TECHNICAL UNIVERSITY OF MOMBASA

UNIVERSITY EXAMINATIONS 2015/2016

EXAMINATION FOR THE DEGREE OF BACHELOR OF BUSINESS ADMINISTRATION AND BACHELOR OF COMMERCE YEAR 3 SEMESTER 2

BMS 4307: OPERATIONS RESEARCH I

DATE: MAY 2016 _____**DURATION:** 2 HOURS

INSTRUCTIONS: ANSWER QUESTION ONE AND ANY OTHER TWO

QUESTION ONE (30 MARKS)

1.a)(i.) List the principal phases for implementing Operations Research.   (4 marks)

(ii.) Give a brief description of two of these phases.   (8 marks)

b.)(i.) Reddy Mikks produces both interior and exterior paints from two raw materials, M1 and M2. The following table provides the basic data for the problem:

	Tons of raw materials per ton of		
	Exterior Paint	Interior Paint	Maximum daily Availability (tons)
Raw Material, M1	6	4	24
Raw Material, M2	1	2	6
Profit per ton (1,000)	5	4	

A market survey indicates that the daily demand for interior paint cannot exceed that for exterior paint by more than 1 ton. Also, the maximum daily demand for interior paint is 2 tons. Prepare a model to determine the optimum product mix of interior and exterior paints that maximizes the total daily profit.   (4 marks)

(ii.) Prepare a graphical LP solution for the Reddy Mikks problem, showing clearly the feasible solution space and use it to determine the optimal solution.   (10 marks)

c.) In preparation for the winter season, a clothing company is manufacturing parka and goose overcoats, insulated pants and gloves. All products are manufactured in four different

departments: cutting, insulation, sewing and packaging. The company has received firm orders for its products. The contract simulates a penalty simulates a penalty for undelivered items. Devise an optimal production plan for the company based on the following data.

Department	Parka	Goose	Pants	Gloves	Capacity
			Time per Unit (Hrs)		
Cutting	0.30	0.30	0.25	0.15	1000
Insulation	0.25	0.35	0.30	0.10	1000
Sewing	0.45	0.50	0.40	0.22	1000
Packaging	0.15	0.15	0.10	0.05	1000
Demand	800	750	600	500	
Unit Profit	30	40	20	10	
Unit Penalty	15	20	10	8	

(4 marks)

QUESTIONS TWO (20 MARKS)

a.) Give a summary of the simplex method using a flow chart.   (4 marks)

b.) Explain what is meant by sensitivity analysis as applied to variation in the total amount of resources or constraints.   (4 marks)

c.) A chemical manufacturer processes two chemicals, Arkon and Zenon, in varying proportions to produce three products A, B and C. He wishes to produce at least 150 units of A, 200 units of B and 60 units of C. Each ton of Arkon yields $3 of A, $5 of B and $3 of C. Each ton of Zenon yields $5 of A, $5 of B and $1 of C. If Arkon cost $40 per ton and Zenon $50 per ton, advice the Manufacturer how to minimise his costs.   (12 Marks)

QUESTIONS THREE (20 MARKS)

a.) Give brief description of CPM and PERT as network-based methods. How do the two methods differ?   (8 Marks)

b.) A publisher has a contact with an author to publish a textbook. The author submits a hard copy and a computer file of the manuscript. The (Simplified) activities associated with the production of the text-book are summarized in the following table.

Activity	Predecessor(s)	Duration (Weeks)
A: Manuscript Proofreading by Editor	-------	3
B: Sample pages preparation	-------	2
C: Book cover design	-------	4
D: Artwork preparation	-------	3
E: Author's approval of edited manuscript	A, B	2
F: Book formatting	E	4
G: Author's review of formatted pages	F	2
H: Author's review of artwork	D	1

| I: Production of printing plates | G, H | 2 |
| J: Book production and binding | C, I | 4 |

Prepare a project network.   (12 marks)

QUESTION FOUR (20 MARKS)

a.) Explain the meaning of the following:

i.) The objective of inventory control.   (2 marks)

ii.) Lead or Procurement time.   (2 marks)

iii.) Economic ordering Quantity.   (2 marks)

b.) Describe what Pareto Analysis is.   (6 marks)

c.) Neon lights on the TUM campuses are replaced at the rate of 100 units per day. The physical plant orders the neon lights periodically. It costs $100 to initiate a purchase order. A neon light kept in storage is estimated to cost about $0.02 per day. The lead time between placing and receiving an order is 12 days. Determine the optimal inventory policy for ordering the neon lights.   (8 marks)

QUESTION FIVE (20 MARKS)

a.) i.) Define a Transportation Model.   (4 marks)

ii.) Give a representation of the transport model with nodes and arcs.   (3 marks)

b.) Using the table below, apply the Least Cost Method to find a non-artificial starting basic solution for the transport problem.   (6 marks)

c.) A transport company ships truckloads of grain from three silos to four mills. The supply (in truckloads) and the demand (in truckloads) together with the unit transport costs per truckload on the different routes, is shown below. The unit transportation costs, C_{ij}, (shown in the northwest corner of each box) are in hundreds of dollars. The model seeks the minimum cost shipping schedule between the silos and the mills. Use the stepping stone method to find the minimum cost.

Transportation Model

Mills

Silos	1		2		3		4		Supply
1		10		2		20		11	15
	X_{11}		X_{12}		X_{13}		X_{14}		
2		12		7		9		20	25
	X_{21}		X_{22}		X_{23}		X_{24}		
3		4		14		16		18	10
	X_{31}		X_{32}		X_{33}		X_{34}		
Demand	5		15		15		15		

(7 marks)