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> # Example: Advertising with HIM/LIP/HIW and Budget constraints
# This uses the penalties and budget as a goal.
with(LinearAlgebra):
interface(rtablesize=11);

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10 (1)

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> # Vars: x1 x2 s1 e1 s2 e2 s3 e3 s4 (and rhs)
A:=<<0,7,10,5,100>|<0,3,5,4,60>|<1,1,0,0,0>|<0,-1,0,0,0>|<1,0,1,
0,0>|<0,0,-1,0,0>|<1,0,0,1,0>|<0,0,0,-1,0>|<0,0,0,0,1>|<1,0,0,0,
-1>|<0,40,60,35,600>>;

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$$A := \begin{bmatrix} 0 & 0 & 1 & 0 & 1 & 0 & 1 & 0 & 0 & 1 & 0 \\ 7 & 3 & 1 & -1 & 0 & 0 & 0 & 0 & 0 & 0 & 40 \\ 10 & 5 & 0 & 0 & 1 & -1 & 0 & 0 & 0 & 0 & 60 \\ 5 & 4 & 0 & 0 & 0 & 0 & 1 & -1 & 0 & 0 & 35 \\ 100 & 60 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & -1 & 600 \end{bmatrix}$$

(2)

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> # Clear the values above the identity columns for an initial BFS:
A2:=RowOperation(A,[1,2],-1):
A3:=RowOperation(A2,[1,3],-1):
A4:=RowOperation(A3,[1,4],-1);

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$$A4 := \begin{bmatrix} -22 & -12 & 0 & 1 & 0 & 1 & 0 & 1 & 0 & 1 & -135 \\ 7 & 3 & 1 & -1 & 0 & 0 & 0 & 0 & 0 & 0 & 40 \\ 10 & 5 & 0 & 0 & 1 & -1 & 0 & 0 & 0 & 0 & 60 \\ 5 & 4 & 0 & 0 & 0 & 0 & 1 & -1 & 0 & 0 & 35 \\ 100 & 60 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & -1 & 600 \end{bmatrix}$$

(3)

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> # Pivot in Column 1, and perform Ratio Test:
evalf([40/7, 60/10, 35/5, 600/100]);

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[5.714285714, 6., 7., 6.] (4)

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> #Pivot in Column 1, Row 2:
A5:=RowOperation(A4,2,1/7):
A6:=RowOperation(A5,[1,2],22):
A7:=RowOperation(A6,[3,2],-10):
A8:=RowOperation(A7,[4,2],-5):
A9:=RowOperation(A8,[5,2],-100);

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(5)

$$A9 := \begin{bmatrix} 0 & -\frac{18}{7} & \frac{22}{7} & -\frac{15}{7} & 0 & 1 & 0 & 1 & 0 & 1 & -\frac{65}{7} \\ 1 & \frac{3}{7} & \frac{1}{7} & -\frac{1}{7} & 0 & 0 & 0 & 0 & 0 & 0 & \frac{40}{7} \\ 0 & \frac{5}{7} & -\frac{10}{7} & \frac{10}{7} & 1 & -1 & 0 & 0 & 0 & 0 & \frac{20}{7} \\ 0 & \frac{13}{7} & -\frac{5}{7} & \frac{5}{7} & 0 & 0 & 1 & -1 & 0 & 0 & \frac{45}{7} \\ 0 & \frac{120}{7} & -\frac{100}{7} & \frac{100}{7} & 0 & 0 & 0 & 0 & 1 & -1 & \frac{200}{7} \end{bmatrix} \quad (5)$$

> # Pivot in Column 4, and perform Ratio Test: Tie between 3 and 5. Choose 3:

A10:=RowOperation(A9,3,7/10):

A11:=RowOperation(A10,[1,3],15/7):

A12:=RowOperation(A11,[2,3],1/7):

A13:=RowOperation(A12,[4,3],-5/7):

A14:=RowOperation(A13,[5,3],-100/7);

$$A14 := \begin{bmatrix} 0 & -\frac{3}{2} & 1 & 0 & \frac{3}{2} & -\frac{1}{2} & 0 & 1 & 0 & 1 & -5 \\ 1 & \frac{1}{2} & 0 & 0 & \frac{1}{10} & -\frac{1}{10} & 0 & 0 & 0 & 0 & 6 \\ 0 & \frac{1}{2} & -1 & 1 & \frac{7}{10} & -\frac{7}{10} & 0 & 0 & 0 & 0 & 2 \\ 0 & \frac{3}{2} & 0 & 0 & -\frac{1}{2} & \frac{1}{2} & 1 & -1 & 0 & 0 & 5 \\ 0 & 10 & 0 & 0 & -10 & 10 & 0 & 0 & 1 & -1 & 0 \end{bmatrix} \quad (6)$$

> # Pivot in Column 2, Row 5:

A15:=RowOperation(A14,5,1/10):

A16:=RowOperation(A15,[1,5],3/2):

A17:=RowOperation(A16,[2,5],-1/2):

A18:=RowOperation(A17,[4,5],-3/2):

A19:=RowOperation(A18,[3,5],-1/2);

(7)

$$A19 := \begin{bmatrix} 0 & 0 & 1 & 0 & 0 & 1 & 0 & 1 & \frac{3}{20} & \frac{17}{20} & -5 \\ 1 & 0 & 0 & 0 & \frac{3}{5} & -\frac{3}{5} & 0 & 0 & -\frac{1}{20} & \frac{1}{20} & 6 \\ 0 & 0 & -1 & 1 & \frac{6}{5} & -\frac{6}{5} & 0 & 0 & -\frac{1}{20} & \frac{1}{20} & 2 \\ 0 & 0 & 0 & 0 & 1 & -1 & 1 & -1 & -\frac{3}{20} & \frac{3}{20} & 5 \\ 0 & 1 & 0 & 0 & -1 & 1 & 0 & 0 & \frac{1}{10} & -\frac{1}{10} & 0 \end{bmatrix} \quad (7)$$