

C 41739

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Name.....

Reg. No.....

**FOURTH SEMESTER M.A. DEGREE (REGULAR/SUPPLEMENTARY)
EXAMINATION, APRIL 2023**

(CBCSS)

Econometrics

ECM 4C 13—LINEAR PROGRAMMING AND ITS APPLICATIONS IN ECONOMICS

(2020 Admission onwards)

Time : Three Hours

Maximum : 30 Weightage

Part A*Answer all questions.**Each bunch of five questions carries 1 weightage.*

1. One disadvantage of using North-West corner rule to find an initial solution to the transportation problem is that
 - (a) It leads to a degenerate initial solution.
 - (b) It does not take into account cost of transportation.
 - (c) It is complicated to use.
 - (d) All of the above.

2. If the i^{th} constraint of primal (maximization) is equality, then the dual (minimization) variable y_i is :

(a) ≥ 0 .	(b) ≤ 0 .
(c) unrestricted in sign.	(d) All of the above.

3. _____ is defined as a situation in which supply and demand are not equal.
 - (a) Gomery's cutting algorithm.
 - (b) Assignment problem.
 - (c) Unbalanced transportation problem.
 - (d) Game theory.

Turn over

4. _____ is a modified version of the simplex method in linear programming (LP) in which we assign a very large value to each of the artificial variables.
- (a) Revised simplex method.
 - (b) Integer programming.
 - (c) Big M method.
 - (d) Parametric Programming.
5. When 2 vectors are _____ if they are perpendicular to each other, i.e. the dot product of the two vectors is zero.
- (a) Inner product.
 - (b) Quotient space.
 - (c) Orthogonal.
 - (d) Independence.
6. _____ is used to solve problems that have certain design variables as implicit functions of some independent input parameters.
- (a) Integer programming.
 - (b) Parametric optimization.
 - (c) Artificial variable.
 - (d) Unrestricted variable.
7. The objective function of a linear programming problem is :
- (a) A constraint.
 - (b) Function to be optimized.
 - (c) A relation between the variables.
 - (d) None of these.
8. A set of values of decision variables which satisfies the linear constraints and non-negativity conditions of a L.P.P. is _____.
- (a) Unbounded solution.
 - (b) Optimum solution.
 - (c) Feasible solution.
 - (d) None of these.
9. A _____ is a vector space that is a subset of some larger vector space.
- (a) Inner product.
 - (b) Quotient space.
 - (c) Vector subspace.
 - (d) None of the above.
10. _____ is the generalization of the notion of perpendicularity to the linear algebra of bilinear forms.
- (a) Inner Product.
 - (b) Sub space.
 - (c) Orthogonality.
 - (d) Direct Sum.

11. If all incoming variable column is negative then the solution is :
- (a) Feasible Solution. (b) Unbounded solution.
(c) Infeasible solution. (d) None of the above.
12. When the total allocations in a transportation model of $m \times n$ size do not equal to $m + n - 1$ the situation is known as :
- (a) Unbalanced situation. (b) Tie situation.
(c) Degeneracy. (d) None of the above.
13. In case, there is no saddle point in a game then the game is :
- (a) Deterministic game. (b) Fair game.
(c) Mixed strategy game. (d) Multiplayer game.
14. Alternative solutions exist for an LP model when :
- (a) Two constraints are parallel.
(b) One of the constraints is redundant.
(c) Objective functions equation is parallel to one of the constraints.
(d) All of the above
15. The role of artificial variables in the simplex method is :
- (a) To start phases of simplex method.
(b) To aid in finding the initial solution.
(c) To find optimal dual prices in the final simplex table.
(d) All of the above

(15 × 1/5 = 3 weightage)

Part B (Very Short Answer Questions)

*Answer any five questions.
Each question carries 1 weightage.*

16. What space is a vector in ?
17. What do you mean by the term Pure strategy ?

Turn over

18. Find the maximum value of the object function $Z = 5x + 10y$ subject to the constraints
 $x + 2y \leq 120$, $x + y \geq 60$, $x - 2y \geq 0$, $x \geq 0$, $y \geq 0$.
19. What is Parametric programming ?
20. What are Bound techniques ?
21. What is Cycling ?
22. What is two person's zero-sum game ?
23. What is a Hyper plane ?

(5 × 1 = 5 weightage)

Part C (Short Answer Questions)*Answer any seven questions.**Each question carries 2 weightage.*

24. Write a short note on an Unbalanced transportation problem.
25. How do you solve an LPP using The Big M Method ?
26. What is sensitivity analysis in linear programming ?
27. Solve the given linear programming problems graphically :
- Maximize : $Z = 50x + 15y$
 and the constraints are :
- $$5x + y \leq 100,$$
- $$x + y \leq 50,$$
- $$x \geq 0, y \geq 0.$$
28. When does degeneracy occur ?
29. Explain the importance of Integer Programming ?
30. What is a Reduced Payoff matrix ?
31. State the Duality Theorem of linear programming, and use it to prove the Theorem of Complementary Slackness.
32. What does an assignment problem explain ?
33. What is Linear Independence ?

(7 × 2 = 14 weightage)

Part D (Essay Questions)

Answer any two questions.

Each question carries 4 weightage.

34. Describe in detail Gomory's Cutting plane algorithm.
35. Find solution using the Branch and Bound method.

$$\begin{aligned} \text{Maximize : } Z &= 3x_1 + 5x_2 \\ \text{subject to } 2x_1 + 4x_2 &\leq 25 \\ x_1 &\leq 8 \\ 2x_2 &\leq 10 \\ \text{and } x_1, x_2 &\geq 0. \end{aligned}$$

36. What is the travelling salesman problem ? How it can be solved using LPP ?
37. Two companies are competing for the same product. To improve its market share, company A decides to launch the following strategies.

A1 = give discount coupons

A2 = home delivery services

A3 = free gifts

The company B decides to use media advertising to promote its product.

B1 = internet

B2 = newspaper

B3 = magazine

Use linear programming to determine the best strategies for both the companies.

(2 × 4 = 8 weightage)