

Total No. of Questions : 12]

SEAT No. :

P862

[4659] - 242

[Total No. of Pages : 4

**B.E (Computer Engineering)
OPERATION RESEARCH
(2008 Pattern) (Elective - IV) (Semester - II)**

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) *Answer 3 questions from each section.*
- 2) *Answers to the two sections should be written in separate answer- books.*
- 3) *Neat diagrams must be drawn whenever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Assume suitable data, if necessary.*

SECTION - I

Q1) a) What is meant by the term 'feasible region'? Why must this be well defined boundary for the maximization problem? **[6]**

b) Solve the following LP problem graphically and state what your solution indicate. **[10]**

i) $\text{Min } Z = 4X_1 - 2X_2$
Subject to $X_1 + X_2 \leq 14$
 $3X_1 + 2X_2 \geq 36$
 $2X_1 + X_2 \leq 24$

And $X_1, X_2 \geq 0$

ii) $\text{Max } Z = 3X + 2Y$
Subject to $-2X + 3Y \leq 9$
 $3X - 2Y \leq -20$
And $X, Y \geq 0$

OR

Q2) a) Define slack and surplus variables in a linear programming problem. **[6]**

b) Solve the following LP problem graphically and state what your solution indicates. **[10]**

i) $\text{Min } Z = 20X_1 + 10X_2$
Subject to $X_1 + 2X_2 \leq 40$
 $3X_1 + X_2 \geq 30$
 $4X_1 + 3X_2 \geq 60$

And $X_1, X_2 \geq 0$

P.T.O.

ii) $\text{Max } Z = 6X - 4Y$
 Subject to $2X + 4Y \leq 4$
 $4X + 8Y \geq 16$
 And $X, Y \geq 0$

- Q3) a)** A baking company sells one of its types of cake by weight. It makes profit of Rs. 2 a kg on every Kg of cake sold on the day it is baked. It disposes of all cakes not sold on the day they are baked at a loss of Rs. 0.50 a Kg. If the demand is known to have probability density function $f(R) = 0.3 - 0.0003R$, find the optimum amount of cake the company should bake daily. [10]
- b) Explain the following with respect to probability [6]
- i) random variable
 - ii) probability distribution function
 - iii) transition probability.

OR

- Q4) a)** The probability distribution of demand of an item is as follows [10]

Monthly demand	0	1	2	3	4	5
Probability	0.1	0.2	0.2	0.3	0.1	0.1

The cost of carrying inventory is Rs. 1 per unit per month. The current policy is to maintain a stock of three items at the beginning of each month. Assuming that this is the optimum level, calculate the shortage cost of one item for one time unit.

- b) For events A and B in the probability. [6]

Show that $P(A \cup B) = P(A) + P(B) - P(A \cap B)$.

- Q5) a)** Four counters are being opened on the border of a country for checking the passport and necessary papers of the tourists. The tourist chooses a counter at random. If arrivals at the border are Poisson at rate λ and the service time is exponential with parameters $\lambda/2$. What is the steady state average queue at each counter? [10]
- b) Describe the general problem of M/M/k queuing and deduce an explicit expression for the steady state probability of the length of the queue in an M/M/1 system. [8]

OR

- Q6) a)** A telephone exchange has two long distance operators. The telephone company finds that during the peak load, long distance call arrive in a Poisson fashion at an average rate of 15-per hours. The length of service on these calls is approximately exponentially distributed with mean length of 5 minutes. What is the probability that a subscriber will have to wait for his long distance call during the peak hours of a day? [10]
- b)** State the basic axioms governing Poisson queues. Find the distribution of arrival for the Poisson queues. [8]

SECTION - II

- Q7) a)** Find an optimal sequence for the following sequencing problem of four jobs and five machines of which processing time is as follows: [12]

Job	1	2	3	4
Machine M_1	6	5	4	7
Machine M_2	4	5	3	2
Machine M_3	1	3	4	2
Machine M_4	2	4	5	1
Machine M_5	8	9	7	5

Also find the total elapsed time.

- b)** What do you understand by the following terms in the context of sequence of jobs: [6]
- i) job arrival pattern
 - ii) number of machines
 - iii) the flow pattern in the shop
 - iv) the criteria of evaluating performance of a schedule.

OR

- Q8) a)** Five jobs have to be processed on same machine. The set up time for each job depends on the job processed earlier. A table of the set up time is shown below. Find a sequence for processing all jobs that minimizes the total set up cost. [12]

Predecessor Job	Follower Job				
	A	B	C	D	E
A	0	29	20	18	24
B	0	0	14	19	16
C	0	35	0	37	26
D	0	15	10	0	10
E	0	18	16	40	0

- b) By using appropriate notion, obtain formulae for the following. [6]
- waiting time of job
 - mean flow time
 - completion time of a job

Q9) Explain the following with respect to separable programming: [16]

- separable programming problem
- separable convex problem
- separable function
- reduction to separable form

OR

Q10) When $n > m+1$, solve the following NLP problem [16]

$$\text{Minimize } f(x) = 5x_1 x_2^{-1} + 2x_1^{-1} x_2 + 5x_1 + x_2^{-1}$$

Using the geometric programming method.

Q11)a) Use dynamic programming to find the value of: [10]

$$\text{Max } Z = y_1 \cdot y_2 \cdot y_3$$

Subject to the constraints

$$y_1 + y_2 + y_3 = 5 \text{ and } y_1, y_2, y_3 \geq 0$$

- b) Explain the concept of dynamic programming and the relation between dynamic and linear programming. [6]

OR

Q12)a) Solve the following LP problem by dynamic programming [10]

$$\text{Maximize } Z = 8x_1 + 7x_2$$

Subject to the constraints

$$\text{i) } 2x_1 + x_2 \leq 8$$

$$\text{ii) } 5x_1 + 2x_2 \leq 15 \quad x_1, x_2 \geq 0$$

- b) Discuss briefly [6]

- The general similarities between dynamic programming and linear programming.
- How dynamic programming conceptually differ from linear programming?

