Algorithm and examples

Method 7. Branch and Bound method

Solve the Linear programming problem using Branch and Bound method calculator

Type your linear programming problem

```
MAX Z = 2.5x1 + 6x2
subject to
3x1 + 5x2 <= 26
x1 >= 4
and x1,x2 >= 0
```

OR

Total Variables : 2 Total Constraints : 2 Generate

Max Z = 2.5 x1 + 6 x2

Subject to constraints

3 x1 + 5 x2 <= 26

1 x1 + 0 x2 >= 4

and x1,x2 >= 0 and unrestricted in sign ☐x1, ☐x2

Mode : Decimal

Find Random New

Solution Help

Solution will be displayed step by step (In 6 parts)

Solution

Find solution using Branch and Bound method
MAX Z = 2.5x1 + 6x2
subject to
3x1 + 5x2 <= 26
x1 >= 4
and x1,x2 >= 0

Solution:
Solution steps by **BigM method**, **Graphical method**

$$\text{Max } Z = 2.5x_1 + 6x_2$$

subject to

$$3x_1 + 5x_2 \le 26$$

$$x_1 \ge 4$$

and $x_1, x_2 \ge 0;$

Solution is

$\text{Max } Z_A = 26.8 \left(x_1 = 4, x_2 = 2.8\right)$

and $Z_L = 22 \left(x_1 = 4, x_2 = 2\right)$ obtainted by the rounded off solution values.

The branch and bound diagram

A

$x_1 = 4, x_2 = 2.8$
$Z_A = 26.8$
$Z_L = 22$
Solution steps by **BigM method**, **Graphical method**

In Sub-problem A, $x_2 (= 2.8)$ must be an integer value, so two new constraints are created, $x_2 \le 2$ and $x_2 \ge 3$

Sub-problem B : Solution is found by adding $x_2 \le 2$.	Sub-problem C : Solution is found by adding $x_2 \ge 3$.
Solution steps by **BigM method**, **Graphical method**	Solution steps by **BigM method**, **Graphical method**
$\text{Max } Z = 2.5x_1 + 6x_2$	$\text{Max } Z = 2.5x_1 + 6x_2$
subject to	subject to

$3x_1 + 5x_2 \le 26$ $x_1 \ge 4$ $x_2 \le 2$ and $x_1, x_2 \ge 0$; Solution is Max $Z_B = 25.3333$ $(x_1 = 5.3333, x_2 = 2)$ and $Z_L = 24.5$ $(x_1 = 5, x_2 = 2)$ obtainted by the rounded off solution values.	$3x_1 + 5x_2 \le 26$ $x_1 \ge 4$ $x_2 \ge 3$ and $x_1, x_2 \ge 0$; Solution is This Problem has an infeasible solution, so this branch is terminated.

The branch and bound diagram

A

$x_1 = 4, x_2 = 2.8$
$Z_A = 26.8$
$Z_L = 22$
Solution steps by **BigM method**, **Graphical method**

$x_2 \le 2$ $\qquad$ $x_2 \ge 3$

B	C
$x_1 = 5.3333, x_2 = 2$ $Z_B = 25.3333$ $Z_L = 24.5$ Solution steps by **BigM method**, **Graphical method**	Infeasible Solution Solution steps by **BigM method**, **Graphical method**

In Sub-problem B, $x_1 (= 5.3333)$ must be an integer value, so two new constraints are created, $x_1 \le 5$ and $x_1 \ge 6$

Sub-problem D : Solution is found by adding $x_1 \le 5$. Solution steps by **BigM method**, **Graphical method** Max $Z = 2.5x_1 + 6x_2$ subject to $3x_1 + 5x_2 \le 26$ $x_1 \ge 4$ $x_2 \le 2$ $x_1 \le 5$ and $x_1, x_2 \ge 0$; Solution is Max $Z_D = 24.5$ $(x_1 = 5, x_2 = 2)$ and $Z_L = 24.5$ $(x_1 = 5, x_2 = 2)$ obtainted by the rounded off solution values. This Problem has integer solution, so no further branching is required.	Sub-problem E : Solution is found by adding $x_1 \ge 6$. Solution steps by **BigM method**, **Graphical method** Max $Z = 2.5x_1 + 6x_2$ subject to $3x_1 + 5x_2 \le 26$ $x_1 \ge 4$ $x_2 \le 2$ $x_1 \ge 6$ and $x_1, x_2 \ge 0$; Solution is Max $Z_E = 24.6$ $(x_1 = 6, x_2 = 1.6)$ and $Z_L = 21$ $(x_1 = 6, x_2 = 1)$ obtainted by the rounded off solution values.

The branch and bound diagram

A

$x_1 = 4, x_2 = 2.8$
$Z_A = 26.8$
$Z_L = 22$
Solution steps by **BigM method**, **Graphical method**

$x_2 \le 2$ $\qquad$ $x_2 \ge 3$

B	C
$x_1 = 5.3333, x_2 = 2$ $Z_B = 25.3333$ $Z_L = 24.5$ Solution steps by	Infeasible Solution Solution steps by **BigM method**, **Graphical method**

BigM method,
Graphical method

$x_1 \le 5$ $x_1 \ge 6$

D	E
$x_1 = 5, x_2 = 2$ $Z_D = 24.5$ $Z_L = 24.5$ Solution steps by **BigM method**, **Graphical method**	$x_1 = 6, x_2 = 1.6$ $Z_E = 24.6$ $Z_L = 21$ Solution steps by **BigM method**, **Graphical method**

In Sub-problem E, $x_2 (= 1.6)$ must be an integer value, so two new constraints are created, $x_2 \le 1$ and $x_2 \ge 2$

Sub-problem F : Solution is found by adding $x_2 \le 1$.	Sub-problem G : Solution is found by adding $x_2 \ge 2$.
Solution steps by **BigM method**, **Graphical method** Max $Z = 2.5x_1 + 6x_2$ subject to $3x_1 + 5x_2 \le 26$ $x_1 \ge 4$ $x_2 \le 2$ $x_1 \ge 6$ $x_2 \le 1$ and $x_1, x_2 \ge 0$; Solution is Max $Z_F = 23.5$ $(x_1 = 7, x_2 = 1)$ and $Z_L = 23.5$ $(x_1 = 7, x_2 = 1)$ obtainted by the rounded off solution values. This Problem has integer solution, so no further branching is required.	Solution steps by **BigM method**, **Graphical method** Max $Z = 2.5x_1 + 6x_2$ subject to $3x_1 + 5x_2 \le 26$ $x_1 \ge 4$ $x_2 \le 2$ $x_1 \ge 6$ $x_2 \ge 2$ and $x_1, x_2 \ge 0$; Solution is This Problem has an infeasible solution, so this branch is terminated.

The branch and bound diagram

A

$x_1 = 4, x_2 = 2.8$
$Z_A = 26.8$
$Z_L = 22$
Solution steps by
BigM method,
Graphical method

$x_2 \le 2$ $x_2 \ge 3$

B	C
$x_1 = 5.3333, x_2 = 2$ $Z_B = 25.3333$ $Z_L = 24.5$ Solution steps by **BigM method**, **Graphical method**	Infeasible Solution Solution steps by **BigM method**, **Graphical method**

$x_1 \le 5$ $x_1 \ge 6$

D	E
$x_1 = 5, x_2 = 2$ $Z_D = 24.5$ $Z_L = 24.5$ Solution steps by **BigM method**, **Graphical method**	$x_1 = 6, x_2 = 1.6$ $Z_E = 24.6$ $Z_L = 21$ Solution steps by **BigM method**, **Graphical method**

$x_2 \le 1$ $x_2 \ge 2$

F	G
$x_1 = 7, x_2 = 1$ $Z_F = 23.5$ $Z_L = 23.5$ Solution steps by **BigM method**, **Graphical method**	Infeasible Solution Solution steps by **BigM method**, **Graphical method**

The branch and bound algorithm thus terminated and the optimal integer solution is :
$Z_D = 24.5$ and $x_1 = 5, x_2 = 2$

Solution provided by AtoZmath.com

Any wrong solution, solution improvement, feedback then **Submit Here**

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