Botlhale Village
Working together for ICT innovation and growth in Africa

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ARE YOU READY?

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Cutting Plane Algorithm

Integer Programming models

Formulating a linear programming model

The Oakfield Corporation manufactures tables and chairs. A table requires 1 hour of labour and 9 square board metres of wood, and a chair requires 1 hour of labour and 5 square board metres of wood. Currently, 6 hours of labour and 45 square board metres of wood are available. Each table contributes R8 to profit, and each chair contributes R5 to profit.

1. Formulate an Integer Programming Model to maximise Oakfield's profit.
2. Solve the formulated Integer Programming Model using the Branch & Bound Simplex Algorithm.

Formulating a linear programming model

$$x_i = The\ number\ of\ i\ manufactured. i = 1 = Tables, 2 = Chairs$$

$$\max z = 8x_1 + 5x_2$$

$$s.t. x_1 + x_2 \leq 6$$

$$9x_1 + 5x_2 \leq 45$$

$$x_1, x_2 \geq 0$$

$$x_1, x_2\ integers$$

Relaxed Integer Programming Model

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Integer Programming Model: Relaxed					
Max z =	$8x_1$	+	$5x_2$		
s.t	x_1	+	x_2	≤	6
	$9x_1$	+	$5x_2$	≤	45
	x_1, x_2	≥	0		

Canonical Form

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Canonical Form: Branch & Bound Algorithm								
	(z)	-	$8x_1$	-	$5x_2$	=	0	
		x_1	+	x_2	+	s_1	=	6
		$9x_1$	+	$5x_2$	+	s_2	=	45

Primal Simplex Solution

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T-i	x1	x2	s1	s2	rhs	θ
z	-8	-5	0	0	0	
1	1	1	1	0	6	6
2	9	5	0	1	45	5

Initial

T-2	x1	x2	s1	s2	rhs	θ
z	0	- 5/9	0	8/9	40	
1	0	4/9	1	- 1/9	1	2 1/4
2	1	5/9	0	1/9	5	9

T-3*	x1	x2	s1	s2	rhs
z	0	0	1 1/4	3/4	41 1/4
1	0	1	2 1/4	- 1/4	2 1/4
2	1	0	-1 1/4	1/4	3 3/4

1/4
3/4

Same with B&B simplex algorithm, choose the one closest to 0.5

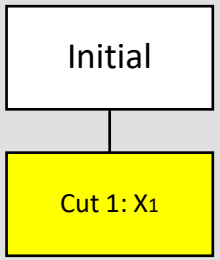
If both are the same distance, choose the lower subscript.

Cut on x1

Exercises:

Found in the document called ‘Cutting Plane Algorithm Exercises’

Cutting Plane Algorithm Sub-Problem 1



T-3*	x1	x2	s1	s2	s3	rhs
z	0	0	1 1/4	3/4	0	41 1/4
1	0	1	2 1/4	- 1/4	0	2 1/4
2	1	0	-1 1/4	1/4	0	3 3/4
3	0	0	- 3/4	- 1/4	1	- 3/4
θ			1 2/3	3		

T-3*	x1	x2	s1	s2	rhs
z	0	0	1 1/4	3/4	41 1/4
1	0	1	2 1/4	- 1/4	2 1/4
2	1	0	-1 1/4	1/4	3 3/4

T-4*	x1	x2	s1	s2	s3	rhs
z	0	0	0	1/3	1 2/3	40
1	0	1	0	-1	3	0
2	1	0	0	2/3	-1 2/3	5
3	0	0	1	1/3	-1 1/3	1

x1 -1,25s1 +0,25s2 = 3 3/4

x1 -2s1 +0,75s1 +0s2 +0,25s2 = 3 +0,75

x1 -2s1 +0s2 -3 = -0,75s1 -0,25s2 +0,75

-0,75s1 -0,25s2 +0,75 ≤ 0

END

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