

**MA ECONOMICS  
FOURTH SEMESTER  
OPERATION RESEARCH  
MEC-405D**

Duration : 3 hrs.

Full Marks: 70

Time : 20 min.

( PART-A: Objective )

Marks : 20

*Choose the correct answer from the following:*

1X20=20

1. If an optimal solution is degenerate, then
  - a. There are alternative optimal solutions.
  - b. The solution is infeasible.
  - c. The solution is of no use to the decision-maker.
  - d. None of the above.
2. Operations research practitioners do not
  - a. Predict future operations
  - b. Build more than one model
  - c. Collect relevant data
  - d. Recommend decision and accept
3. Non-negativity condition in an LP model implies
  - a. A positive coefficient of variables in objective function
  - b. A positive coefficient of variables in any constraint
  - c. Non-negative value of resources
  - d. None of the above
4. A constraint in an LP model restricts
  - a. Value of objective function
  - b. Value of a decision variable
  - c. Use of the available resource.
  - d. All of the above.
5. A feasible solution to an LP problem
  - a. Must satisfy all of the problem's constraints simultaneously.
  - b. need not satisfy all of the constraints, only some of them.
  - c. Must be a corner point of the feasible region.
  - d. Must optimize the value of the objective function.
6. Constraints in LP problem are called active if they-
  - a. Represent optimal solution
  - b. At optimality do not consume all the available resources.
  - c. Both of (a) and (b)
  - d. None of the above.
7. The initial solution of a transportation problem can be obtained by applying any known method. However, the only condition is that
  - a. The solution be optimal.
  - b. The rim conditions are satisfied.
  - c. The solution not be degenerate.
  - d. All of the above.
8. One disadvantage of using North-West Corner Rule to find initial solution to the transportation problem is that
  - a. It is complicated to use.
  - b. It does not take into account cost of transportation.
  - c. It leads to a degenerate initial solution.
  - d. All of the above.



9. An assignment problem can be solved by
- Simplex method
  - Transportation method
  - Both (a) and (b)
  - None of the above.
10. Which of the following methods is used to verify the optimality of the current solution of the transportation problem
- Least cost method
  - Vogel's approximation method
  - Modified distribution method
  - All of the above
11. An optimal assignment requires that the maximum number of lines that can be drawn through squares with zero opportunity cost be equal to the number of
- Rows or columns
  - Rows and columns
  - Rows + columns-1
  - None of the above.
12. The assignment problem
- Requires that only one activity be assigned to each resource.
  - Is a special case of transportation problem
  - Can be used to maximize resources.
  - All of the above.
13. The another term commonly used for activity slack time is
- Total float
  - Free float
  - Independent float
  - All of the above
14. The objective of network analysis is to
- Minimize total project duration
  - Minimize total project cost
  - Minimize production delays
  - All of the above
15. Generally, the PERT technique deals with the project of
- Repetitive nature
  - Non-repetitive nature
  - Deterministic nature
  - None of the above
16. While drawing the network diagram, for each activity project, we should look
- What activities precede this activity?
  - What activities follow this activity?
  - What activities can concurrently take place with this activity?
  - All of the above
17. The mathematical model of an LP problem is important because
- It helps in converting the verbal description and numerical data into mathematical expression
  - Decision-makers prefer to work with formal models
  - It captures the relevant relationship among decision factors
  - It enables the use of algebraic technique
18. Linear programming is a
- Constrained optimization technique
  - Technique for economic allocation of limited resources
  - Mathematical technique
  - All of the above

19. Before formulating a formal LP model, it is better to-
- a. Express each constraint in words
  - b. Express the objective function in words
  - c. Verbally identify decision variables
  - d. All of the above
20. Which of the following is an assumption of an LP model
- a. Divisibility
  - b. Proportionality
  - c. Additivity
  - d. All of the above

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**( PART-B : Descriptive )**

Time: 2 HRS 40 MINS

Marks : 50

[ Answer question no.(1) & any four (4) from the rest ]

1. Explain in details the methodology of Operations Research 10
  
2. Use simplex method to solve the following LPP - 5+5=10  
  
Maximise  $Z = 2x_1 - x_2 + 2x_3$   
subject to  $2x_1 + x_2 \leq 10$   
 $x_1 + 2x_2 - 2x_3 \leq 20$   
 $x_1 + 2x_3 \leq 5$   
and  $x_1, x_2, x_3 \geq 0$
  
3. a. Mention the steps of Linear Programming model formulation. 5+5=10  
b. Discuss the importance of Operational Research in decision-making process.
  
4. a. Discuss the different types of models used in Operations Research. 5+5=10  
b. State the difference between a transportation problem and an assignment problem
  
5. Solve the LP problem graphically and state what your solution indicates. 5+5=10  
Maximize  $Z = 40x_1 + 100x_2$   
subject to  $2x_1 + 3x_2 \leq 48$   
 $x_1 \leq 20$   
 $x_2 \leq 10$   
and  $x_1, x_2 \geq 0$
  
6. Consider the details of a project as shown in the table:- 5+5=10

Activity	Preceding activities	Activity duration(months)
A	-	2
B	-	5
C	-	4
D	B	5
E	A	7
F	A	3
G	B	3
H	C,D	6
I	C,D	2
J	E	5
K	F,G,H	4
L	F,G,H	3
M	I	12
N	J,K	8

(i) Draw the CPM network diagram and find the critical path and also the project completion time.

(ii) Calculate total floats and free floats for each of the activities.

7. Three time estimates (in months) of all activities of a project are as given below-

5+5=10

Activity (i-j)	Optimistic time(o)	Most likely time(m)	Pessimistic time(p)
1-2	0.8	1.0	1.2
2-3	3.7	5.6	9.9
2-4	6.2	6.6	15.4
3-4	2.1	2.7	6.1
4-5	0.8	3.4	3.6
5-6	0.9	3.4	2.7

a) Find the expected duration and variance of each activity.

b) Draw the project network and find its critical path, expected project length.

8. a. Discuss the phases of project management.

5+5=10

b. Define the following terms - critical path, forward pass method, backward pass method.

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