MURANG'A UNIVERSITY COLLEGE

A constituent college of Jomo Kenyatta University of Agriculture and Technology

University Examination 2015/2016

END OF SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN HUMAN RESOURCE MANAGEMENT YEAR 3 SEMESTER 1, BACHELOR OF COMMERCE YEAR 2

HEH 2305/HBC 2210: OPERATIONS RESEARCH

DATE:15TH DECEMBER 2015 **TIME: 2 HOURS**

Instructions: Answer question **One** and **Two** other questions

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Question One (30 Marks)

a) (i) Explain briefly the term 'Operations Research'. (2 Marks)

(ii) Name two broad areas of application of Operations Research in management'. (2 Marks)

(iii) Operations Research is sometimes referred to as 'Management Science'. Explain. (2 Marks)

b) The KICOMI retail store stocks two types of shirts A and B. In one week, the store can sell a maximum of 400 shirts of type A and a maximum of 300 shirts of type B. The storage capacity, however, is limited to a maximum of 600 of both types combined. Type A shirt fetches a profit of Kshs.20 per unit and type B a profit of Kshs.50 per unit The store wants to establish how many of each type of shirt should be stocked per week in order to maximize the total profit. Formulate the linear programming problem to maximize the total profit. (5 Marks)

c) Use the Simplex method to solve the problem:

$Maximize\ x_o = 45x_1 + 80x_2$

$Subject\ to$:

$5x_1 + 20x_2 \leq 400$

$10x_1 + 15x_2 \leq 450$

$x_1 \geq 0, x_2 \geq 0.$ (6 Marks)

d) A construction company wants cement at three of its project sites P1, P2 and P3. It procures cement from four plants C1, C2, C3 and C4. Transportation costs per tonne, capacities and requirements are as follows:

	P1	P2	P3	Capacity(tones)
C1	2	7	4	50
C2	3	3	1	80
C3	5	4	7	70
C4	1	6	2	140
Requirement	70	90	180	340

Use Vogel's Approximation Method to develop an initial feasible solution..

(4 Marks)

e) State five essential characteristics of the queuing process.

(5 Marks)

f) Distinguish between single server and multiserver systems. (4 Marks)

Question Two (20 Marks)

a) State six conditions that a managerial problem must meet in order to be modeled into a LP model. (6 Marks)

b) The MARANGI paint company produces both interior and exterior paints from two raw materials, M1 and M2. The following table provides the basic data for the problem:

	Tonnes of raw material		Maximum daily available(tonnes)
	Exterior paint	Interior paint	
Raw material M1	6	4	24
Raw material M2	1	2	6
Profit per tonne($ 1000)	5	4	

A market survey indicates that the daily demand for interior paint cannot exceed that of exterior paint by more than 1 tonne. Also, the maximum daily demand for interior paint is 2 tonnes. Formulate the Linear Programming problem that maximizes the Company's daily profits and hence solve the problem graphically. (14 Marks)

Question Three (20 Marks)

a) Consider the following transportation problem:

	Destinations				
Origins	A	B	C	D	a_i
P	2	3	4	5	6
Q	5	4	3	1	8
R	1	3	3	2	10
b_j	4	6	8	6	24

Use the North – west corner method to find the initial solution and hence determine the optimal solution. (10 Marks)

b) The average rate of arrivals at a service store is 30 per hour. At present there is one cashier who on average attends to 45 customers per hour. The store proprietor estimates that each extra minute of system process time per customer means a loss of Rs 0.50. An assistant can be provided to the cashier and in that case the service unit can deal with 75 customers per hour. The wage rate of the assistant is Rs 15 per hour. By suitable calculation, determine whether it is suitable to employ the assistant. (10 Marks)

Question Four (20 Marks)

Mohan is a confectioner. He buys plastic boxes in bulk and uses them to pack his chocolates. His annual requirement of boxes is 1200 and each box costs him Rs 30. He has estimated that his ordering costs are Rs 10 per order and his carrying costs are 20 per cent.

a) How many boxes should he order at a time so as to minimize his expenses? (4 Marks)

b) If the supplier sells the boxes only in lots of 25, should Mohan buy 50 or 75? (7 Marks)

c) The Supplier offers 2% discount if the purchases are in quantities of 300 at a time. Should Mohan accept the discount? (9 Marks)

Question Five (20 Marks)

A project has the following time schedule:

Activity	Time in months	Activity	Time in months
1 – 2	2	4 – 6	3
1 – 3	2	5 – 8	1
1 – 4	1	6 – 9	5
2 – 5	4	7 – 8	4
3 – 6	8	8 – 9	3
3 – 7	5		

a) Draw a network and compute: (5 Marks)

(i) Critical path and its duration. (2 Marks)

(ii) Total float for each activity. (5 Marks)

b) Find the minimum number of cranes the project must have for its activities 2 – 5 , 3 – 7, and 8 – 9 without delaying the project. (8 Marks)