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'''>>>>> start CodeP1.1
    V.P. Carey ME249, Spring 2021'''
#import math and numpy packages
import math
import numpy

%matplotlib inline
# importing the required module
import matplotlib.pyplot as plt
plt.rcParams['figure.figsize'] = [10, 8] # for square canvas


#import copy
from copy import copy, deepcopy
# version 3 print function
from __future__ import print_function
# seed the pseudorandom number generator
from random import seed
from random import random
# seed random number generator
seed(1)

#Parameters for Evolution Loop
#create arrays - SWITCH n3 and n4
ydata = []
lydata = []

#set data parameters
ND = 45       #number of data vectors in array
DI = 5        #number of data items in vector
NS = 45       #total number of DNA strands

# j is column, i is row downward for ydata[i][j] - both start at zero
# so it is:  ydata[row][column]
# this is an array that is essentially a list of lists

#assembling data array
#store array where rows are data vectors [heat flux, superheat, gravity, surf

ydata =      [[44.1, 32.5, 0.098, 1.79, 5.5]]
ydata.append([47.4, 33.2, 0.098, 1.79, 5.5])
ydata.append([49.4, 34.2, 0.098, 1.79, 5.5])

ydata.append([59.2, 34.8, 0.098, 1.79, 5.5])
ydata.append([67.8, 36.3, 0.098, 1.79, 5.5])
ydata.append([73.6, 37.3, 0.098, 1.79, 5.5])
ydata.append([76.3, 37.8, 0.098, 1.79, 5.5])
ydata.append([85.3, 39.2, 0.098, 1.79, 5.5])
ydata.append([96.5, 39.3, 0.098, 1.79, 5.5])
ydata.append([111., 42.3, 0.098, 1.79, 5.5])
ydata.append([124., 43.5, 0.098, 1.79, 5.5])
ydata.append([136.2, 45.4, 0.098, 1.79, 5.5])
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ydata.append([143.5, 46.7, 0.098, 1.79, 5.5])
ydata.append([154.6, 47.9, 0.098, 1.79, 5.5])
ydata.append([163.1, 48.6, 0.098, 1.79, 5.5])
ydata.append([172.8, 50.9, 0.098, 1.79, 5.5])
ydata.append([184.2, 51.7, 0.098, 1.79, 5.5])
ydata.append([203.7, 56.4, 0.098, 1.79, 5.5])

ydata.append([36.7, 30.2, 9.8, 1.79, 5.5])
ydata.append([55.1, 34.1, 9.8, 1.79, 5.5])
ydata.append([67.5, 35.3, 9.8, 1.79, 5.5])
ydata.append([78.0, 37.8, 9.8, 1.79, 5.5])
ydata.append([92.0, 38.1, 9.8, 1.79, 5.5])
ydata.append([120., 44.1, 9.8, 1.79, 5.5])
ydata.append([134.3, 46.9, 9.8, 1.79, 5.5])
ydata.append([150.3, 48.5, 9.8, 1.79, 5.5])
ydata.append([167., 49.2, 9.8, 1.79, 5.5])
ydata.append([184., 52.7, 9.8, 1.79, 5.5])
ydata.append([196.5, 53.1, 9.8, 1.79, 5.5])
'''
ydata.append([42.4, 28.0, 19.6, 1.79, 9.5])
ydata.append([48.7, 29.3, 19.6, 1.79, 9.5])
ydata.append([54.5, 29.6, 19.6, 1.79, 9.5])

ydata.append([62.1, 28.5, 19.6, 1.79, 9.5])
ydata.append([70.8, 30.5, 19.6, 1.79, 9.5])
ydata.append([73.7, 30.3, 19.6, 1.79, 9.5])
ydata.append([81.8, 30.6, 19.6, 1.79, 9.5])
ydata.append([91.9, 34.5, 19.6, 1.79, 9.5])
ydata.append([103.9, 34.5, 19.6, 1.79, 9.5])
ydata.append([119.1, 35.4, 19.6, 1.79, 9.5])
ydata.append([133.7, 36.8, 19.6, 1.79, 9.5])
ydata.append([139.9, 38.1, 19.6, 1.79, 9.5])
ydata.append([148.3, 39.1, 19.6, 1.79, 9.5])
ydata.append([157.0, 40.0, 19.6, 1.79, 9.5])
ydata.append([169.1, 42.2, 19.6, 1.79, 9.5])
ydata.append([179.2, 43.2, 19.6, 1.79, 9.5])
ydata.append([205.0, 46.0, 19.6, 1.79, 9.5])
'''
ydata.append([42.4, 29.7, 19.6, 1.79, 5.5])
ydata.append([48.7, 31.0, 19.6, 1.79, 5.5])
ydata.append([54.5, 31.2, 19.6, 1.79, 5.5])
ydata.append([70.8, 32.4, 19.6, 1.79, 5.5])
ydata.append([73.7, 31.4, 19.6, 1.79, 5.5])
ydata.append([81.8, 32.5, 19.6, 1.79, 5.5])
ydata.append([91.9, 36.3, 19.6, 1.79, 5.5])
ydata.append([103.9, 36.3, 19.6, 1.79, 5.5])
ydata.append([119.1, 37.2, 19.6, 1.79, 5.5])
ydata.append([133.7, 38.4, 19.6, 1.79, 5.5])
ydata.append([139.9, 39.7, 19.6, 1.79, 5.5])
ydata.append([148.3, 40.9, 19.6, 1.79, 5.5])
ydata.append([157.0, 41.6, 19.6, 1.79, 5.5])
ydata.append([169.1, 43.9, 19.6, 1.79, 5.5])
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ydata.append([179.2, 45.0, 19.6, 1.79, 5.5])
ydata.append([205.0, 47.9, 19.6, 1.79, 5.5])
'''
ydata.append([77.0, 41.5, 9.8, 0.00, 7.0])
ydata.append([71.0, 40.5, 9.8, 0.00, 7.0])
ydata.append([66.0, 39.5, 9.8, 0.00, 7.0])
ydata.append([62.0, 38.5, 9.8, 0.00, 7.0])
ydata.append([42.0, 34.0, 9.8, 0.00, 7.0])
ydata.append([60.0, 37.5, 9.8, 0.00, 7.0])
ydata.append([53.0, 37.0, 9.8, 0.00, 7.0])

ydata.append([71.7, 36.4, 0.098, 1.71, 5.5])
ydata.append([81.5, 38.5, 0.098, 1.71, 5.5])
ydata.append([90.7, 39.5, 0.098, 1.71, 5.5])
ydata.append([103.3, 41.6, 0.098, 1.71, 5.5])
ydata.append([117.0, 43.1, 0.098, 1.71, 5.5])
ydata.append([138.6, 45.4, 0.098, 1.71, 5.5])
ydata.append([161.7, 47.9, 0.098, 1.71, 5.5])
ydata.append([207.5, 50.9, 0.098, 1.71, 5.5])
'''
# print the data array
print ('ydata =', ydata)


''' need deepcopy to create an array of the same size as ydata,
#   since this array is a list(rows) of lists (column entries)  '''
lydata = deepcopy(ydata)  # create array to store ln of data values


# j is column, i is row downward for ydata[i][j] - both start at zero
# so it is:  ydata[row][column]
#now store log values for data
for j in range(DI):
    for i in range(ND):
        lydata[i][j]=math.log(ydata[i][j]+0.000000000010)

#OK now have stored array of log values for data
'''>>>>> end CodeP1.1 '''
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