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Q.9] e)

Maximize z = 3x1 + 2x2 ---------------‘0’

Subject to:

4x1 + 3x2 ≤ 12 -----------------‘1’

4x1 + x2 ≤ 8 ----------------‘2’

4x1 – x2 ≤ 8 -----------------‘3’

and x1, x2 ≥ 0.

Ans] i) Graphically :

From constraint ‘1’ :

|  |  |
| --- | --- |
| x1 | x2 |
| 0 | 4 |
| 3 | 0 |

From constraint ‘2’ :

|  |  |
| --- | --- |
| x1 | x2 |
| 0 | 8 |
| 2 | 0 |

From constraint ‘3’ :

|  |  |
| --- | --- |
| x1 | x2 |
| 0 | -8 |
| 2 | 0 |

(1.5,2)

|  |  |
| --- | --- |
| Points | Z |
| (0,0) | 0 |
| (2,0) | 6 |
| (0,4) | 8 |
| (1.5,2) | 8.5 (Maximum) |

ii) Simplex Method:

z -3x1 – 2x2 = 0 ------------------(0)

4x1 + 3x2 + s1 = 12 ------------------(1)

4x1 + x2 + s2 = 8 -----------------(2)

4x1 – x2 + s3 = 8 -----------------(3)

and x1 , x2, s1, s2, s3 ≥ 0

Total variables = (z, x1 , x2, s1, s2, s3) = 6

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Eq No. | Basic Variable | z | x1 | x2 | s1 | s2 | s3 | RHS | Ratio |
| 0 | z | 1 | -3 | -2 | 0 | 0 | 0 | 0 | \_ |
| 1 | s1 | 0 | 4 | 3 | 1 | 0 | 0 | 12 | 12/4=3 |
| 2 | s2 | 0 | 4 | 1 | 0 | 1 | 0 | 8 | 8/4=2 |
| 3 | s3 | 0 | 4 | -1 | 0 | 0 | 1 | 8 | 8/4=2 |
|  |  |  |  |  |  |  |  |  |  |
| 0 | z | 1 | 0 | -5/4 | 0 | 3/4 | 0 | 6 | \_ |
| 1 | s1 | 0 | 0 | 2 | 1 | -1 | 0 | 4 | 2 |
| 2 | x1 | 0 | 1 | 1/4 | 0 | 1/4 | 0 | 2 | 8 |
| 3 | s3 | 0 | 0 | -2 | 0 | -1 | 1 | 0 | \_ |

(new x1 row) = (s1 row)/4 = (new key row)

Applying Gauss-Jordan row operation;

(new row) = (current row) – (key column coeff.) x (new key row)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | z | 1 | 0 | 0 | 5/8 | 1/8 | 0 | 17/2 | \_ |
| 1 | x2 | 0 | 0 | 1 | 1/2 | -1/2 | 0 | 2 |  |
| 2 | x1 | 0 | 1 | 0 | -1/8 | 3/8 | 0 | 3/2 |  |
| 3 | s3 | 0 | 0 | 0 | 1 | -2 | 1 | 4 |  |

So, optimal Solution is;

z\* = 17/2=8.5 , x1\* = 3/2=1.5 , x2\* = 2, s3\* = 4,

and s1\*=s2\*=0

