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# File Name: model27_mySimplex_Q1.py                                     #
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# LP problem (Model 27: Hydrological Model) from:                        #
# https://sites.math.washington.edu/~burke/crs/407/models/m27.html       #
##########################################################################
import MySimplex

def oneHot(length, hotIdx):
    hotVec = [0.0]*length
    hotVec[hotIdx] = 1.0
    return hotVec

## STEP 1. Set up what we need. ------------------------------------------------------
## Declare small constant epsilon for strict inequality removal:
EPSILON = 0.000000000001
## Declare variable names:
variables = ["b0", "b1", "b2", "x3", "x4", "x5", "x6", "x7", "x8", "x9", "x10", "x11", "x12"]
## Delare a list of coefficients  of each variable in the objective function (same order):
obj_coeffs = 3*[0.0] + 10*[1.0]
## Delare a list of lowerbounds of each variable:
#lowerbounds = 3*[EPSILON] + 10*[-float("inf")]
lowerbounds = 3*[EPSILON] + 10*[0]
## Declare contraint names:
constraint_names = ["Period 3-(1)", "Period 3-(2)",
                                    "Period 4-(1)", "Period 4-(2)",
                                    "Period 5-(1)", "Period 5-(2)",
                                    "Period 6-(1)", "Period 6-(2)",
                                    "Period 7-(1)", "Period 7-(2)",
                                    "Period 8-(1)", "Period 8-(2)",
                                    "Period 9-(1)", "Period 9-(2)",
                                    "Period 10-(1)", "Period 10-(2)",
                                    "Period 11-(1)", "Period 11-(2)",
                                    "Period 12-(1)", "Period 12-(2)",
                                    "b2", "b1 - b2", "b0 - b1",
                                    "b0+b1+b2"]
## Declare a list of RHS constants of each constraints:
righthand = [1.0, -1.0, 2.1, -2.1, 3.7, -3.7, 4.2, -4.2, 4.3, -4.3,
                    4.4, -4.4, 4.3, -4.3, 4.2, -4.2, 3.6, -3.6, 2.7, -2.7,
                    EPSILON, EPSILON, EPSILON, 1.0]

## Declare a list of inequality directions of each constraints:
senses = 23*['G'] + ['E']

## Declare and complete a coefficient matrix for the constraints:
Mat = []
Precip = [3.8, 4.4, 5.7, 5.2, 7.7, 6.0, 5.4, 5.7, 5.5, 2.5, 0.8, 0.4]
for i in range(2, 12):
    tmp1 = [Precip[i], Precip[i-1], Precip[i-2]] + oneHot(length=10, hotIdx=(i-2))
    tmp2 = [-Precip[i], -Precip[i-1], -Precip[i-2]] + oneHot(length=10, hotIdx=(i-2))
    Mat.append(tmp1)
    Mat.append(tmp2)
Mat.append([0.0, 0.0, 1.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0])
Mat.append([0.0, 1.0,-1.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0])
Mat.append([1.0,-1.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0])
Mat.append([1.0, 1.0, 1.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0, 0.0])

## Set coefficients of each variables in each constraints:
lin_expr = []
for row in Mat:
    print(row)
    lin_expr.append( row )

## STEP 2. Generate LP problem object ------------------------------------------------
## Generate an LP problem framework
problem = MySimplex.SimplexProblem()
## Set objective as minimization
problem.setObjectiveDirection( Max=False )
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69 ## Set variables and objective function
70 problem.setVariables( Names=variables, ObjCoeffs=obj_coeffs, Lowerbounds=lowerbounds )
71 ## Set constraints
72 for idx in range(len(lin_expr)):
73     problem.addConstraint( Name = constraint_names[idx]
74                                             , rowVec = lin_expr[idx]
75                                             , ineq_dir = senses[idx]
76                                             , RHS = righthand[idx] )
77
78 ## STEP 3. Solve the problem ----------------------------------------------------------------
79 problem.setup()
80 Tableau = problem.buildTableau()
81 Tableau = problem.solve(Tableau)
```