



Institute of Health Management Research

MBA Hospital and Health Management

Batch-27th (2022-2024)

Health Management

Second Year, Term 6 End Term Examination, March 2024

HEM-713 Operations Research

Time - 3 Hour

Maximum Marks: 50 (Minimum Marks: 20)

Instructions to students:

- This question paper contains 4 printed pages.
- Don't write anything on the Question Paper except writing your Enrolment No.

Part A

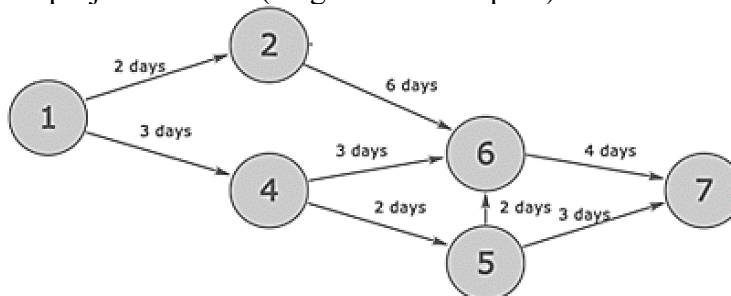
(Maximum Marks: 5)

Q1. Choose the most appropriate option for the following questions (1 mark each):

(a). Operations Research techniques are _____ in nature

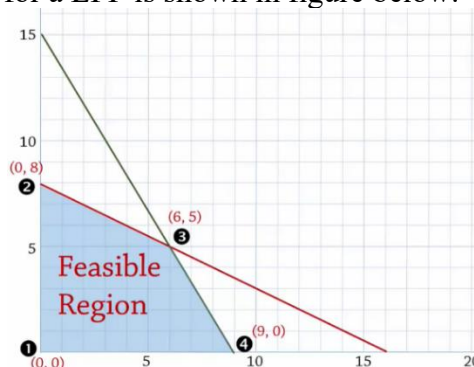
- (a) Qualitative
- (b) Judgemental
- (c) Approximate
- (d) Quantitative

(b). The project duration (length of critical path) in the network diagram below is:



- (a) 10 days
- (b) 11 days
- (c) 12 days
- (d) 14 days

(c). Feasible region (shaded) for a LPP is shown in figure below:



The objective function is Maximize $Z = 2x_1 + 5x_2$, The point at which the objective function is maximized is :

- (a) (0, 8)
 - (b) (6,5)
 - (c) (9,0)
 - (d) (0,0)
- (d). An assignment problem can be viewed as a special case of transportation problem in which the capacity from each source is _____ and the demand at each destination is _____.
- (a) 1000; 1000
 - (b) Infinity; infinity
 - (c) 0; 0
 - (d) 1; 1
- (e). Qualitative (judgemental) techniques in forecasting include:
- (a) Delphi method
 - (b) jury of executive opinion
 - (c) Both a and b above
 - (d) None of the above

Part B

(Maximum Marks: 15)

Attempt any three of the following questions of Part B (5 mark each):

- Q2. What do you understand by Operations Research. Explain in brief, important techniques which could be applied in healthcare organisations.
- Q3. Explain the LP structure of assignment problem and the Hungarian method of solving assignment problem.
- Q4. 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.

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. Use VAM method only.

- Q5. Explain EOQ model along with EOQ under quantity discount used in inventory management.
- Q6. Explain the operations research techniques in location analysis.

Part C

(Maximum Marks: 30)

Attempt any three of the following questions of Part C (10 mark each):

- Q7. Table below shows the precedence relationships among the activities to complete a health project.

Activity	Predecessor	Duration (days)
A	–	18
B	A	19
C	A	17
D	B	15
E	C	18
F	D	13
G	E	17
H	F, G	12

Construct an activity on arrow network for the project. Identify the paths and path project durations. Determine the critical path and the expected project completion time. Find the ES, LS, EF, LF, and slack time for each activity.

- Q8. An insurance company desires to enter the health care market and offer its potential customers both a staff model health maintenance organization (HMO) and commercial indemnity insurance. The company is deciding how to allocate its marketing efforts between those options to maximize its profits. The analysts have estimated that the company will realize a profit of \$ 1,200 per enrollee from the HMO, and \$ 600 per enrollee from commercial plans. Furthermore, for the coming year the company is forced to rely on its present resources in terms of sales force. The administrative support of the HMO will take two hundred hours, and the commercial administration will take, on average, four hundred hours; currently, the company can allocate 1.6 million hours to sales. To break even, the HMO requires that the contribution margins for enrollees must exceed \$ 1.5 million.
- The estimated contribution margins are \$ 500 and \$ 300, for HMO and for commercial insurance enrollees, respectively. With a limited number of physicians participating in the staff model HMO at the present time, the HMO can handle at most 5,000 enrollees. Formulate the LP problem and identify the decision variables and find out how the

resources should be allocated to each program so as to maximize the profits. Solve the problem graphically.

- Q9. The following data corresponds to the annual consumption of 8 pharmaceutical products which was obtained from inventory records:

Item No.	Annual Consumption (no. of units)	Price per unit (Rs.)
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 organization wants to classify the products into three categories A, B, and C according to the following basis.

Category	Percentage of total ACV
A	70
B	20
C	10

Draw an ABC analysis graph after classifying A, B & C class products.

- Q10. Explain the various qualitative and quantitative techniques in predictive analytics (forecasting).
- Q11. Explain Queuing & Capacity Planning in Hospitals. Explain the server utilization, line length, queue length, wait in queue and in system for single server model. Also explain the queue cost analysis.