

Reg. No. :

**Code No. : 30010 E Sub. Code : GMMA 62/
GMMC 62**

B.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2020.

Sixth Semester

Mathematics/Mathematics with CA – Core

LINEAR PROGRAMMING

(For those who joined in July 2012-2015)

Time : Three hours

Maximum : 75 marks

PART A — ($10 \times 1 = 10$ marks)

Answer ALL the questions.

Choose the correct answer :

1. The leading element obtained in simple table is also called _____ element
 - (a) pivotal
 - (b) minimum
 - (c) bounded
 - (d) unbounded

2. The set of all feasible solution to a LPP is a _____
- (a) closed set (b) open set
(c) convex set (d) none
3. Which one of the following is an artificial technique?
- (a) Graphical method
(b) Simplex method
(c) Vogel's method
(d) Big method
4. In the formulation of primal dual pair, the number of dual constraints is always equal to _____
- (a) number of primal constraints
(b) number of dual variables
(c) number of primal variables
(d) none of these
5. The other name for the least cost method is _____
- (a) matrix-minima method
(b) column- minima method
(c) row- minima method
(d) north west corner rule

6. The number of linearly independent equations in a transportation problem is _____
- (a) $mn - 1$ (b) $m + n - 1$
(c) $m + n$ (d) mn
7. The method of solving an assignment problem is _____ method
- (a) Charnes (b) Dantzig
(c) Konig (d) Vogel
8. An optimum assignment table stop when _____
- (a) $p > n$ (b) $n > p$
(c) $p \neq n$ (d) $p = n$
9. The time for which the machine has no job to process is _____ on machine
- (a) total time (b) processing time
(c) idle time (d) none
10. _____ time is a time for a job to flow through the system
- (a) processing (b) completion
(c) idle (d) total

PART B — ($5 \times 5 = 25$ marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) Write the following LPP in standard form

$$\text{Minimize } z = 2x_1 + 5x_2 + x_3$$

Subject to

$$x_1 + 3x_2 - 4x_3 \leq 20$$

$$2x_1 + x_2 + x_3 \geq 10$$

$$x_1 + 4x_2 + 5x_3 = 10$$

$$x_1, x_2, x_3 \geq 0$$

Or

- (b) Solve the following LPP graphically

$$\text{Minimize } z = 20x_1 + 30x_2$$

Subject to

$$3x_1 + 3x_2 \leq 36$$

$$5x_1 + 2x_2 \leq 50$$

$$2x_1 + 6x_2 \leq 60$$

$$x_1, x_2 \geq 0.$$

12. (a) Explain the two phase simplex method.

Or

- (b) Write the dual of the following LPP

$$\text{Maximize } z = x_1 + 2x_2 + 3x_3$$

Subject to

$$4x_1 + 5x_2 + 4x_3 \leq 9$$

$$6x_1 - x_2 + 5x_3 = 10$$

$$x_1, x_2, x_3 \geq 0.$$

13. (a) Find the initial basic feasible solution by least cost method to the following transportation problem.

| | W_1 | W_2 | W_3 | a_i | |
|-------|-------|-------|-------|-------|--------|
| F_1 | 8 | 10 | 12 | 900 | |
| F_2 | 12 | 13 | 12 | 1000 | |
| F_3 | 14 | 10 | 11 | 1200 | Supply |
| b_j | 1200 | 1000 | 900 | 3100 | |

Demand

Or

- (b) Find the initial basic feasible solution by North West corner method to the following transportation problem.

| | W_1 | W_2 | W_3 | a_i |
|-------|-------|-------|-------|-------|
| F_1 | 2 | 7 | 4 | 5 |
| F_2 | 3 | 3 | 1 | 8 |
| F_3 | 5 | 4 | 7 | 7 |
| F_4 | 1 | 6 | 2 | 14 |
| b_j | 2 | 9 | 18 | 34/29 |

14. (a) Prove that the optimal solution to the assignment problems remains the same if a constant is added or subtracted to any row or column of cost matrix.

Or

- (b) Write the algorithm for solving assignment problem.
15. (a) Determine the optimum sequence for the 5 jobs and minimum total elapsed time and idle time of two machines.

| | | | | | |
|---------------|---|----|---|---|---|
| Job : | 1 | 2 | 3 | 4 | 5 |
| Machine M_1 | 3 | 8 | 5 | 7 | 4 |
| Machine M_2 | 4 | 10 | 6 | 5 | 8 |

Or

- (b) Describe the method of processing n jobs through m machines.

PART C — ($5 \times 8 = 40$ marks)

Answer ALL questions, choosing either (a) or (b).

16. (a) Using simplex method to solve the following LPP

$$\text{Maximize } z = 25x_1 + 20x_2$$

Subject to

$$16x_1 + 12x_2 \leq 100$$

$$8x_1 + 16x_2 \leq 80$$

$$x_1, x_2 \geq 0.$$

Or

- (b) Use simplex method to solve the following LPP.

$$\text{Minimize } z = x_1 - 3x_2 + 2x_3$$

Subject to

$$3x_1 - x_2 + 3x_3 \leq 7$$

$$-2x_1 + 4x_2 \leq 12$$

$$-4x_1 + 3x_2 + 8x_3 \leq 10$$

$$x_1, x_2, x_3 \geq 0$$

17. (a) Use Big M method to solve the following LPP

$$\text{Maximize } z = 4x_1 + x_2$$

Subject to

$$3x_1 + x_2 = 3$$

$$4x_1 + 3x_2 \geq 6$$

$$x_1 + 2x_2 \leq 4$$

$$x_1, x_2 \geq 0$$

Or

- (b) Solve by simplex method using dual of the following LPP:

$$\text{Minimize } z = 2x_1 + 3x_2$$

Subject to

$$x_1 + x_2 \geq 5$$

$$x_1 + 2x_2 \geq 6$$

$$x_1, x_2 \geq 0$$

18. (a) Solve the following transportation problem.

| | D ₁ | D ₂ | D ₃ | D ₄ | a _i |
|----------------|----------------|----------------|----------------|----------------|----------------|
| S ₁ | 3 | 1 | 7 | 4 | 300 |
| S ₂ | 2 | 6 | 5 | 9 | 100 |
| S ₃ | 8 | 3 | 3 | 2 | 500 |
| b _j | 250 | 350 | 400 | 200 | 1200 |

Or

- (b) Solve the following transportation problem.

| | F ₁ | F ₂ | F ₃ | F ₄ | a _i |
|----------------|----------------|----------------|----------------|----------------|----------------|
| W ₁ | 10 | 15 | 12 | 12 | 200 |
| W ₂ | 8 | 10 | 11 | 9 | 150 |
| W ₃ | 11 | 12 | 13 | 10 | 120 |
| b _j | 140 | 120 | 80 | 220 | 560/470 |

19. (a) Solve the following assignment problem.

| | A | B | C | D |
|---|----|----|----|----|
| X | 18 | 24 | 28 | 32 |
| Y | 8 | 13 | 17 | 19 |
| Z | 10 | 15 | 19 | 22 |

Or

- (b) Solve the following assignment problem, find the maximum profit.

| | A ₁ | A ₂ | A ₃ | A ₄ |
|----------------|----------------|----------------|----------------|----------------|
| J ₁ | 62 | 71 | 87 | 48 |
| J ₂ | 78 | 84 | 92 | 64 |
| J ₃ | 50 | 61 | 111 | 87 |
| J ₄ | 101 | 73 | 71 | 77 |
| J ₅ | 82 | 59 | 81 | 80 |

20. (a) Solve the following transportation problem.

| Machines | | M ₁ | M ₂ | M ₃ | M ₄ |
|----------|----------------|----------------|----------------|----------------|----------------|
| Jobs | J ₁ | 15 | 5 | 5 | 15 |
| | J ₂ | 12 | 2 | 10 | 12 |
| | J ₃ | 16 | 2 | 4 | 16 |
| | J ₄ | 18 | 3 | 4 | 18 |

Or

- (b) Solve the following transportation problem.

| Job 1 | Time sequence | A | B | C | D |
|-------|---------------|---|---|---|---|
| | | 4 | 6 | 7 | 3 |
| Job 2 | Time sequence | D | B | A | C |
| | | 8 | 7 | 4 | 5 |
