



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)

- a.) Give a brief Historical background of how Operations Research came into being.(3 marks)
- b.) Give a format for a general OR model. (3 marks)
- c.) Two of the principal phases for implementing OR in practice are model solution and model validity. Give a brief explanation of each of them. (8 marks)
- d.) A Manufacturer is to market a new fertiliser which is to be a mixture of two ingredients A and B. The properties of the two ingredients are:

Ingredients Analysis

| | Bone Meal | Nitrogen | Lime | Phosphates | Cost/Kg |
|--------------|-----------|----------|------|------------|---------|
| Ingredient A | 20% | 30% | 40% | 10% | 1.2 p |
| Ingredient B | 40% | 10% | 45% | 5% | 0.8 p |

It has been decided that:

- the fertilizer will be sold in bags containing 100 Kgs
- it must contain at least 15% nitrogen
- it must contain at least 8% phosphates

- it must contain at least 25% Bone meal

The manufacturer wishes to meet the above requirements at the minimum cost possible.

- Formulate the LP model in the standardised manner. (4 marks)
- Use a graphical method to represent the LP problem, showing clearly the feasible region. (8 marks)
- Use the graphical method to find the optimum solution. (4 marks)

QUESTION TWO (20 MARKS)

- Give a brief description of an assignment model and state its goal. (6 marks)
- Joe’s three children, A, B and C, want to earn some money for personal expenses. Joe has chosen three chores for his children: mowing the lawn, painting the garage door and washing the family cars. To avoid anticipated sibling competition, he asks them to submit individual (secret) bids for what they feel is fair pay for each of the three chores.

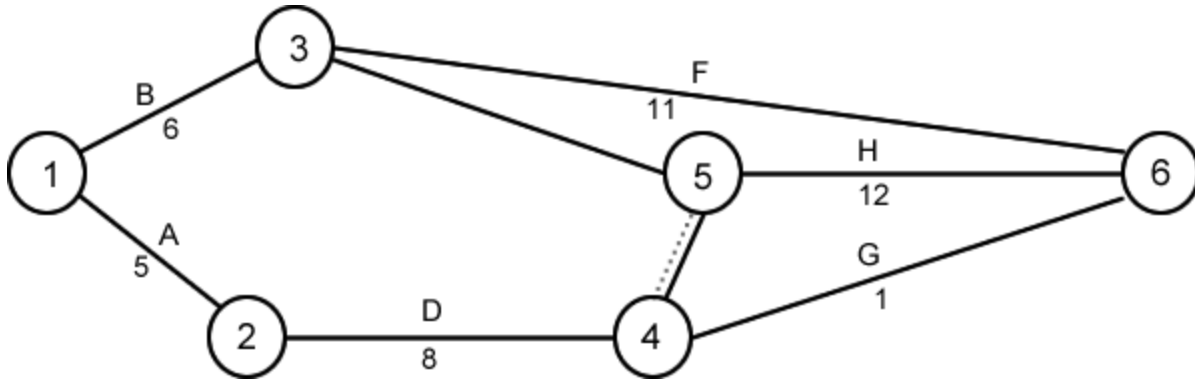
Joe’s Assignment Problem

| | Mow | Paint | Wash |
|---|------|-------|------|
| A | \$15 | \$10 | \$9 |
| B | \$9 | \$15 | \$10 |
| C | \$10 | \$12 | \$8 |

- Use the Hungarian method to solve the assignment problem. (10 marks)
- Find the total cost to Joe. (4 marks)

QUESTION THREE (20 MARKS)

- CPM (Critical Path Method) and PERT (Program Evaluation and Review Technique) are network-based methods designed to assist in the planning, scheduling and control of projects. Give a summary of the steps of these techniques and show diagrammatically. (8 marks)
- Determine the critical path for the project network in the figure below. All the durations are in days. Show forward and backward pass calculations for the project. (12 marks)



QUESTION FOUR (20 MARKS)

a.) Explain the General Inventory Model. (6 marks)

b.) Explain the role of demand in the Development of inventory Models. (6 marks)

c.) Lube Car specializes in fast automobile oil change. The garage buys car oil in bulk at \$3 per gallon discounted to \$2.50 per gallon if the order quantity is more than 1000 gallons. The garage services approximately 150 cars per day, and each oil change takes 1.25 gallons. Lube Car stores bulk oil at the cost \$0.02 per gallon per day. Also, the cost of placing an order is \$20. There is a 2-day lead time for delivery. Determine the optimal inventory policy.

(8 marks)

QUESTION FIVE (20 MARKS)

a.) Explain the Game Theory. (8 marks)

b.) Two companies, A and B, sell two brands of flu medicine. Company A advertises in radio (A₁), television (A₂), and newspaper (A₃). Company B, in addition to using radio (B₁), television (B₂), and newspaper (B₃), also mails brochures (B₄). Depending on the effectiveness of each advertising campaign, one company can capture a portion of the market from the other. The following matrix summarizes the percentage of the market captured or lost by company A. Determine the strategies that define the saddle point and the value of the game.

| | | | | |
|----------------|----------------|----------------|----------------|----------------|
| | B ₁ | B ₂ | B ₃ | B ₄ |
| A ₁ | 8 | -2 | 9 | -3 |
| A ₂ | 6 | 5 | 6 | 8 |
| A ₃ | -2 | 4 | -9 | 5 |

(12 marks)