MAR IVANIOS COLLEGE (AUTONOMOUS)
THIRUVANANTHAPURAM

Reg. No. :…… **Name :…….**

Fifth Semester B.Sc. Degree Examination, November 2016
First Degree Programme under CBCSS
Open Course: Mathematics – I
AUMM581: Operations Research

Time: **3** Hours Max. Marks: **80**

SECTION – A

*Answer **ALL** questions / problems in one or two sentences.*

1. What is a Linear Programming Problem ?
2. Identify the objective function of the L.P.P: Maximize $Z = 8x_1 + 6x_2$ subject to $4x_1 + 2x_2 \leq 60,\ 2x_1 + 4x_2 \leq 48, x_1, x_2 \geq 0.$
3. Is $x_1 = 2,\ x_2 = 1,$ a feasible solution of the L.P.P: Minimize $Z = x_1 + 2x_2$ subject to $2x_1 - x_2 \geq 2,\ x_1 + 3x_2 \leq 8;\ x_1, x_2 \geq 0$?
4. Name any one advantage of simplex method over graphical method in solving a linear programming problem.
5. Define a transportation problem.
6. Write a necessary and sufficient condition for the existence of a feasible solution to an $m \times n$ transportation problem.
7. Write the name of a method used to find the optimal solution of a transportation problem.
8. Name a method for solving assignment problem.
9. Define an event.
10. Name two techniques for Project management.

(10 × 1 = 10 Marks)

P.T.O.

SECTION – B

*Answer any **EIGHT** questions / problems, not exceeding a paragraph.*

11. A house wife wishes to mix two types of food F_1 and F_2 in such a way that the vitamin contents of the mixture contain at least 8 units of vitamin A and 11 units of vitamin B. Food F_1 costs Rs. 60/Kg and Food F_2 costs Rs. 80/Kg. Food F_1 contains 3 units/Kg of vitamin A and 5 units/Kg of vitamin B while Food F_2 contains 4 units/Kg of vitamin A and 2 units/Kg of vitamin B. Formulate this problem as a linear programming model to minimize the cost of mixtures.
12. What are the basic components of a linear programming problem ?
13. Define Slack and Surplus variables ?
14. Convert the following constraints into equations:

    $2x_1 + x_2 + 3x_3 \leq 2; \quad x_1 - 4x_2 + x_3 \geq 3$
15. Write the following LPP in the standard form:

    Maximize $Z = 3x_1 + 2x_2 + 10x_3$

    Subject to $x_1 + x_2 + 4x_3 \geq 4$

    $x_1 - x_2 + 2x_3 \leq 6$

    $x_1,\ x_2,\ x_3\ \geq 0$
16. Represent the following LPP in matrix – vector notation

    Maximize $Z = 2x_1 + 4x_2 - 3x_3 + x_4$

    Subject to $x_1 + 2x_2 + x_3 + 5x_4\ = 10$

    $x_2 - 2x_3\ + x_4\ =\ 7$

    $x_1 + 7x_2 + 3x_3 + x_4\ =\ 2$

    $x_1,\ x_2,\ x_3,\ x_4\ \geq\ 0$
17. Write the Linear Programming formulation of a Transportation Problem.
18. How does the problem of degeneracy arise in a transportation problem ?
19. Use North – West Corner method to find an initial basic feasible solution to the following transportation problem:

	W_1	W_2	W_3	Availability
F_1	16	20	12	200
F_2	14	8	18	160
F_3	26	24	16	90
Demand	180	120	150	

20. What is an assignment problem ? Explain.

21. Give any two applications of CPM or PERT.

22. What are the three time considerations in PERT ?

(8 × 2 = 16 Marks)

SECTION – C

*Short essay type problems: Answer any **SIX** questions.*

23. Use graphical method to solve the following LP problem:

Minimize $Z = 3x_1 + 2x_2$

Subject to $5x_1 + x_2 \geq 10$

$x_1 + x_2 \geq 6$

$x_1 + 4x_2 \geq 12$

$x_1, x_2 \geq 0$

24. Solve the following LPP using Simplex Method:

Maximize $Z = 7x_1 + 5x_2$

Subject to $x_1 + 2x_2 \leq 6$

$4x_1 + 3x_2 \leq 12$

$x_1, x_2 \geq 0$

25. Determine an initial basic feasible solution to the following transportation problem using North – West Corner Rule.

	D_1	D_2	D_3	D_4	Availability
O_1	6	4	1	4	14
O_2	8	9	2	7	16
O_3	4	3	6	2	5
Demand	6	10	15	4	

26. Use Vogel's Method to find an initial basic feasible solution to the following transportation problem:

	D	E	F	G	Availability
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Demand	200	225	275	250	

27. Find an initial basic feasible solution for the following transportation problem using North – West Corner Rule:

	M_1	M_2	M_3	M_4	Availability
W_1	4	6	8	13	500
W_2	13	11	10	8	700
W_3	14	4	10	13	300
Demand	250	350	650	250	

28. Obtain the optimal assignment of four jobs and four machines when the cost of assignment is given by the following table:

	J_1	J_2	J_3	J_4
M_1	12	30	21	15
M_2	18	33	9	31
M_3	44	25	21	21
M_4	14	30	28	14

29. Use Hungarian method to solve the following assignment problem:

	A	B	C	D
1	10	9	7	8
2	5	8	7	7
3	5	4	6	5
4	2	3	4	5

30. A batch of four jobs can be assigned to five different machines. The setup time for each job on various machines is given by the following table:

	M_1	M_2	M_3	M_4	M_5
J_1	10	11	4	2	8
J_2	7	11	10	14	12
J_3	5	6	9	12	14
J_4	13	15	11	10	7

Find an optimal assignment of jobs to machines which will minimize the total setup time.

31. A project with 5 jobs and with the following job sequence is given. Draw a project network. Write all the paths of the project and hence identify its critical path:

Activity	A	B	C	D	E
Sequence	1-2	1-3	2-4	3-4	4-5
Completion time (days)	3	1	4	2	5

(6 × 4 = 24 Marks)

SECTION – D

*Long essay type problems: Answer any **TWO** questions.*

32. Solve the following LPP:

Maximize $Z = x_1 + 2x_2$

Subject to $x_1 + 2x_2 \leq 4$

$x_1 + 7x_2 \leq 14$

$x_1 - x_2 \leq 1$

$x_1,\ x_2 \geq 0$

33. Find an initial basic feasible solution for the following transportation problem using any two different methods and critically evaluate the methods:

	M_1	M_2	M_3	M_4	Supply
W_1	2	2	2	1	3
W_2	10	8	5	4	7
W_3	7	6	6	8	5
Demand	4	3	4	4	

34. The following table gives the activities in a project and other relevant information.

i) Draw the network of the project.

ii) Find the forward pass and backward pass.

iii) Find the critical path and total duration of the project.

Activity	Sequence	Duration
A	1-2	10
B	2-3	12
C	2-4	5
D	3-4	6
E	4-5	3

35. Consider a project consisting of 7 jobs: A, B, …,G with the following job sequence and time estimates:

Job	Sequence	Optimistic time (a)	Most probable time (m)	Pessimistic time (b)
A	1-2	2	5	8
B	1-3	6	9	12
C	2-3	3	6	9
D	3-5	1	4	7

E	3-4	8	8	8
F	4-5	5	14	17
G	5-6	3	12	21

i). Draw the network

ii). Find the average time and variance of each job

(2 × 15 = 30 Marks)

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