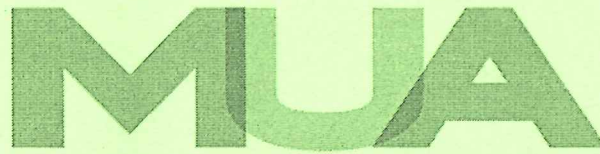


The
Management
University
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UNDERGRADUATE UNIVERSITY EXAMINATIONS
SCHOOL OF MANAGEMENT AND LEADERSHIP
DEGREE OF BACHELOR OF MANAGEMENT AND LEADERSHIP

BML 303 : OPERATIONS RESEARCH

DATE: 2ND DECEMBER 2019

DURATION: 2 HOURS

MAXIMUM MARKS: 70

INSTRUCTIONS:

1. Write your registration number on the answer booklet.
2. **DO NOT** write on this question paper.
3. This paper contains **SIX (6)** questions.
4. Question **ONE** is compulsory.
5. Answer any other **THREE** questions.
6. Question **ONE** carries **25 MARKS** and the rest carry **15 MARKS** each.
7. **Write all your answers in the Examination answer booklet provided.**

QUESTION 1:

- a) Operations Research (OR) may be defined as the application of scientific methods to complex problems arising in the direction and management of large systems of men, machines, material and money in the industry, business, government and defense. Trace in detail the history of OR applications from its early beginning to current situation. [10 Marks]
- b) With the help of an appropriate diagram, explain in details the concept of "The Prisoner's Dilemma" as used in Game Theory. [5 Marks]
- c) An animal feed manufacturing Company has to supply 15 bags of feed to its 4 customers(C1,C2,C3,C4) from its 3 Depots (D1,D2,D3). The details as in the table below;

Customers	C1	C2	C4	C5	Total
Requirement(Bags)	3	3	4	5	15
Available					Transportation
Depot D1: 2	13	11	15	20	Cost per bag
Depot D2: 6	17	14	12	13	(Ksh)
Depot D3: 7	18	18	15	12	
Total 15					

Required;

- i) Analyze this transportation problem and show all your steps. [8 Marks]
- ii) Advise the management on the least cost schedule to supply the customers. [2 Marks]

QUESTION 2

The manager of a local bank is convinced that customers arrive in a single-serve queuing situation with Poisson serves and Poisson service. Customers arrive randomly at a rate of 0.20 customers per hour. Each customer require different amount of times for service. The manager reckons that customers are served at an average rate of 0.21 customers per hour.

Calculate:

- a) The average number of customers in the queuing system. [2 Marks]
- b) The number of customers actually waiting in the queue. [2 Marks]
- c) The average amount of time a customer spends in the queuing system. [2 Marks]
- d) The average amount of time a customer spends in the queue. [2 Marks]
- e) The probability of having exactly zero customers in the queuing system. [2 Marks]
- f) The probability that there will be 10 or more customers in the queuing system. [2Marks]
- g) The utilization ratio with the manager functioning as the service mechanism. [3 Marks]

QUESTION 3

At a University, the head of department want to assign course to various lecturers based on their abilities as in the following table;

Academic Staff	Responsibility				
	Mathematics	Marketing	Sociology	Accounting	Computing
Dr Omollo	40	15	25	30	35
Dr Hassan	30	10	30	40	35
Prof Korir	35	25	40	10	45
Dr Ongeri	10	10	55	10	50
Prof Kamau	35	55	50	15	45

Required;

Assign each academic staff to each responsibility.

[15 marks]

QUESTION 4

"Smart Furniture" is a Jua Kali artisan based in Githurai. He makes Wooden beds and Tables for sale. He sell each bed for Ksh.2,700 and each of the Tables at Ksh.2,100=. Each Bed uses Ksh. 1,000= worth of raw materials and a further Ksh. 1,400= labour cost and other overheads. On the other hand, each Table uses raw material worth Ksh.900 and a further Ksh. 1,000= labour cost and other overheads.

To complete the furniture, each Bed needs 1 hour of carpentry work and 2 hours for finishing work while the Table needs 1 hour of carpentry work and 1 hour for finishing work. More than enough raw materials are available but only 80 hours of carpentry work is available and only 100 hours of finishing is available each week. Demand for beds is unlimited but only up to 40 Tables can be sold each week.

Required:

- Formulate the LP problem. [5 Marks]
- Using a well labeled graph, solve the problem. [7 Marks]
- Advise the owner of "Smart Furniture" how many of each furniture he should make each week in order to maximize his profits. [3 Marks]

QUESTION 5

- Discuss the importance of transportation problems in business applications. [5 Marks]
- KPLC has three electric power plants, Olkaria, Kindaruma and Kaburu that supply the need for four cities, Nairobi, Thika, Nakuru and Mombasa. Each power plant can supply the following number of KWH of electricity; Olkaria 35 million, Kindaruma, 50 Million, Kaburu 40 million. The peak power demands in this cities are as follows in (KWH): Nairobi, 45 Million, Thika, 20 Million, Nakuru 30 Million, Mombasa 30 Million. The cost of sending 1 million KWH of electricity from each plant to each city is given in the table below. In order to minimize the cost of meeting each city's peak power demand, formulate a balanced transportation problem in a transportation tableau and represent the problem as an LP model. [10 Marks]

	To(Ksh)			
From(Ksh)	Nairobi	Thika	Nakuru	Mombasa
Olkaria	8	6	10	9
Kindaruma	9	12	13	7
Kaburu	14	9	16	5

QUESTION 6

One of the methods available for solving managerial optimization problems is using the Simplex Method. Because of its complexity the Simplex method is best done using a well coded computer program. But although as a manager you are not expected to manually compute the simplex algorithm, it is important to understand the principles involved for better interpretation of the Computer output.

- a) In this regard describe in details the five steps involved in solving a transportation problem using the Simplex method. **[9 Marks]**
- b) Describe in detail the pivoting procedure. **[6 Marks]**

