LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **STATISTICS**

SIXTH SEMESTER – **NOVEMBER 2023**

UST 6502 – OPERATIONS RESEARCH

Date: 30-10-2023 Dept. No. Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

Section A

Answer **ALL** the questions 10 x 2 = 20 marks

1.Define operations research.
2.When are slack and surplus variables introduced in LPP ?
3.Define degenerate solution to the system of linear equations.
4.Find the dual of the following primal problem:
Maximize $z = 6x_1 + 4x_2$
Subject to the constraints:
$7x_1 + 8x_2 \leq 17$
$4x_1 + 9x_2 \leq 12$
$x_1 \geq 0$ and $x_2 \geq 0$
5.Define basic feasible solution for a transportation problem.
6.Why is an assignment problem viewed as a particular case of transportation problem ?
7.Write a note on network scheduling.
8.Explain CPM and PERT.
9.When does a saddle point exist for a game?
10.How to solve a game without saddle point?

Section B

Answer any **FIVE** questions 5 x 8 = 40 marks

11.Obtain all the basic feasible solutions to the following system of linear equations:

$$x_1 + 2x_2 + x_3 = 4$$
$$2x_1 + x_2 + 5x_3 = 5$$

12. Use the graphical method to solve the following L.P.P.:
Minimize $z = -x_1 + 2x_2$
subject to the constraints:
$-x_1 + 3x_2 \leq 10$, $x_1 + x_2 \leq 6$, $x_1 - x_2 \leq 2$
$x_1 \geq 0$ and $x_2 \geq 0$.
13. Write the procedure for Big M method to solve an LPP.
14. Explain Hungarian method to solve an assignment problem.
15. Four operators O_1, O_2, O_3 and O_4 are available to a manager who has to get four jobs J_1, J_2, J_3 and J_4 done by assigning one job to each operator. The times needed by different operators for different jobs are given in the following table:

…2

To / From	J_1	J2	J3	J4
O_1	12	10	10	8
O_2	14	12	15	11
O3	6	10	16	4
O_4	8	10	9	7

How should the manager assign the jobs so that the total time needed for all jobs is minimum ?

16. The following are the details of estimated times of a certain project.

Activity	Immediate predecessors	Normal time (days)
A	-	16
B	-	20
C	A	8
D	A	10
E	B, C	6
F	D,E	12

Draw the network(arrow) diagram and find the critical path. Also find the expected time of the project.

17. Explain the following methods used to find the initial solution to a transportation problem:
(i) North-west corner rule (ii) Least-cost method and (iii) Vogel's approximation method. (2+2+4)

18. Explain the procedure for solving (2 x n) and (m x 2) games graphically. (4+4)

Section C

Answer any **TWO** questions 2 x 20 = 40 marks

19. Use Penalty (Big M) method to
Maximize $z = 3x_1 - x_2$
subject to the constraints:
$2x_1 + x_2 \geq 2$
$x_1 + 3x_2 \leq 3$
$x_2 \leq 4$
x_1, x_2 are non-negative.

20. Find the optimum solution to the following transportation problem:

Warehouse / Factory	I	II	III	IV	Capacity
A	42	48	38	37	160
B	40	49	52	51	150
C	39	38	40	43	190
Demand	80	90	110	160	

21. The following optimistic (O) , pessimistic (P) and most likely (M) time estimates(days) for each task have been given for a project:

Task	Predecessors	O	M	P
A	-	10	12	15
B	-	6	10	16
C	A,B	3	5	10
D	C	8	12	17
E	C	4	7	12
F	C	3	4	6
G	D,E	5	8	13
H	F,G	5	7	10

Construct the network diagram for this project and find the critical path. Also find the expected duration of the project.

22. Solve the following problem graphically:

		Player B		
		B_1	B_2	B_3
Player A	A_1	3	-3	4
	A_2	-1	1	-3

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