



MUEO

MOI UNIVERSITY

OFFICE OF THE CHIEF ACADEMIC OFFICER

UNIVERSITY EXAMINATIONS 2012/2013 ACADEMIC YEAR

THIRD YEAR END OF SEMESTER II EXAMINATIONS

**DEGREE IN
BACHELOR OF BUSINESS MANAGEMENT**

EXAM CODE:- BBM 355

COURSE TITLE:- OPERATIONS RESEARCH I

DATE:- 23RD OCTOBER, 2012 TIME:- 9.00A.M. - 12.00 NOON.

INSTRUCTION TO CANDIDATES

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BBM 355: OPERATIONS RESEARCH I

MAIN EXAMINATION

INSTRUCTIONS:-

- Answer Question **ONE** and any other **THREE** questions.
- All workings must be shown clearly.

QUESTION ONE Compulsory [25 Marks]

- (a) "Operations Research normally starts with a simple model and subsequently develops it into an elaborate one to reflect the reality of the problem." Briefly explain this statement. [4 marks]
- (b) Give four limitations of using models in Operations Research. [4 marks]
- (c) Explain the importance of Linear Programming in business and industry. [4 marks]
- (d) *Super Angels East Africa Ltd*, a major dealer in ladies cosmetics wishes to allocate its monthly budget of KSh 10,000 among advertising media: Television, Radio and Newspaper. The number of prospective buyers reached by a single advertisement in each of the three media is 100,000; 18,000 and 40,000 persons, respectively, and the cost per advertisement is KSh 1,000, KSh 150 and KSh 300 respectively. The company has decided that it will not release more than 10, 20 and 10 advertisements in Television, Radio and Newspaper respectively.

Required:

Determine the number of advertisement that should be run in Television, Radio and Newspaper respectively, in order to maximize the total audience coverage using the simplex method. [13 marks]

QUESTION TWO [15 Marks]

- (a) Briefly describe the steps involved in solving transportation problem by applying the North West Corner Rule. [3 marks]
- (b) State **three** assumptions made in solving transportation problems. [3 marks]
- (c) For the following transportation problem, obtain initial feasible solution by:
- (i) North West Corner Rule. [3 marks]
- (ii) Least Cost Method. [3 marks]
- (iii) Vogel's Approximation Method. [3 marks]

The entries in the matrix indicate the cost in shillings for transporting a unit from a particular source to a particular destination.

Origin	Destination				Availability
	E	F	G	H	
A	10	8	11	7	20
B	9	12	14	6	40
C	8	9	12	10	35
Requirement	16	18	31	30	95

QUESTION THREE [15 Marks]

- (a) The assignment problem can be regarded as a special case of a transportation problem. Describe these special features of the assignment problem and explain why the transportation algorithm tends not to be used to solve such problems. [4 marks]
- (b) *The Melemeta Products Company Ltd* is considering an expansion into five new sales districts. The company has been able to hire four new experienced salespersons. Upon analyzing the new sales persons' past experience in combination with a personality test which was given to them, the company assigned a rating to each of the salesperson for each of the districts. These ratings are as follows:

Sales person	Districts				
	D ₁	D ₂	D ₃	D ₄	D ₅
A	92	90	94	91	83
B	84	88	96	82	81
C	90	90	93	86	93
D	78	94	89	84	88

The company knows that with four salespersons, only four of the five potential districts can be covered.

Required:

The four districts that the salespersons should be assigned to in order to maximize the total of the ratings and the maximum total rating. [11 marks]

QUESTION FOUR [15 Marks]

- (a) Briefly, explain the following terms as used in game theory.

- (i) Two-person zero-sum game. [1 mark]
- (ii) Dominance property. [1 mark]
- (iii) Maximin principle [1 mark]

- (b) *Shushy Ltd* has developed a sales forecasting function for its products and the products of its competitor *Pushy Ltd*. There are four strategies, S₁, S₂, S₃ and S₄ available to *Shushy Ltd* and three strategies, P₁, P₂, and P₃ to *Pushy Ltd*. The pay-offs in Kenya Shillings (Kshs) corresponding to all the twelve combinations of the strategies are given below.

		Pushy Ltd's Strategies		
		P ₁	P ₂	P ₃
Shushy Ltd's Strategies	S ₁	30,000	-21,000	1,000
	S ₂	18,000	14,000	12,000
	S ₃	-6,000	28,000	4,000
	S ₄	18,000	6,000	2,000

Required:

- (i) Considering the information, what would be the optimal strategy for *Shushi Ltd* and *Pushy Ltd*? [3 mark]
- (ii) What is the value of the game? [1 mark]
- (iii) Is the game fair? [1 mark]

- (c) In Eldoret town, there are two major supermarkets, Nakumatt and Uchumi that serve majority of the customers. The total number of customers is equally divided between the two, because the price and quality of goods sold are equal. Both supermarkets have good reputation in the community, and they render equally good customer service. Assume that a gain of customers by Nakumatt is a loss to Uchumi and vice-versa. Both supermarkets plan to run annual pre-Christmas sales during the first week of December. Sales are advertised through a local news paper, radio and television media. With the aid of an advertising firm, Nakumatt supermarket constructed the game matrix given below. (Figures in the matrix represent gain or loss of customers in '000').

Strategy of Nakumatt	Strategy of Uchumi		
	Newspaper	Radio	Television
Newspaper	30	40	-80
Radio	0	15	-20
Television	90	20	50

Required:

Determine the optimal strategies and the worth of such strategies for both Nakumatt and Uchumi.

[6 mark]

QUESTION FIVE [15 Marks]

A self service store employs one cashier at its counter. 8 customers arrive on an average every 5 minutes while the cashier can serve 10 customers in the same time. Assume Poisson distribution for arrival and an exponential distribution for service rate, determine.

- (a) The average number of customers in the system. [2 mark]
- (b) The average number of customers in queue (average queue length). [2 mark]
- (c) The average time a customer spends in the system. [2 mark]
- (d) The average time a customer waits before being served. [2 mark]
- (e) Probability that there is no customer at the counter. [2 mark]
- (f) Utilization factor. [2 mark]
- (g) Probability that there are more than 2 customers in the system. [2 mark]
- (h) Probability that there are equal to or more than 3 customers in the queue. [1 mark]

QUESTION SIX [15 Marks]

- (a) Give two advantages and two disadvantages of using simulation technique. [4 mark]

(b) The output of a production line is checked by an inspector for one or more of the three different types of defects, called defects A, B and C. If defect A occurs, the item is scrapped. If defect B or C occurs, the item must be reworked. The time required to rework a B defect is 15 minutes and the time to rework a C defect is 30 minutes. The probabilities of an A, a B and a C defects are 0.15, 0.20 and 0.10 respectively. Given the following random numbers for defects A, B and C.

Random numbers for defect A: 48 55 91 40 93 01 83 63 47 52
 Random numbers for defect B: 47 36 57 04 79 55 10 13 57 09
 Random numbers for defect C: 82 95 18 96 20 84 56 11 52 03

Required:

Using the random numbers above for 10 items coming to the assembly line, determine the number of items without any defects, the number scrapped and the total minutes of rework time. [11 mark]