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MP-1 TUTORIAL-13

1. Demonstrate the Discrete Optimization using Cutting Plane method.

QUESTION:

Max z=x1+x2

Subject To: 3x1+2x2<=5

X2<=2

X1,x2>=0

Tutorial -13

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Max $z = x_1 + x_2$

subject To :

$3x_1 + 2x_2 <= 5$

$x_2 <= 2$

and $x_1, x_2 >= 0$

The problem is converted to canonical form by adding slack variables, surplus and artificial variables as appropriate.

Max $z = x_1 + x_2 + 0s_1 + 0s_2$

subject To

$3x_1 + 2x_2 + s_1 = 5$

$x_2 + s_2 = 2$ $x_1, x_2, s_1, s_2 >= 0$

C_{B_i}	c_j	1	1	0	0		
	B.V	x_1	x_2	s_1	s_2	sol	
0	s_1	3	2	1	0	5	5/3
0	s_2	0	1	0	1	2	
	z_j	0	0	0	0		
	$c_j - z_j$	1	1	0	0		

Entering = 1

leaving = s_1

key element = 3

C_{Bi}	C_j	1	1	0	0	
	B.V	x_1	x_2	S_1	S_2	sol
1	x_1	1	2/3	1/3	0	5/3
0	S_2	0	1	0	1	2
	Z_j	1	2/3	1/3	0	
	$C_j - Z_j$	0	1/3	-1/3	0	

Leaving = S_2

Entering = x_2

key elemet = 1

C_{Bi}	C_j	1	1	0	0	
	B.V	x_1	x_2	S_1	S_2	sol
1	x_1	1	0	1/3	-2/3	1/3
1	x_2	0	1	0	1	2
	Z_j	1	1	1/3	1/3	
	$C_j - Z_j$	0	0	-1/3	-1/3	

Since all $C_j - Z_j <= 0$

Hence non-integer optimal solution is arrived with value of variables as-

$x_1 = 1/3 \quad x_2 = 2$

$\text{Max } Z = 5/3$

To obtain integer valued solution we proceed to construct Gomory's fractional cut, with the help of x_1 - row as follows.

$$0.3333 = 1x_1 + 0.3333 s_1 - 0.6667 s_2$$

$$0 + 0.3333 = (1+0)x_1 + (0+0.3333)s_1 + (-1+0.3333)s_2$$

The fractional cut will become

$$-0.3333 = sg1 - 0.3333 s_1 - 0.3333 s_2$$

Cut-1

Adding this constraint at the bottom of optimal simplex table

C_{B_i}	c_j	1	1	0	0	0	
	B.V	x_1	x_2	s_1	s_2	$sg1$	sol
1	x_1	1	0	$1/3$	$-2/3$	0	$1/2$
1	x_2	0	1	0	1	0	2
0	sg_1	0	0	$-1/3$	$-1/3$	1	$-1/3$
	z_j	1	1	$1/3$	$1/3$	0	
	$c_j - z_j$	0	0	$-1/3$	$-1/3$	0	
	Ratio	–	–	1	1	–	

$\therefore$ Entering = s_1

Leaving = sg_1

key element = $-1/3$

C_{B_i}	C_j	1	1	0	0	0	
	BV	x_1	x_2	s_1	s_2	sg_1	sol
1	x_1	1	0	0	-1	1	0
1	x_2	0	1	0	1	0	2
0	s_1	0	0	1	1	-3	1
	z_j	1	1	0	0	1	
	$c_j - z_j$	0	0	0	0	-1	

since all $c_j - z_j \leq 0$

Hence integer optimal solution is arrived with value of variables as

$x_1 = 0 \quad x_2 = 2$

Max $z = 2$

The integer optimal solution found after 1- cuts