Giapetto's Woodcarving Linear Program with Linear Inequality Constraints

Solve a simple linear program defined by linear inequalities.

Use these linear inequality constraints:

$$2x_s + x_t \leq 100$$
$$x_s + x_t \leq 80$$
$$-x_t \leq 0$$
$$x_s \leq 40$$
$$-x_s \leq 0$$

Construct A-Matrix of LHS constraints.

Construct b-matrix of RHS constraints.

```
A=[2 1; 1 1; 0 -1; 1 0; -1 0]
```

```
A =

     2     1
     1     1
     0    -1
     1     0
    -1     0
```
●

```
b=[100 80 0 40 0]
```

```
b =

   100    80     0    40     0
```
●

Need to invert signs on objective function, ie. f(x) to -f(x) for a max. problem

```
f=[3 2]
```

```
f =

     3     2
```
●

Max f(x) s.t. constraints, invert sign of objective function so Matlab calculates Max problem.

```
[x_lp, eval_lp]= linprog(-f,A,b)
```

```
Optimal solution found.
x_lp =

    20
    60
```
●

```
eval_lp = -180
```

```
A*x_lp % verify constraints are satisfied
```

```
ans =
   100
    80
   -60
    20
   -20
```

●

Dorian Auto Advertising Linear Program with Linear Inequality Constraints

Solve a simple linear program defined by linear inequalities.

Use these linear inequality constraints:

$$-12x_1 - 2x_2 \leq -24$$
$$-2x_1 - 7x_2 \leq -28$$
$$-x_1 \leq 0$$
$$-x_2 \leq 0$$

Construct A-Matrix of LHS constraints.

Construct b-matrix of RHS constraints.

```
AA= [-12000000 -2000000; -2000000 -7000000]
```

```
AA =
   -12000000    -2000000
    -2000000    -7000000
```

```
bb= [-24000000, -28000000]
```

```
bb =
   -24000000   -28000000
```

```
lb= [0; 0]
```

```
lb =
     0
     0
```

●

```
ff=[50000, 100000]
```

```
ff =
      50000      100000
```
●

Min f(x) s.t. constraints

```
[xx_lp, fval_lp] = linprog(ff, AA, bb, [], [], lb)
```

```
Optimal solution found.
xx_lp =
    1.4000
    3.6000
fval_lp = 4.3000e+05
```

```
AA*xx_lp % verify constraints are satisfied
```

```
ans =
   1.0e+07
   -2.4000
   -2.8000
```
●

Dorian Auto Advertising Linear Program with Linear Inequality Constraints and Integer solutions

Solve a simple linear program defined by linear inequalities.

Use these linear inequality constraints:

$$-12x_1 - 2x_2 \le -24$$
$$-2x_1 - 7x_2 \le -28$$
$$-x_1 \le 0$$
$$-x_2 \le 0$$

Construct A-Matrix of LHS constraints.

Construct b-matrix of RHS constraints.

```
AAA= [-12000000 -2000000; -2000000 -7000000]
```

```
AAA =
   -12000000    -2000000
    -2000000    -7000000
```

```
bbb= [-24000000, -28000000]
```

```
bbb =
```

```
     -24000000    -28000000
```

```
lb= [0; 0]
```

```
lb =

     0
     0
```

```
fff=[50000, 100000]
```

```
fff =

      50000      100000
```

Min f(x) s.t. constraints

```
[xxx_lp, fval1_lp] = intlinprog(fff, 1:2, AAA, bbb, [], [], lb)
```

```
LP:                Optimal objective value is 430000.000000.

Heuristics:        Found 1 solution using rounding.
                   Upper bound is 500000.000000.
                   Relative gap is 14.00%.

Heuristics:        Found 1 solution using rss.
                   Upper bound is 500000.000000.
                   Relative gap is 14.00%.

Cut Generation:    Applied 1 Gomory cut,
                   and 1 strong CG cut.
                   Lower bound is 500000.000000.
                   Relative gap is 0.00%.


Optimal solution found.

Intlinprog stopped at the root node because the objective value is within a gap tolerance of the optimal
options.AbsoluteGapTolerance = 0 (the default value). The intcon variables are integer within tolerance,
options.IntegerTolerance = 1e-05 (the default value).
xxx_lp =
     2
     4
fval1_lp = 500000
```

```
AAA*xxx_lp % verify constraints are satisfied
```

```
ans =

    -32000000
    -32000000
```