LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

SIXTH SEMESTER – **APRIL 2024**

UST 6502 – OPERATIONS RESEARCH

Date: 03-04-2024 Dept. No. Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

SECTION A

Answer ALL the questions **(10 x 2 = 20)**

1.Define Slack and surplus variables.
2.What is the use of artificial variable in LPP?
3.Define degenerate solution to the system of linear equations.
4.Find the dual of the following primal problem:
Minimize $z = 6x_1 + 4x_2$
Subject to the constraints:
$7x_1 + 8x_2 \geq 17$
$4x_1 + 9x_2 \geq 12$
$x_1 \geq 0$ and $x_2 \geq 0$
5.Define (m x n) transportation problem.
6.Why is an assignment problem viewed as a particular case of transportation problem ?
7.When an activity in Network is called critical?
8.Differentiate between CPM and PERT.
9.When a competitive situation is called a game?
10.How to solve a game without saddle point?

SECTION B

Answer any FOUR questions **(4 x 10 = 40)**

11.Show that the following system of linear equations has a degenerate solution:

$2x_1 + x_2 - x_3 = 2$
$3x_1 + 2x_2 + x_3 = 3$

12. Use the graphical method to solve the following L.P.P. :
Maximize $z = 7x_1 + 3x_2$
subject to the constraints:
$x_1 + 2x_2 \geq 3$, $x_1 + x_2 \leq 4$, $0 < x_1 \leq 5/2$ and $0 < x_2 \leq 3/2$
13. Write the procedure for two-phase 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:

To / From	J_1	J2	J3	J4
O_1	15	13	13	11
O_2	17	15	18	14

O3	9	13	19	7
O_4	11	13	12	10

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	-	12
B	-	22
C	A	10
D	A	12
E	B, C	8
F	D,E	14

Draw the network 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) Least-cost method and (ii) Vogel's approximation method. (4+4)
18. Explain the procedure for solving (m x n) game by LP method.

SECTION C

Answer any TWO questions **(2 x 20 = 40)**

19. Use simplex method to
Maximize $z = 4x_1+10x_2$
subject to the constraints:
$2x_1 + x_2 \leq 50$
$2x_1 + 5x_2 \leq 100$
$2x_1 + 3x_2 \leq 90$
x_1, x_2 are non-negative.

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

Warehouse / Factory	I	II	III	Supply
A	16	20	12	200
B	14	8	18	160
C	26	24	16	90
Demand	180	120	150	450

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	-	12	14	17
B	-	8	12	18
C	A,B	5	7	12
D	C	10	14	19
E	C	6	9	14

F	C	5	6	8
G	D,E	7	10	15
H	F,G	7	9	12

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	6	-3	7
	A_2	-3	0	-6

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