:

	To		
From	A	B	C
A	**0.700**	**0.100**	**0.200**
B	**0.100**	**0.800**	**0.100**
C	**0.200**	**0.100**	**0.700**

Using this matrix, determine the steady state equilibrium conditions **[12 marks]**

QUESTION FIVE

(a) Define the following terms as used in network analysis

i. project **[2 marks]**

ii. activity **[2 marks]**

(b) XYZ Ltd has listed the following activities in respect of a project.

Activity	Preceding activity	Duration in days
A		2
B	A	3
C	A	5
D	A	8
E	B	6
F	C	1
G	C	2
H	C and D	3
I	E and F	7
J	G and H	4
K	I and J	5

Draw a network diagram and determine the critical path **[11 marks]**

QUESTION SIX

A businessman has three alternatives open to him, each of which can be followed by any of the four possible events. The conditional payoffs (in ksh) for each action – event – combination are as shown below

	Payoffs conditional on events			
	A	B	C	D
Alternative				
X	8	0	-10	6
Y	-4	12	18	-2
Z	14	6	0	8

Determine which alternative the businessman should choose if he adopts

i. Maximum criterion
ii. Maximax criterion
iii. Hurwicz criterion, his degree of optimum being 0.7
iv. Laplace criterion
v. Minimax regret criterion **[15 marks]**