(Pages : 7) **H – 6184**

Reg. No. : .....

Name : .....

Fifth Semester B.A./B.Sc./B.Com. Degree Examination, December 2019

First Degree Programme under CBCSS

Mathematics

Open Course

MM 1551.1 : OPERATIONS RESEARCH

(2014 Admission onwards)

Time : 3 Hours Max. Marks : 80

PART – A

Answer **all** the **ten** are compulsory. They carry 1 mark each.

1. Write standard form of a Linear programming Problem.

2. Define a feasible solution to an a Linear programming Problem.

3. Define a basic variable in a Linear programming Problem.

4. Name any two methods to solve a Linear programming Problem.

5. Define a transportation problem.

6. If a standard transportation problem has $(m+n)$ constraints, then find the number of positive value variables?

7. Which is the superior method to find the initial solution of a transportation problem?

8. If the cost of doing any job on machine 1 is reduced by k, then what will be the change in the objective function of the assignment problem?

9. Which methods are used for project management?

10. Who is the inventor of CPM?

PART – B

Answer **any eight** questions from this section. Each question caries **2** marks.

11. Mark the feasible region of the Linear programming Problem

Maximize $50x + 18y$

Subject to

$2x + y \leq 10$
$x + y \leq 8$
$x \geq 0, y \geq 0.$

12. Which are the main features of a Linear programming Problem in standard form?

13. Reduce the following Linear programming Problem in standard form

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

Subject to

$x_1 + x_2 + x_3 \leq 7$
$x_1 - x_2 + x_3 \geq 2$
$3x_1 - x_2 - 2x_3 = -5$
$x_1, x_2 \geq 0,\ x_3$ unrestricted in sign.

14. What is a transportation Problem?

15. Write the standard form of a transportation problem when total demand exceeds total supply?

16. Furnish the transportation table for the following transportation problem with three ware houses and four markets.

The ware house capacities are $a_1 = 250$, $a_2 = 300$ and $a_3 = 400$. The market demands are $b_1 = 200$, $b_2 = 225$, $b_3 = 275$ and $b_4 = 250$. The unit cost of shipping is giving by the following table :

	M_1	M_2	M_3	M_4
W_1	11	13	17	14
W_2	16	18	14	10
W_3	21	24	13	10

17. What is an assignment problem?

18. What is the condition for solving an assignment problem by Hungarian method?

19. Write the transportation matrix of a standard assignment problem with *n* Jobs and *n* Machines.

20. Define an event in network problem.

21. If the optimistic time of a job is 5, most probable time is 14 and pessimistic time is 17, then find standard deviation?

22. Write a short note on project management.

PART – C

Answer **any six** questions from this section. Each question caries **4** marks

23. Solve graphically

Maximize $Z = 50x_1 + 18x_2$

Subject to the constraints

$2x_1 + x_2 \leq 100$

$x_1 + x_2 \leq 80$

$x_1 \geq 0, x_2 \geq 0$

24. Use simplex method to solve

Maximize $Z = 2x_1 + 3x_2$

Subject to the constraints

$x_1 + x_2 \leq 1$

$3x_1 + x_2 \leq 40$

$x_1, x_2 \geq 0.$

25. A firm produces three products. These products are processed on three different machines. The time required to manufacture one unit of each of the three products and the daily capacity of the three machines are given in the table below :

Machine	Time per unit (minutes)			Machine capacity (minutes/day)
	Product 1	Product 2	Product 3	
M_1	2	3	2	440
M_2	4	-	3	470
M_3	2	5	-	430

It is required to determine the daily number of units to be manufactured for each product. The profit per unit for product 1, 2 and 3 is Rs. 4, Rs. 3 and Rs. 6 respectively. It is assumed that all the amounts produced are consumed in the market. Formulate the Linear programming Problem that will maximize the daily profit.

26. Explain a model of a transportation problem.

27. Solve the following transportation problem with North West Corner Rule.

	M_1	M_2	M_3	Supplies
W_1	5	8	4	50
W_2	6	6	3	40
W_3	3	9	6	60
Demand	20	95	35	

28. Find the optimal assignment of three jobs and three machines when the cost of assignment is given by the following table.

	J_1	J_2	J_3
M_1	8	5	6
M_2	7	7	8
M_3	6	8	7

29. Solve the following cost matrix of an assignment problem ; where J_1, J_2, J_3 are jobs and M_1, M_2 and M_3 are machines.

	J_1	J_2	J_3
M_1	250	400	350
M_2	400	600	350
M_3	200	400	250

30. Draw a Network for the following activities in a project.

Active	Predecessor Activity
A	–
B	A
C	A
D	B
E	B, C

31. Find the average time and standard deviation of the following activities.

Activity	Time estimates in weeks		
	Optimistic	Most likely	Pessimistic
A	5	8	11
B	3	6	9

PART – D

Answer **any two** questions from this section. Each question caries **15** marks

32. Solve

Maximize $Z = x_1 + x_2 + x_3$

Subject to

$x_1 + 2x_2 + 3x_3 \leq 1$
$3x_1 + x_2 + 3x_3 \leq 1$
$2x_1 + 3x_2 + x_3 \leq 1$
$x_1, x_2, x_3 \geq 0$

33. Find an initial basic feasible solution to the transportation problem using the North-west corner rule.

	M_1	M_2	M_3	M_4	Supplies
W_1	3	5	7	6	50
W_2	2	5	8	2	75
W_3	3	6	9	2	25
Demand	20	20	50	60	

34. Find 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	8	7
M_2	3	4	5	6
M_3	2	1	1	2
M_4	4	3	5	6

35. An architect has been awarded a contract to prepare a plans for an urban renewal project. The job consists of the following activities and estimated times.

Activity	Duration (Weeks)	Predecessors
A	2	-
B	1	-
C	3	A
D	2	A, B
E	1	C, D
F	3	D
G	1	E, F

(a) Draw the network diagram of activities for the project

(b) Identify the critical path.