Optimization with Matlab

Pricing Under Pressure

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```
function sn = objfunc(sc)
N = 0.000615731;
sn = exp(N)*sc;
end
```

Figure 1: This image shows the objective function

1 Introduction

The drive to achieve better or be the best in one field or another is the concept of optimization. Numerical optimization can be used in engineering to attain this goal of optimization. MATLAB is a strong piece of software that lets you handle optimization issues with a variety of tools. Our goal in this section is to tackle an optimization problem involving pricing under pressure using functions from the MATLAB optimization toolbox as well as genetic and simulated annealing procedures.

2 Genetic Algorithm and Simulated Annealing

Simulated annealing (SA) is a method for solving unconstrained and bound-constrained optimization problems. The method models the physical process of heating a material and then slowly lowering the temperature to decrease defects, thus minimizing the system energy. At each iteration of the simulated annealing algorithm, a new point is randomly generated. The distance of the new point from the current point, or the extent of the search, is based on a probability distribution with a scale proportional to the temperature. The algorithm accepts all new points that lower the objective, but also, with a certain probability, points that raise the objective. By accepting points that raise the objective, the algorithm avoids being trapped in local minima in early iterations and is able to explore globally for better solutions.The Global Optimization Toolbox is used to perform these tasks in matlab.

3 Pricing Under Pressure

The optimization task given was "Pricing Under Pressure". The task given was to predict the stock price. The stock price in the previous week was used to calculate the stock price in the next week. The relationship between the stock price in the previous week and the stock price in the next week is given by $S_N = e^2 * S_C$, where Sn was stock price in next week and Sc was stock price in the previous week. The problem given was a simulation problem which required generating a series of random observations from the normal distribution, N. The current stock was given as \$42 and the exercising stock price was given as \$44. This was used in the MATLAB optimization tool as the lower and upper limit respectively for the selected Simulated Annealing simulation optimization solver. A function file with relationship, $S_N = e^2 * S_C$ was used as the objective function. The solver was then started.

4 Method

The matlab optimization toolbox was used to solve this problem.In the method we show the objective function, variables and constraints as used in the matlab interface. The upper bound and lower bound was input. The upper bound was changed on every iteration to get the new price.

5 Results

The simulation was tested with a starting point of \$42, lower bound of\$ 42 and upper bound of \$44. The test was carried out to test for the 12 week interval. After each iteration, the new stock price is used as the current for the next week's prediction. The stock prices saw a steady increase in value

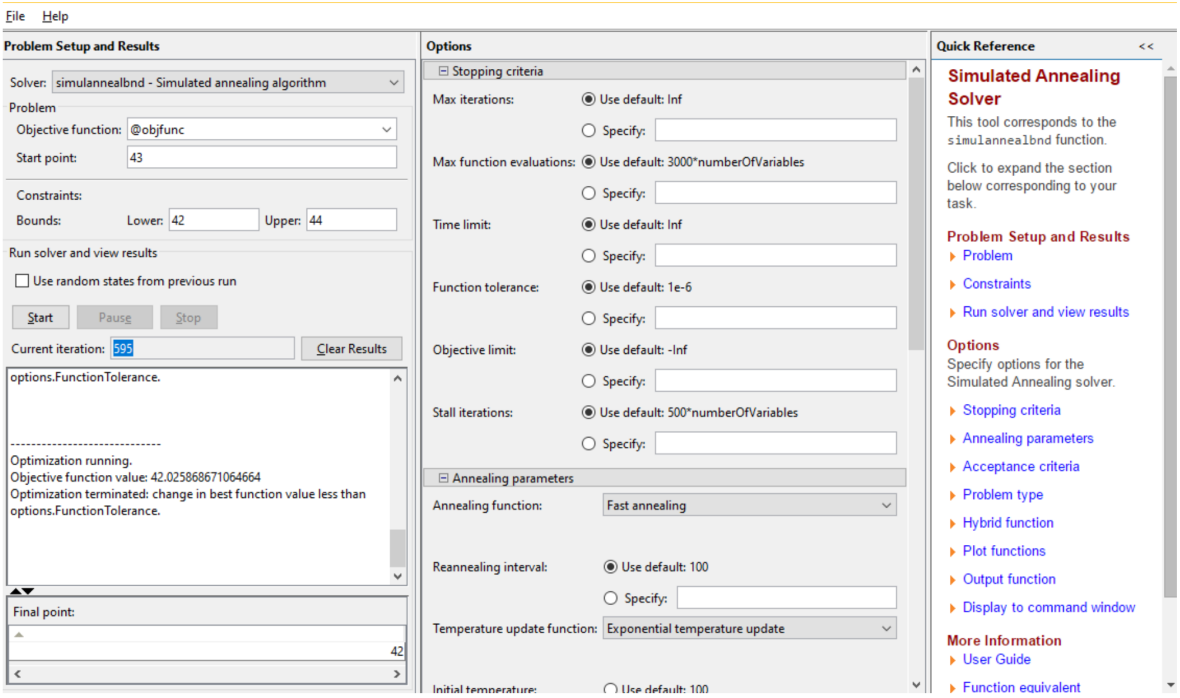

Figure 2: This shows the optimization toolbox

after each week's iteration. The table below shows the achieved results using the simulated annealing optimization. Current Stock Price = \$42.00 Exercise Price = \$44.00

6 Observations

One component appears in this system: the stock price. The stock price in the previous week is used to calculate the stock price in the next week. The relationship between the stock price in the previous week and the stock price in the next week is given by $S_N = e^2 * S_C$. State of the system: P(t) = price of the stock at time t. This simulation requires generating a series of random observations from the normal distribution. Each random observation is a normally distributed random variable that determines the increase or decrease of the stock price at the end of next week. The random variable is substituted for N in the following equation:

$S_N = e^2 * S_C$ To generate a series of random variables, we define an assumption cell with normal distribution, where

$$\mu = 0.0006 and \sigma = 0.0416.$$

In this simulation, the time periods are fixed. We have a twelve-week period, and we need to calculate the change in the stock price each week. We have a formula $S_N = e^2 * S_C$ that relates the stock price at the end of the next week to the stock price at the end of the previous week. Thus, we do not have to worry about advancing the clock. We simply have to generate N for each of the twelve weeks.

7 Conclusion

$S_n = e^2 * S_c$ Simulated annealing can be used for very hard computational optimization problems where exact algorithms fail; even though it usually achieves an approximate solution to the global minimum, it could be enough for many practical problems. Simulated Annealing (SA) is an effective and general form of optimization. It is useful in finding global optima in the presence of large numbers of local optima. In this task Simulated annealing helped to achieve optimum value of stock prices with the aid of the optimization toolbox. It approximates the global optimum of a given function.

Week	N	Stock Price at End of Week
1	0.000615731	$42.03
2	0.000615731	$42.05
3	0.000615731	$42.08
4	0.000615731	$42.10
5	0.000615731	$42.13
6	0.000615731	$42.15
7	0.000615731	$42.18
8	0.000615731	$42.20
9	0.000615731	$42.23
10	0.000615731	$42.26
11	0.000615731	$42.28
12	0.000615731	$42.31

Figure 3: This table shows stock prices for 12 weeks