The Co-operative University of Kenya

END OF SEMESTER EXAMINATION – DECEMBER 2016

EXAMINATION FOR THE BACHELOR OF COMMERCE (BCOM YR II SEM II)

UNIT CODE: HBC 2210

UNIT TITLE: OPERATIONS RESEARCH

DATE: 15TH DECEMBER, 2016 **TIME: 9:00 AM – 11:00 AM**

INSTRUCTIONS:

- Answer question **ONE (compulsory)** and any other **TWO** questions

QUESTION ONE

(a) One of the earliest applications of analytical methods in operational problems was carried out in early 20th Century by Erlang a Dashish mathematician. Describe the focus of his study. (2 Marks)

(b) Describe the following terms as applied in operations research

i. Linear programming (3 marks)
ii. Assignment model (3 Marks)
iii. Network model (3 Marks)

(c) A manufacturer produces two products namely Soad and Ash. The contribution of the two products is Soda Kshs 30 and Ash Kshs 40 per unit respectively. The manufacturer wishes to establish the monthly production plan which maximizes contribution. The production data is as follows: -

	Per Unit		
	Machining (Hrs)	Labour (Hrs)	Materials (Kgs)
Soda	40	40	10
Ash	20	60	10
Total Available per Month	1,000	1,800	400

The government has limited the sale of Soda to a maximum of 200 units per month and the company has agreed to sell at least 100 units of Ash per month

Required:

i. Formulate the LP model in a standardises form (4 Marks)
ii. Compute the LP feasible solution using the graphical model (6 Marks)

(d) Matbabu Hospital has monitored the arrival of patients at the Accident and Emergency unit for the past one month. The number arriving every five (5) minutes was found to range between 0 and 4 patients. The table given below shows the probability of a given number of patients arriving within a five minute period

No. of Patients	0	1	2	3	4
Probability	0.1	0.3	0.3	0.2	0.1

Required:

Compute the expected number of patients arriving within this time (3 Marks)

(e) Explain the following cases of an LP model

i. Redundancy constraint (2 Marks)
ii. Infeasible problem (2 Marks)
iii. Unboundedness problems (2 Marks)

QUESTION TWO

(a) A ladies fashion shop wishes to purchase the following quantities of summer dresses:-

Dress Size	SS	MM	LL	EL
Quantity	1,000	2,000	4,500	1,500

Three (3) Manufacturers are willing to supply the dresses. The quantities given below are the maximum that they are able to supply for any given combination of dresses ordered

Manufacturer	Kicomi	Rivatex	Titex
Total Quantity	1,500	4,500	2,500

The shop expects that the profit per dress (Kshs) to vary with manufacturer as given below: -

	Sizes			
Manufacturer	**SS**	**MM**	**LL**	**EL**
Kicomi	25	40	50	20
Rivatex	30	35	55	15
Titex	20	45	45	25

Required:

i. Using the transportation technique to maximize profits (12 Marks)
ii. Compute the number of orders to be made to ach supplier (4 Marks)
iii. Compute the maximum profits (4 Marks)

QUESTION THREE

(a) The following information was provided by an Engineering Company which builds Ferries in Mombasa

Activity	**Preceding Activity**	**Activity Description**	**Duration (Days)**
A	-	Designing the Hull	9
B	-	Prepare Ferry Sheds	3
C	A	Design Mast and Mount it	8
D	A	Obtain Hull	2
E	A	Design Sails	3
F	C	Obtain Mast Mount	2
G	C	Design Rigging	6
H	C	Prepare Hull	1
J	B, D	Fix Mast Mount to Hull	4
K	F, J	Step Mast	1
L	E, H, G, K	Obtain Sails and Rigging	2
M	E, H	Fit Sail and Rigging	3
N	L, M	Testing	4

Required:

i. Draw a network (9 Marks)
ii. Compute the project duration (4 Marks)
iii. Determine the critical path (2 Marks)

(b) Explain the following terms as used in operations research.

i. Slack variable (2 Marks)
ii. Pivot number (2 Marks)
iii. Optimal solution (1 Mark)

QUESTION FOUR

Two players, Row and Column, are driving toward each other on a one-lane road. Each player chooses simultaneously between going straight (S), swerving left (L) and swerving right (R). if one player goes straight while the other swerves either right or left, the one who goes straight gets payoff 3 while the other gets -1.if each player swerves to his left or each swerves to his right, then each gets 0 (remember, they are going in opposite directions). If both go straight, or is one swerves to his left while the other swerves to his right, then the cars crash and each gets payoff -4.

(a) Write the payoff matrix for this game
(b) Find all of the game's rationalizable strategies for each player
(c) Find all of the game's Nash equilibrium in pure strategies
(d) Find a Nash equilibrium in which Row uses a pure strategy and Column mixes between two of his strategies. Clearly identify which strategy or strategies have positive probabilities for each player, and what Column's mixing probabilities are (Hint: Which of Row's pure strategies could make Column willing to put positive probability on two of Column's pure strategies?)
(e) Find a Nash equilibrium in which both Row and Column mix between two of their strategies. Clearly identify which strategies have positive probabilities for each player, and their mixing probabilities are. (Hint: Pick two pure strategies for each player – because the game is symmetric, it's natural to try the same two strategies for each – and figure put what the mixing probabilities would have to be on just those strategies. Then compare each player's expected payoff with what he could get by switching to his third strategy)
(f) Find the (Unique) Nash equilibrium where each player uses all three of his strategies in a mixture. (Hint: first prove that the probabilities of L abd R must be equal in the equilibrium mixture, then show that for each player the probability of S must be 5/8)

(20 Marks)