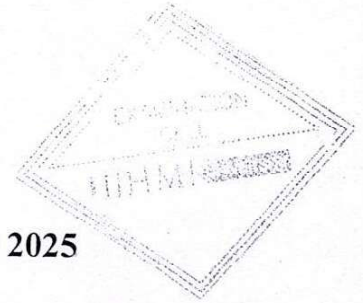


**Time - 3 Hour****Maximum Marks: 50 (Minimum Marks: 20)****Instructions to students:**

- 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. MCQ's. Attempt all questions from Part A (1 mark each):**

- a) If A and B are two matrices with order 2×2 as below,

$$A = \begin{bmatrix} 1 & 3 \\ 2 & 4 \end{bmatrix} \text{ and } B = \begin{bmatrix} -1 & 7 \\ 0 & 8 \end{bmatrix}$$

A – B is equal to:

(a) $\begin{bmatrix} 2 & -4 \\ 2 & 0 \end{bmatrix}$

(b) $\begin{bmatrix} 0 & -4 \\ 2 & 0 \end{bmatrix}$

(c) $\begin{bmatrix} 2 & -4 \\ 2 & 4 \end{bmatrix}$

(d) $\begin{bmatrix} 2 & -4 \\ 2 & -4 \end{bmatrix}$

- b) Consider the following linear programming

Maximize $1600x_1 + 3000x_2$

Subject to:

$$40x_1 + 25x_2 \leq 80,000 \quad (\text{constraint 1})$$

$$20x_1 + 30x_2 \leq 60,000 \quad (\text{constraint 2})$$

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

The number of decision variables are

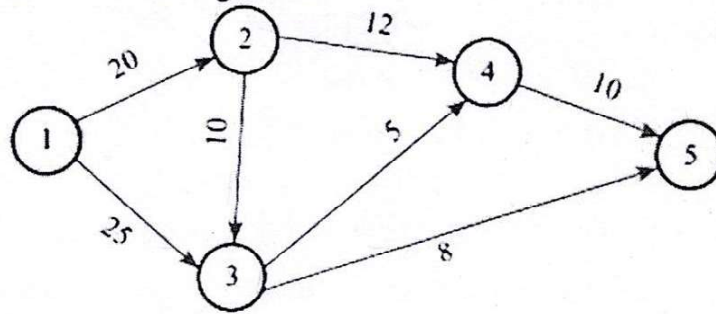
a) 3

b) 1

c) 2

d) None of the above

- c) The critical path of the following network is:



- a) 1 - 2 - 4 - 5
 b) 1 - 3 - 5
 c) 1 - 2 - 3 - 5
 d) 1 - 2 - 3 - 4 - 5
- d) A situation in which a decision maker knows all of the possible outcomes of a decision and also knows the probability associated with each outcome is referred to as
- a) Certainty
 b) Risk
 c) Uncertainty
 d) Strategy
- e) A hospital is exploring the level of staffing needed for a booth in the local mall, where they would test and provide information on diabetes. If every fifteen minutes a new person approaches the booth and a nurse can complete testing and answering questions, on average, in twelve minutes, the system utilization is :
- a) .8 or 80 %
 b) .6 or 60 %
 c) .5 or 50 %
 d) .4 or 40 %



Part B

(Maximum Marks: 15)

Short Answer Questions. Attempt any Three (3) questions from Part B (5 marks each):

- Q2. What do you understand by Operations Research. Explain in brief, important techniques which could be applied in the development sector.
- Q3. A company management and the labour union are negotiating a new three year settlement.
 Each of these has 4 strategies:
 I: Hard and aggressive bargaining II: Reasoning and logical approach
 III: Legalistic strategy IV: Conciliatory approach

The costs to the company (in lac of rupees) are given for every pair of strategy choice.

Union Strategies	Company Strategies			
	<i>I</i>	<i>II</i>	<i>III</i>	<i>IV</i>
<i>I</i>	20	15	12	35
<i>II</i>	25	14	8	10
<i>III</i>	40	2	10	5
<i>IV</i>	-5	4	11	0

What strategy will the two sides adopt? Also determine the value of the game.

- Q4. Consider the following assignment problem (time in days).

	Employees				
	I	II	III	IV	V
A	6	12	3	11	15
B	4	2	7	1	10
C	8	11	10	7	11
D	16	19	12	23	21
E	9	5	7	6	10

The coordinator would like to minimize the time in days required for the completion of these tasks. Solve by using Hungarian method. Who will be assigned to each job?

- Q5. Explain the mathematical structure of transportation problem in LPP which deals with the situation in which a commodity is transported from sources to destinations.
- Q6. Explain the various techniques of decision making under uncertainty and risk. Also explain game theory in brief.

Part C

(Maximum Marks: 30)

Long Answer Questions. Attempt any Three (3) questions from Part C (10 marks each):

- Q7. 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 and solve the LP problem graphically to find out how the resources should be allocated to each program so as to maximize the profits. What is total objective function value?

- Q8.** The table below shows the precedence relationships among the activities to complete a development project.

	Activity	Immediate Predecessors	Duration (days)
Start	A	-	6
	B	A	12
	C	A	10
	D	B	20
	E	B	11
	F	C	8
	G	E	6
	H	D,F	3
Finish	I	G,H	6

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.

- Q9.** What do you understand by Inventory Management. Explain the EOQ and ABC analysis which could be used in inventory management.
- Q10.** Describe the meaning of quality in the development sector. Explain the Lean Six Sigma (LSS) approach focused on improving quality, reducing variation, and eliminating waste in a healthcare organization.
- Q11.** Explain the Queuing theory and capacity planning. Explain the characteristics and important parameters which are used in judging the queueing system performance.

