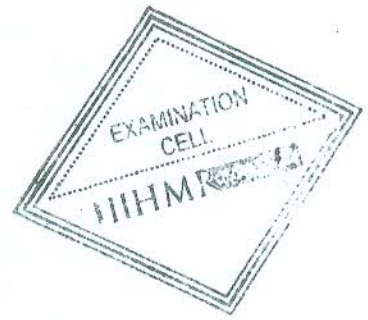


**LIHMR UNIVERSITY**  
**Institute of Health Management Research**  
**MBA Hospital and Health Management**  
**Batch-22 (2017-2019)**  
**Health Management**  
**Operations Research**  
**Term Examination**



**Time - 3 Hour**

**MM-70**

The question paper contains 3 printed pages.

**Instructions**

1. The question paper contains 8 Questions. Candidates are required to answer any five (5) questions.
2. All questions carry equal marks.

**Q. 1.** What is Operations Research (OR)? Trace the history of OR and explain the important model that are used in healthcare. **[14]**

**Q. 2.** A Health Project manager is faced with a project with the following activities:

| Activity-id | Activity - Description                  | Duration |
|-------------|-----------------------------------------|----------|
| 1-2         | Social Work Team to live in Village     | 6 Weeks  |
| 1-3         | Social Research Team to do survey       | 12 Weeks |
| 3-4         | Analyse results of survey               | 5 Weeks  |
| 2-4         | Establish Mother & Child Health Program | 13 Weeks |
| 3-5         | Establish Rural Credit Programme        | 16 Weeks |
| 4-5         | Carry out Immunization of Under Fives   | 4 Weeks  |

Draw the arrow diagram, using the helpful numbering of the activities. Calculate the Earliest and Latest Event Times. Tabulate and Analyze the Activities. Also determine the float for each activity. **[14]**

**Q. 3.** Given the following linear programming formulation:

Maximize

$$1,600 x_1 + 3,000 x_2$$

Subject to:

$$40 x_1 + 25 x_2 \leq 80,000 \text{ (constraint1)}$$

$$20 x_1 + 30 x_2 \leq 60,000 \text{ (constraint2)}$$

$$x_1, x_2 \geq 0 \text{ (non-negativity constraints).}$$

- a. Solve the problem graphically. **[8]**
- b. What is the total objective function value? **[2]**
- c. Do both variables contribute to the solution? Why? **[2]**
- d. Does any variable have a slack value? If so, what does it mean? **[2]**



**Q. 4.** (a) Explain the mathematical structure of linear programming problem which could be used in resource allocation. [4]

(b) The dietician at the local hospital is planning the breakfast menu for the maternity ward patients. She is planning a special non-fattening diet, and has chosen cottage cheese and scrambled eggs for breakfast. She is primarily concerned with Vitamin E and Iron requirements in planning the breakfast.

According to the State Medical Association (SMA) new mothers must get at least 12 milligrams of Vitamin E and 24 milligrams of iron from the breakfast. The SMA handbook reports that a scoop of cottage cheese contains 3 milligrams of Vitamin E and 3 milligrams of iron. An average scoop of scrambled egg contains 2 milligrams of Vitamin E and 8 milligrams of iron. The SMA handbook recommends that new mothers should eat at least two scoops of cottage cheese for their breakfast. The dietician considers this as one of the model constraints.

The hospital accounting department estimates that the scoop of cottage cheese costs Rs. 10, and a scoop of scrambled egg costs Rs. 20.

The dietician is attempting to determine the optimum breakfast menu that satisfies all the requirements and minimize total cost. The cook insists that he can serve foods by only full scoop, thus necessitating an integer solution.

Formulate and solve this problem as an LP problem to determine the optimum solution to the above problem. [10]

**Q. 5.** (a) Explain the structure of transportation problem as a special class of the linear programming problem. [4]

(b) One of the main products of a Social Marketing NGO (say, NGO X) is ORS-packet. The packets are prepared by the NGO at three centres (Centres A, B, and C) and then shipped by Van to four distributing depots located in remote areas (Depot I, II, III, IV). Because the transport costs are a major expense, management is initiating a study to reduce them as much as possible. For the upcoming season, an estimate has been made of the output from each producing centre, and each depot has been allocated a certain amount from the total supply of packets.

This information (in units of vanloads), along with the transport cost per vanload for each centre-depot combination, is given in the following table. Thus, there are a total of 300 van-loads to be shipped. Centre "A" produces 70 vanloads of packets; the corresponding figures for Centres B and C are 90 and 180. On the other hand, Depot I needs 50 vanloads of packets; the needs for Depots II, III, and IV are 80, 70, and 140 respectively.

**Table: Transport data for NGO X**

|                      |  | Transport Cost ('00 Rs) per vanload |    |     |     | Output (Vanload) |
|----------------------|--|-------------------------------------|----|-----|-----|------------------|
|                      |  | Depots                              |    |     |     |                  |
| Centers              |  | I                                   | II | III | IV  |                  |
| A                    |  | 19                                  | 30 | 50  | 10  | 70               |
| B                    |  | 70                                  | 30 | 40  | 60  | 90               |
| C                    |  | 40                                  | 8  | 70  | 20  | 180              |
| Allocation (Vanload) |  | 50                                  | 80 | 70  | 140 |                  |

Determine the transportation plan for assigning these shipments to the various centre-depot combinations which would minimize the total transport cost. Also find the minimum total cost. [10]



- Q. 6.** An NGO has five persons working in MCH department – Satish, Lalita, Bindu, Chitra and Raj. Each of these individuals is uniquely qualified with experience in specific components. The Coordinator of this department has just received five jobs that be assigned to these individuals, and only one job may be assigned to each individual. The estimated number of days required to complete each of these jobs by the five individuals is given in the table below.

|                                |        | <i>Jobs</i> |           |            |           |          |
|--------------------------------|--------|-------------|-----------|------------|-----------|----------|
|                                |        | <i>I</i>    | <i>II</i> | <i>III</i> | <i>IV</i> | <i>V</i> |
| <i>Employees<br/>(Persons)</i> | Satish | 10          | 5         | 13         | 15        | 16       |
|                                | Lalita | 3           | 9         | 18         | 13        | 6        |
|                                | Bindu  | 10          | 7         | 2          | 2         | 2        |
|                                | Chitra | 7           | 11        | 9          | 7         | 12       |
|                                | Raj    | 7           | 9         | 10         | 4         | 12       |

The Coordinator would like to minimize the number of days required for the completion of these jobs. Solve this using Hungarian method. How many work days will be required to complete these jobs? Who will be assigned to each job? [14]

- Q. 7.** (a) Explain the EOQ model in hospital supply chain management. [4]

(b) The following data corresponds to the annual consumption of 8 pharmaceutical products which was obtained from inventory records:

| <b>Item No.</b> | <b>Annual Consumption<br/>(no. of units)</b> | <b>Price per unit<br/>(Rs.)</b> |
|-----------------|----------------------------------------------|---------------------------------|
| 1               | 3000                                         | 200                             |
| 2               | 60,000                                       | 2                               |
| 3               | 20                                           | 5000                            |
| 4               | 200                                          | 12.5                            |
| 5               | 350                                          | 9                               |
| 6               | 6000                                         | 25                              |
| 7               | 40                                           | 1000                            |
| 8               | 300                                          | 70                              |

For inventory control reasons the hospital want to classify the products into three categories A, B, and C according to the following basis.

| <b>Category</b> | <b>Percentage of total<br/>ACV</b> |
|-----------------|------------------------------------|
| A               | 70                                 |
| B               | 20                                 |
| C               | 10                                 |

Classify the products into A, B, and C categories and draw the ABC classification graph. [10]

- Q. 8.** Write short notes on any two of the following: [7 x 2]

- Statistical control charts in Quality Mgmt.
- Queuing and capacity planning in hospitals.
- 7-QC tools of Quality Management in hospitals.
- Project Crashing and Cost analysis.

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