MURANG'A UNIVERSITY OF TECHNOLOGY

SCHOOL OF BUSINESS AND ECONOMICS

DEPARTMENT OF COMMERCE

UNIVERSITY SPECIAL EXAMINATION

2018/2019 ACADEMIC YEAR

END OF II SEMESTER EXAMINATION FOR BCOM

HBC 2210– OPERATIONS RESEARCH

DURATION: 2 HOURS

DATE:

TIME:

Instructions to candidates:

1. Answer question One and Any Other Two questions
2. Mobile phones are not allowed in the examination room.
3. You are not allowed to write on this examination question paper.

SECTION A: ANSWER ALL QUESTIONS IN THIS SECTION

QUESTION ONE (30 MARKS)

a)   Four jobs are to be assigned to four machines. The table below shows the costs associated with each job- machine combination. Determine the assignment that minimizes the cost of processing the jobs and determine this minimum cost. (6marks)

MACHINE

		A	B	C	D
JOB	1	8	6	2	4
	2	6	7	11	10
	3	3	5	7	6
	4	5	10	12	9

b)   A firm produces three products A, B and C each of which passes through three departments: Fabrication, Finishing and Packaging. Each unit of product A requires 3 hours, 4 hours and 2 hours in the fabrication, finishing and packaging departments respectively. Each unit B product requires 5 hours, 4 hours and 4 hours in the three departments respectively. Every week, 60 hours are available in the fabrication departments, 72 hours are available in the packaging department 100 hours are available in the packaging department. The profit contribution per unit of product A is $ 5, B is $ 10 while C is $*.

Required:

a.   Formulate this problem as a linear programming problem.

(10marks)

b.   Using graphical method find the maximum and minimum value of p= 4x + 3y subject to the following constraints.

$$3x + 5y > 20$$

$$3x + y < 16$$

$$-2x + y < 1$$

$$x, y > 0$$ (6marks)

c)Customer arrives at a banking facility at an average rate of 20 customers per hour and in conformance with the Poisson distribution. The service rate is 24 customers per hour at the single counter available in the facility. Assuming that the service rate follow the exponential distribution, determine:

i)   The probability that in any given hour, exactly 24 customers will arrive at the facility.   (2marks)

ii)   The expected number of customers in the waiting line.   (3marks)

iii)   The expected time a customer spends in the facility.   (3marks)

SECTION B – ANSWER ANY TWO QUESTIONS IN THIS SECTION

QUESTION TWO (20 MARKS)

A firm is engaged in producing two products A and B each unit of product A requires 2kg of raw material and 4 hours of labor for processing while unit of product B requires 3kg of raw material and 3 hours of labor of the same type. Every week, the firm has an availability of 60kg of raw material and 96 hours of labor hours. One unit of product B sold yields $35 as profit.

Required:

a) Formulate this problem as a linear programming problem with profit maximization as the objective. (6marks)

b) Use the simplex method to determine how many units of each product should be produced per week so that the firm can maximize profit. (assume there is no demand constrain so that all that is produced is sold) (14marks)

QUESTION THREE (20 MARKS)

A firm owns facilities at six laces. it has manufacturing plants at places 1, 2 and 3 with respective daily production of 220, 130 and 210 units. At point A, B and C, the firm has warehouses with daily demands of 240, 100 and 220 respectively. Per unit costs are given in the following table. The firm wants to minimize the total transportation cost.

Warehouse

		A	B	C	production
	1	10	12	7	220
plant	2	14	11	6	130
	3	9	5	13	210
demand		240	100	220	

Required:

a) How should the firm route its products if each of the following rules is to be used and what is the total transportation cost associated with each method.

   i) Northwest corner method (3marks)

   ii) Minimum cost method (3marks)

   iii) Vogel's approximation method (4marks)

b)   Suppose it is known that currently nothing can be sent from plant 1 to warehouse and from plant 3 to warehouse C, determine the least cost transportation schedule.

(10marks)

QUESTION FOUR (20 MARKS)

a)   A project has the following six activities. The time estimate for each activity and their predecessors are as shown in the table below.

Activity	A	B	C	D	E	F
Time (days)	6	10	5	4	9	2
Immediate predecessor	-	A	-	C	D	B,E

Required;

   i)   Construct a network diagram for the project   (3marks)

   ii) Determine the critical path of the project   (6marks)

   iii) Determine the project completion time   (1mark)

b)   The annual demand for a certain product is known to be 5,000 units. The holding cost per unit is estimated to be $ 150 and the cost per order is $800. The dealer oprates 365 days per year.

   Required:

   i)   The economic Order quantity   (2marks)

   ii) The total cost associated with the economic order quantity   (2marks)

   iii) Cycle time   (3marks)

   iv) Re-order level   (3marks)