

BACHELOR OF TECHNOLOGY (CBCS) (2020 COURSE)
B.Tech.Sem - VII CS&E : WINTER : 2023
SUBJECT : OPTIMIZATION TECHNIQUES

Day : Tuesday
Date : 5/12/2023

W-24343-2023

Time : 02:30 PM-05:30 PM
Max. Marks : 60

N.B.

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Assume suitable data if necessary.
- 4) Use of non-programmable calculator is allowed.

Q.1 A firm making casting uses electric furnace to melt iron with following (10) specifications:

| | Minimum | Maximum |
|---------|---------|---------|
| Carbon | 3.20% | 3.40% |
| Silicon | 2.25% | 2.35% |

Specifications and costs of various raw materials used for this purpose are given below:

| Material | Carbon% | Silicon% | Cost (₹) |
|---------------------|---------|----------|-----------|
| Steel Scrap | 0.4 | 0.15 | 850/tonne |
| Cast Iron Scrap | 3.80 | 2.40 | 900/tonne |
| Remelt from Foundry | 3.50 | 2.30 | 500/tonne |

If the total charge of iron metal required is 4 tonnes. Find the weights in kgs of each raw material that must be used in the optimal mix at minimum cost. Formulate the above LPP.

OR

Define conical form and standard form of LPP. Justify your answer with example.

Q.2 Solve the following by graphical method (10)

$$\begin{aligned} &\text{Minimize } Z = 3x_1 + 5x_2 \\ &\text{Subject to } -3x_1 + 4x_2 \leq 12 \\ &\quad 2x_1 - x_2 \geq -2 \\ &\quad 2x_1 + 3x_2 \geq 12 \\ &\quad x_1 \leq 4, x_2 \geq 2 \\ &\quad x_1 \geq 0, x_2 \geq 0 \end{aligned}$$

OR

Obtain the basic feasible solution of the following transportation problem:

| Destination→ | D ₁ | D ₂ | D ₃ | D ₄ | Supply |
|----------------|----------------|----------------|----------------|----------------|--------|
| Source↓ | | | | | |
| S ₁ | 10 | 0 | 20 | 11 | 15 |
| S ₂ | 12 | 7 | 9 | 20 | 25 |
| S ₃ | 0 | 14 | 16 | 18 | 5 |
| Demand | 5 | 15 | 15 | 10 | 45 |

Also find total transportation cost.

P.T.O.

- Q.3 By using steepest descent method, solve the following: (10)
 Minimize $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ starting from point
 $x_1 = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$

OR

Graphically solve the following non-linear programming problem.

Maximize $Z = 8x_1 - x_1^2 + 8x_2 - x_2^2$

Subject to the constraints

- i) $x_1 + x_2 \leq 12$
 ii) $x_1 - x_2 \geq 4$ and $x_1, x_2 \geq 0$

- Q.4 Solve the following LP problem by dynamic programming approach (10)
 Maximize $Z = 8x_1 + 7x_2$

Subject to constraints

i) $2x_1 + x_2 \leq 8$ ii) $5x_1 + 2x_2 \leq 15$

$x_1, x_2 \geq 0$

OR

Divide quantity b into n parts so as to maximize their product. Let $f_n(b)$ be maximum value.

Then show that

$f_1(b) = b$ and

$f_n(b) = \text{Max}\{zf_{n-1}(b-z)\}$

$0 \leq z \leq b$

Hence find $f_n(b)$ and the division that maximizes it.

- Q.5 Solve the following integer programming problem by using cutting plane algorithm (10)

Maximize $Z = 3x_1 + 12x_2$

Subject to constraint

i) $2x_1 + 4x_2 \leq 7$

ii) $5x_1 + 3x_2 \leq 15$

And $x_1, x_2 \geq 0$ and are integers.

OR

Formulate and solve following ILP.

A manufacturer of toys makes two types of toys, A and B. Processing of these two toys is done on two machines X and Y. The toy A requires two hours on machine X and six hours on machine Y. Toy B requires four hours on machine X and six hours on machine Y. There are 16 hours of time per day available on machine X and 13 hours of machine Y. The profit obtained on both toys is same ₹5 per toy.

- Q.6 Convert the following problem to separable form (10)
 Maximize $f(x_1, x_2) = 10x_1^2 + 8x_1x_2 - 5x_1e^{x_2} + 2x_2 \cos x_2$ with $x_1 > 0, x_2 > 0$.

OR

What is genetic algorithm? Describe representation of objective function and constraints in (GA) with proper variables and functions.

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