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Reg. No. : .....

Name : .....

Fifth Semester B.A./B.Sc./B.Com. Degree Examination, December 2017
First Degree Programme Under CBCSS
MATHEMATICS
Open Course
MM – 1551.1 : Operations Research
(2013 Admission Onwards)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** question carries **1** mark.

1. Give an example of a linear programming problem.
2. What are the main features of the standard form of a linear programming problem ?
3. Convert the constraint $x_1 - x_2 + x_3 \geq 2$ into equality using slack or surplus variable.
4. Define slack variable.
5. Define basic feasible solution.
6. What are transportation problems ?
7. Which among the following is a superior method over the other to find an initial solution to transportation problems ? Northwest Corner Rule or Vogel's Approximation Method.
8. How can an unbalanced transportation problem, where the total supply exceeds the total demand be converted to a standard problem ?
9. Expand CPM.
10. Define an event in a project.

(10×1=10 Marks)

SECTION – B

Answer **any eight**. **Each** question carries **2** marks.

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

Maximize $Z = x_1 + 2x_2$
Subject to $x_1 + 2x_2 \leq 10$
$x_1 + x_2 \geq 1$
$x_2 \leq 4$
$x_1, x_2 \geq 0$

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12. Write in standard form :

Maximize $Z = x_1 + 3x_2$

Subject to $x_1 \leq 5$

$x_1 + 2x_2 \leq 10$

$x_2 \leq 4$

$x_1, x_2 \geq 0$

13. Represent the following LPP in matrix – vector notation :

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

Subject to $x_1 + x_2 + x_3 - x_4 + x_5 = 7$

$x_1 - x_2 + x_3 - x_4 - x_6 = 2$

$-3x_1 + x_2 + 2x_3 - 2x_4 = 5$

$x_1 \geq 0, x_2 \geq 0, x_3 \geq 0, x_4 \geq 0, x_5 \geq 0, x_6 \geq 0$

14. What are the general steps to be followed while solving LPP by Simplex Method ?

15. What are the basic components of a linear programming problem ?

16. What is an assignment problem ? How does it differ from a transportation problem ?

17. Is it advisable to solve an assignment problem using transportation algorithm ? Why ?

18. Write the steps involved in the Vogel's approximation rule for finding an initial basic feasible solution to a transportation problem.

19. Define penalty in Vogel's approximation method.

20. Find an optimal assignment of 2 jobs and 2 machines using Hungarian Method when the cost of assignment is given by the following table.

	J_1	J_2
M_1	12	30
M_2	18	13

21. State two applications of CPM.

22. Define critical events and critical jobs.

(8×2=16 Mar

SECTION – C

Answer **any six**. **Each** question carries **4** marks.

23. A company sells two different products A and B, making a profit of Rs. 40 and Rs. 30 per unit on them, respectively. They are produced in a common production process and are sold in two different markets. The production process has a total capacity of 3,000 man-hours. It takes three hours to produce a unit of A and one hour to produce a unit of B. The market has been surveyed and company officials feel that the maximum number of units of A that can be sold is 8000 units and that of B is 12000 units. Subject to these limitations products can be sold in any combination. Formulate this problem as an LP model to maximize profit.

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

Minimize $Z = -x_1 + 2x_2$

Subject to $-x_1 + 3x_2 \leq 10$

$x_1 + x_2 \leq 6$

$x_1 - x_2 \leq 2$

$x_1, x_2 \geq 0$

25. Solve the following LPP using Simplex method :

Maximize $Z = 4x_1 + 3x_2$

Subject to $2x_1 + x_2 \leq 1000$

$x_1 + x_2 \leq 800$

$x_1 \leq 400$

$x_2 \leq 700$

$x_1, x_2 \geq 0$

26. Describe the transportation problem with its general mathematical formulation.

27. Use North-West Corner method to find an initial basic feasible solution to the following transportation problem.

	M_1	M_2	M_3	M_4	Warehouse Capacity
W_1	11	13	17	14	250
W_2	16	18	14	10	300
W_3	21	24	13	10	400
Market Demand	200	225	275	250	

28. Obtain an initial basic feasible solution to the following transportation problem using the Vogel's Approximation Rule.

	D_1	D_2	D_3	D_4	Supply
S_1	19	30	50	10	7
S_2	70	30	40	60	9
S_3	40	8	7	20	18
Demand	5	8	7	14	

29. 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	10	9	7	8
M_2	5	8	7	7
M_3	5	4	6	5
M_4	2	3	4	5

30. What are dummy warehouses and dummy markets ? When are they used and why ?

31. Consider a project with 7 jobs A, B, C, D, E, F and G having the following job sequence :

Job A precedes B and C, Jobs C and D precede E, Job B precedes D, Jobs E and F precede G. Draw the project network.

(6×4=24 Marks)

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SECTION – D

Answer **any two**. **Each** question carries **15** marks.

32. Solve the following LPP using Simplex Method.

Maximize $Z = 7x_1 + 5x_2$

Subject to $x_1 + 2x_2 \leq 6$

$4x_1 + 3x_2 \leq 12$

$x_1, x_2 \geq 0$

33. Determine an initial basic feasible solution to the following transportation problem using Vogel's Approximation Method.

	D_1	D_2	D_3	D_4	Availability
S_1	1	2	1	4	30
S_2	3	3	2	1	50
S_3	4	22	5	9	20
Demand	20	40	30	10	

34. Solve the Assignment problem.

	I	II	III	IV	V
A	1	3	2	3	6
B	2	4	3	1	5
C	5	6	3	4	6
D	3	1	4	2	2
E	1	5	6	5	4

35. A project consisting of nine jobs is given with the precedence relations and time durations as follows :

Job	Predecessors	Time Duration (days)
A	–	5
B	A	9
C	A	7
D	B, C	4
E	A	8
F	D, E	13
G	C	12
H	F, G	6
I	H	8

a) Draw the network.

b) Identify the critical path.

c) Determine the project schedule.

(2×15=30 Mark

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