

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc(SS) DEGREE EXAMINATION DECEMBER 2024
(Fourth Semester)

Branch – SOFTWARE SYSTEMS (Five years Integrated)

OPTIMIZATION TECHNIQUES

Time: Three Hours

Maximum: 50 Marks

SECTION-A (5 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(5 x 1 = 5)

- 1 Which of the following is the objective of linear programming?
(i) To maximize or minimize a linear function (ii) To solve nonlinear equations
(iii) To find the roots of polynomials (iv) To analyze statistical data
- 2 In a transportation problem, if there are more supply points than demand points, the problem is termed:
(i) Balanced (ii) Unbalanced
(iii) Feasible (iv) Optimal
- 3 In a zero-sum game, the gain of one player is:
(i) Equal to the loss of the other player (ii) Independent of the other player's actions
(iii) Always positive (iv) None of the above
- 4 In a queuing system, the arrival rate (λ) refers to:
(i) The rate at which customers are served
(ii) The rate at which customers arrive at the queue
(iii) The total number of customers in the system
(iv) The average time a customer spends in the queue
- 5 In PERT, the time estimates for tasks are typically represented as:
(i) A single deterministic value
(ii) Three estimates: optimistic, pessimistic, and most likely
(iii) A range of possible values
(iv) Only the average time

SECTION - B (15 Marks)

Answer ALL Questions

ALL Questions Carry EQUAL Marks

(5 x 3 = 15)

- 6 a Discuss about operations research with its limitations.
OR
- b The manager of an oil refinery must decide on the optimum mix of two possible blending processes of which the input and output production runs are as follows:

Process	Input		Output	
	Crude A	Crude B	Gasoline X	Gasoline Y
1	6	4	6	9
2	5	6	5	5

The maximum amounts available of crudes A and B are 250 units and 200 units respectively. Market demand shows that at least 150 units of gasoline X and 130 units of gasoline Y must be produced. The profits per production run from process 1 and process 2 are Rs. 4 and Rs. 5 respectively. Formulate the problem for maximizing the profit.

Cont...

- 7 a Obtain an initial basic feasible solution to the following transportation problem using the matrix minima method.

	D1	D2	D3	D4	capacity
O1	1	2	3	4	6
O2	4	3	2	0	8
O3	0	2	2	1	10
Demand	4	6	8	6	

OR

- b Write a short note on Hungarian method.
- 8 a Determine the range of value of p and q that will make the pay – off element a_{22} a saddle point for the game whose pay – off matrix (a_{ij}) is given below:

		Player B		
Player A		2	4	5
		10	7	q
		4	p	8

OR

- b Define game and list some characteristics of game.
- 9 a What is queue? Mention the basic elements of queues.
- b Assume that the goods trains are coming in a yard at the rate of 30 trains per day and suppose that the inter arrival times follow an exponential distribution. The service time for each train is assumed to be exponential with an average of 36 minutes. If the yard can admit 9 trains at a time (there being 10 lines, one of which is reserved for shunting purposes), calculate the probability that the yard is empty and find the average queue length.
- 10 a Draw the network diagram for the following data.

Task	A	B	C	D	E	F	G
Immediate predecessor	-	-	B	B	B	E	A,D,C

OR

- b Distinguish between CPM and PERT.

SECTION -C (30 Marks)

Answer ALL questions

ALL questions carry EQUAL Marks (5 x 6 = 30)

- 11 a Use the graphical method to solve the following LPP.

$$\text{Maximize } Z = 2x_1 + 3x_2$$

Subject to the constraints:

$$x_1 + x_2 \leq 30,$$

$$x_1 - x_2 \geq 0$$

$$x_2 \geq 3,$$

$$0 \leq x_1 \leq 20,$$

$$0 \leq x_2 \leq 12.$$

OR

- b Find the maximum value of $Z = 107x_1 + x_2 + 2x_3$ subject to the constraints: $14x_1 + x_2 - 6x_3 + 3x_4 = 7$, $16x_1 + x_2 - 6x_3 \leq 5$, $3x_1 - x_2 - x_3 \leq 0$. $x_1, x_2, x_3, x_4 \geq 0$ using simplex method.

- 12 a Find the starting solution in the following transportation problem by VAM method. Also find an optimum solution.

	D1	D2	D3	D4	Supply
S1	3	7	6	4	5
S2	2	4	3	2	2
S3	4	3	8	5	3
Demand	3	3	2	2	

OR

Cont...

Q.no 12. Cont....

- b A company wishes to assign 3 jobs to 3 machines in such a way that each job is assigned to some machine and no machine works on more than one job. The cost of assigning job I to a machine j is given by the matrix below:

$$\text{cost matrix: } \begin{bmatrix} 8 & 7 & 6 \\ 5 & 7 & 8 \\ 6 & 8 & 7 \end{bmatrix}$$

Draw the associated network. Formulate the network LPP and find the minimum cost of making the assignment.

- 13 a Obtain the optimal strategies for both-persons and the value of the game for zero-sum two-person game whose payoff matrix is as follows:

$$\begin{pmatrix} 1 & -3 \\ 3 & 5 \\ -1 & 6 \\ 4 & 1 \\ 2 & 2 \end{pmatrix}$$

OR

- b Solve the following game

		Player B			
		I	II	III	IV
player A	I	3	2	4	0
	II	3	4	2	4
	III	4	2	4	0
	IV	0	4	0	8

- 14 a The rate of arrival of customers at a public telephone booth follows Poisson distribution, with an average time of 10 minutes between one customer and the next. The duration of a phone call is assumed to follow exponential distribution, with mean time of 3 minutes.
- What is the probability that a person arriving at the booth will have to wait?
 - What is the average length of the non-empty queues that form from time to time?
 - Estimate the fraction of a day that the phone will be in use.
 - What is the probability that it will take him more than 10 minutes altogether to wait for phone and complete his call?

OR

- b A supermarket has two girls serving at the counters. The customers arrive in a Poisson fashion at the rate of 12 per hour. The service time for each customer is exponential with mean 6 minutes. Find i) the probability that an arriving customer has to wait for service. ii) the average number of customers in the system, and iii) the average time spent by a customer in the super market.

- 15 a Given the following information:

Activity	0-1	1-2	1-3	2-4	2-5	3-4	3-6	4-7	5-7	6-7
Duration	2	8	10	6	3	3	7	5	2	8

- Draw the arrow diagram
- Identify the critical path and find the total project duration
- Determine total, free and independent floats.

OR

- b A small project is composed of seven activities whose time estimates are given on the following table:

Activity	1-2	1-3	1-4	2-5	3-5	4-6	5-6
Name	A	B	C	D	E	F	G
t_o	6	6	12	6	12	12	18
t_m	6	12	12	6	30	30	30
t_p	24	18	30	6	48	42	54

- Find the expected duration and variance for each activity.
- What is the expected project length?

Z-Z-Z END