



MUEO

MOI UNIVERSITY

OFFICE OF THE DVC ACADEMIC AFFAIRS, RESEARCH AND EXTENSION

UNIVERSITY EXAMINATIONS

2014/2015 ACADEMIC YEAR

THIRD YEAR END OF SEMESTER EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF BUSINESS MANAGEMENT

EXAM CODE: BMM 355

EXAM TITLE: OPERATIONS RESEARCH I

DATE: 13TH APRIL, 2015

TIME: 2.00 P.M. – 5.00P.M.

INSTRUCTION TO CANDIDATES

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**BBM 355: OPERATIONS RESEARCH I
MAIN EXAMINATION**

INSTRUCTIONS:-

- Answer Question **ONE** and any other **THREE** questions.
- Question **ONE** carries **25 Marks**
- Time allowed: **3 hours**

QUESTION ONE – Compulsory [25 marks]

a) The problem below represents the primal to a linear programming problem;

Maximize $P = 23x + 32y$

s.t.

$10x + 6y \leq 2500$

$5x + 10y \leq 2000$

$1x + 2y \leq 500$

Both x and y are ≥ 0 .

Formulate the Dual to the above problem.

(3 marks)

b) M & K Contractor pays his subcontractors a fixed fee plus mileage or travelling expenses for work performed. On a given day, the contractor is faced with three electrical jobs associated with various projects (A, B and C). M & K contractor has four electrical subcontractors (Wesside, Federal, National and Universal) who are located at various places throughout the area. Given below are the distances in kilometres) between the subcontractors and the projects.

		Projects		
		A	B	C
Subcontractors	Wesside	50	36	16
	Federal	28	30	18
	National	35	32	20
	Universal	25	25	14

Determine how subcontractors should be assigned in order to minimize the total costs and hence the minimum total mileage.

(6 marks)

c) Highlight the characteristics of Operations Research.

(4 marks)

d) Charles Nzioka who is a barber has found out that he can shave on average 4 customers per hour. The arrival rate of customers averages 3 customers per hour

Required

- i. The proportion of time that Charles Nzioka is idle (2 marks)
- ii. The probability that a customer receives immediate service upon arrival (2 marks)
- iii. Average number of customers in the queuing system (2 marks)
- iv. Average time a customer spends in the queuing system (2 marks)

e) Explain the limitations of Simulation in business decision making.

(4 marks)

QUESTION TWO (15 MARKS)

- a) Define the following terms used in game theory:
- i) Dominance. (1 marks)
 - ii) Saddle point. (1 marks)
 - iii) Mixed strategy. (1 marks)
 - iv) Value of the game (1 marks)
- b) Consider a two person zero sum game between players A and B given in the following pay-off table:

		B's STRATEGIES			
		BI	BII	BIII	BIV
A's STRATEGIES	AI	3	2	4	0
	AII	3	4	2	4
	AIII	4	2	4	0
	AIV	0	4	0	8

Using the principle of dominance, determine the value of the game and the optimal strategy (11 marks)

QUESTION THREE (15 MARKS)

- a) Explain the similarities between Transportation and Assignment problem. (4 marks)
- c) Umoja Engineering Works Ltd. Has a network of branches all over Kenya. The branches are used to service, repair and install equipment for their clients. Currently, the Nairobi branch has four clients who require installation of equipment. Each client requires the services of one engineer. There are four engineers who are not engaged at the moment and can be assigned any one of the tasks. However, these engineers have to travel from different locations and the Nairobi branch has to meet their travel and subsistence allowances. The allowances vary from one engineer to another and according to the client the engineer has been assigned to work for.

The table below shows the costs (in thousands of shillings) associated with each engineer.

Engineer	Client			
	1	2	3	4
A	37.0	27.0	34.0	21.0
B	57.0	22.0	79.0	34.0
C	22.0	25.0	61.0	45.0
D	39.0	42.0	54.0	43.0

Determine:

- i) The assignments to be made in order to minimize the total cost of the engineers.
- ii) The minimum cost of using engineers.

(11 marks)

QUESTION FOUR (15 MARKS)

a) Outline the circumstances under which simulation may be an appropriate tool in decision making. (4 marks)

b) The Lajwaab Bakery Shop keeps stock of a popular brand of cake. Previous experience indicates the daily demand as given below:

Daily Demand	Probability
0	0.01
15	0.15
25	0.20
35	0.50
45	0.12
50	0.02

Consider the following sequence of random numbers:

21, 27, 47, 54, 60, 39, 43, 91, 25, 20

Using this sequence,

i) Simulate the demand for the next 10 days.

ii) Find out the stock situation, if the owner of the bakery shop decides to make 30 cakes every day.

iii) Estimate the daily average demand for the cakes on the basis of simulated data. (11 marks)

QUESTION FIVE (15 MARKS)

a) State the assumptions made in solving a transportation problem. (4 marks)

b) Four factories, *A*, *B*, *C* and *D* produce sugar and the capacity of each factory is given below: Factory *A* produces 10 tons of sugar and *B* produces 8 tons of sugar, *C* produces 5 tons of sugar and that of *D* is 6 tons of sugar. The sugar has demand in three markets *X*, *Y* and *Z*. The demand of market *X* is 7 tons, that of market *Y* is 12 tons and the demand of market *Z* is 4 tons. The following matrix gives the costs the factory will incur, by transporting the sugar from each factory to each market.

Costs in Kshs. per ton ($\times 1000$)

Availability in tons.

	<u>Markets</u>			
	<i>X</i>	<i>Y</i>	<i>Z</i>	
Factories				
<i>A</i>	4	3	2	10
<i>B</i>	5	6	1	8
<i>C</i>	6	4	3	6
<i>D</i>	3	5	4	6
Requirement in tons	14	12	4	

- i) Using Vogel's Approximation Method (VAM), determine the optimal transportation Schedule.
- ii) Determine the minimum cost of transportation. (11 marks)

QUESTION SIX (15 MARKS)

A patient visits the doctor to get treatment for ill health. The doctor examines the patient and advises him to consume **at least** 40 units of vitamin *A* and 50 units of vitamin *B* daily for a specified time period. He advises the patient that to get vitamin *A* and vitamin *B* he has to drink tonic *X* and tonic *Y* that have both vitamin *A* and vitamin *B* in a proportion. One unit of tonic *X* consists 2 units of vitamin *A* and 3 units of vitamin *B* and one unit of tonic *Y* consists of 4 units of vitamin *A* and 2 units of vitamin *B*. These tonics are available in medical shops at a cost of Rs.3.00 and Rs.2.50 per unit of *X* and *Y* respectively.

Required:

- i) Formulate the above linear programming Problem. (3 marks)
- ii) Formulate the Dual to the above formulated problem. (2 marks)
- iii) Using simplex method advice the patient how much of *X* and how much of *Y* is to be purchased from the shop in order to **minimize** the total cost and at the same time he can get **required amounts** of vitamins *A* and *B*. (8 marks)
- iii) Determine the shadow costs and the minimum total cost. (2 marks)

END