Simulated Annealing Lab

Introduction. In this lab you will write a program for simulated annealing. You will test the program on a one-dimensional fitness surface with multiple local maxima. In addition you will use this surface to study the effects of various annealing parameters on search efficiency. You will then adapt the code to optimize a neural network to oscillate.

_____ EXERCISE 1

The goal of simulated annealing is to maximize the performance of a model relative to a fitness function defined over the model parameters you are seeking to optimize. In Exercise 2, **you will apply simulated annealing coded in scipy** to a one-dimensional problem in which you seek the value of X that maximizes the output of a function called ***fitnessFunction***. But first you must write code that implements the function, which is the product of *m* and *n*:

$$m = 1 + \cos(0.04v)^2$$
$$n = \exp(-v^2/(20000))$$

Paste your function into your lab report.

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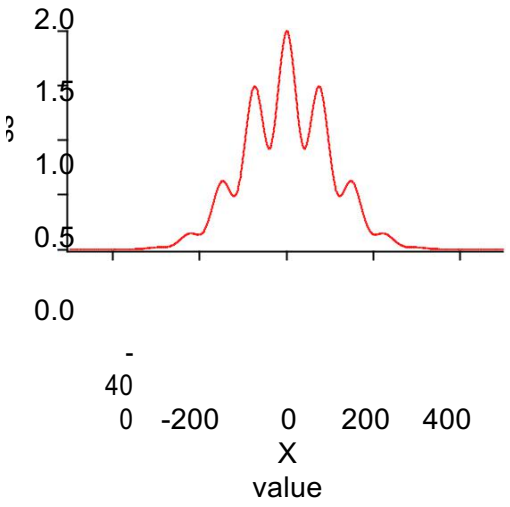
_____ EXERCISE 2

Display the fitness surface. To do this, make the wave *fitness* with 1000 points starting at x
= -500 and ending at x = 500 (using Data > Change Wave Scaling). Set the y-values in *fitness* to the corresponding value of the fitnessFunction(). Display *fitness* and include the graph in your lab report. It should look like this:



EXERCISE 3

Run the algorithm with an initial *X* value of 250 and an initial temperature of 10. Plot the trajectory of the annealing algorithm along the fitness surface, Include the graph in your lab report.

Slowly increase the temperature until you find the peak about 90% of the time.

Report this temperature and explain its significance in terms of the relationship between the search radius and the dimensions of the width of the fitness curve.

EXERCISE 4

Another informative graph is the plot of all the intermediate best fitnesses versus iteration number. Make this plot. Include the graph in your lab report.

EXERCISE 5 [Optional]

Complete the table below by running simulation 20 times with each of 10 different values of temp shown. Plot number of failures vs temperature and number of iterations to reach the peak vs temperature. Describe and explain any trends you find.