

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2024
(Sixth Semester)

Branch – MATHEMATICS WITH COMPUTER APPLICATIONS

OPERATIONS RESEARCH

Time: Three Hours

Maximum: 50 Marks

SECTION-A (5 Marks)

Answer ALL questions
ALL questions carry EQUAL marks (5 x 1 = 5)

- 1 All the values in the key column are negative then choose the correct one
(i) Unbounded solution (ii) Bounded solution
(iii) Optimal solution (iv) Degenerate solution
- 2 In transportation problem if total supply > total demand we add _____.
(i) Dummy row with cost zero (ii) Dummy column with cost zero
(iii) Dummy row with cost 1 (iv) Dummy column with cost 1
- 3 If the sum of gains or losses is not equal to zero, name of the game is
(i) Zero game (ii) Non zero sum game
(iii) Zero sum game (iv) Pure game
- 4 The objective of the critical path analysis is to find the total
(i) Project network (ii) Project duration
(iii) Dummy (iv) Variance
- 5 When does the Probability that the system is idle?
(i) $1 - \rho$ (ii) ρ (iii) 0 (iv) -1

SECTION - B (15 Marks)

Answer ALL Questions
ALL Questions Carry EQUAL Marks (5 x 3 = 15)

- 6 a Apply graphical method, solve the following L.P.P

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

$$\text{subject to } x_1 - x_2 \leq 2$$

$$x_1 + x_2 \geq 4$$

$$x_1, x_2 \geq 0$$

OR

- b Prepare the dual to the primal problem

$$\text{maximize } Z = 3x_1 + 5x_2$$

$$\text{subject to } 2x_1 + 6x_2 \leq 50$$

$$3x_1 + 2x_2 \leq 35$$

$$5x_1 - 3x_2 \leq 10$$

$$x_2 \leq 20$$

$$x_1 \geq 0, x_2 \geq 0$$

- 7 a Determine the initial (starting) basic feasible solution for the following transportation problem by Vogel's Approximation method

		Destination			Supply
		A	B	C	
Source	1	2	7	4	5
	2	3	3	1	8
	3	5	4	7	7
	4	1	6	2	14
Demand		7	9	18	34

OR

Cont...

- 7 b MCS Inc is a software company that has three projects of Y2K with the departments of health, education, and housing of Tamil Nadu Government based on the background and experiences of the project leaders they differ in terms of their performance at various projects. The performance score matrix is given below:

Project leaders	Projects		
	Health	Education	Housing
P ₁	20	26	42
P ₂	24	32	50
P ₃	32	34	44

Help the management by determining the optimal assignment that maximizes the total performance score.

- 8 a Solve the 2×2 game

	B	
A	5	1
	3	4

OR

- b Solve the following game

	B			
	I	II	III	IV
A	-5	3	1	20
	5	5	4	6
	-4	-2	0	-5

- 9 a Tasks A, B, C, ..., H, I constitute a project. The notation $X < Y$ means that the task X must be finished before Y can begin, with this following notation, sketch the project network.

$A < D, A < E, B < F, D < F, C < G, C < H, F < I, G < I$

OR

- b Explain (i) Optimistic time estimate (ii) Pessimistic time estimate (iii) Most likely time estimate.
- 10 a Bring out the basic characteristics of Queueing process.
- OR
- b Derive the formula for the average no. of customers in the system for $(M/M/1):(\infty/FIFO)$

SECTION -C (30 Marks)

Answer ALL questions

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

- 11 a Solve the following Linear Programming problem by Graphical method.

Minimize $z = 20x_1 + 40x_2$

Subject to the constraints

$$36x_1 + 6x_2 \geq 108,$$

$$3x_1 + 12x_2 \geq 36,$$

$$20x_1 + 10x_2 \geq 100$$

$$\text{and } x_1, x_2 \geq 0$$

OR

- b Use Simplex method to solve the following LPP

Maximize $z = 40x_1 + 10x_2$

Subject to the constraints

$$2x_1 + x_2 \leq 50,$$

$$2x_1 + 5x_2 \leq 100,$$

$$2x_1 + 3x_2 \leq 90,$$

$$x_1 \geq 0, x_2 \geq 0.$$

- 12 a Solve the following transportation problem to maximize the profit.

		Profits (Rs)/ Unit				Supply
		Destination				
Source		A	B	C	D	
	1	40	25	22	33	100
	2	44	35	30	30	30
3	38	38	28	30	70	
Demand		40	20	60	30	

OR

- b Solve the following Assignment problem.

		Machines				
		M ₁	M ₂	M ₃	M ₄	M ₅
jobs	J ₁	9	22	58	11	19
	J ₂	43	78	72	50	63
	J ₃	41	28	91	37	45
	J ₄	74	42	27	49	39
	J ₅	36	11	57	22	25

- 13 a Reduce the following square by dominance and find the square value.
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

OR

- b 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

$$\begin{bmatrix} 1 & -3 \\ 3 & 5 \\ -1 & 6 \\ 4 & 1 \\ 2 & 2 \\ -5 & 0 \end{bmatrix}$$

- 14 a Differentiate the difference between CPM and PERT.

OR

- b A project schedule has the following characteristics.

Activity time	Most Optimistic time	Most likely time	Most pessimistic time
1-2	1	2	3
2-3	1	2	3
2-4	1	3	5
3-5	3	4	5
4-5	2	3	4
4-6	3	5	7
5-7	4	5	6
6-7	6	7	8
7-8	2	4	6
7-9	4	6	8
8-10	1	2	3
9-10	3	5	7

- (i) Construct the project network (ii) Find the critical path
(iii) what is the probability that the project will be completed in 30 weeks.

- 15 a Arrivals at a telephone booth are considered to be Poisson with an average time of 12 min. between one arrival and the next. The length of a phone call is assumed to be distributed exponentially with mean 4 min.
- (a) Find the average number of persons waiting in the system.
- (b) What is the probability that a person arriving at the booth will have to wait in the queue?

OR

- b Customers arrive at a watch repair shop according to p poisson process at a rate of one per every 10 minutes and the service time is an exponential r.v. with mean 8 min.
- (i) Find the average number of customers L_s in the shop.
- (ii) Find the average time a customer spends in the shop W_s .
- (iii) Find the average number of customers in the queue L_q .
- (iv) What is the probability that the server is idle?

Z-Z-Z

END