AMS326 Homework 4 Report

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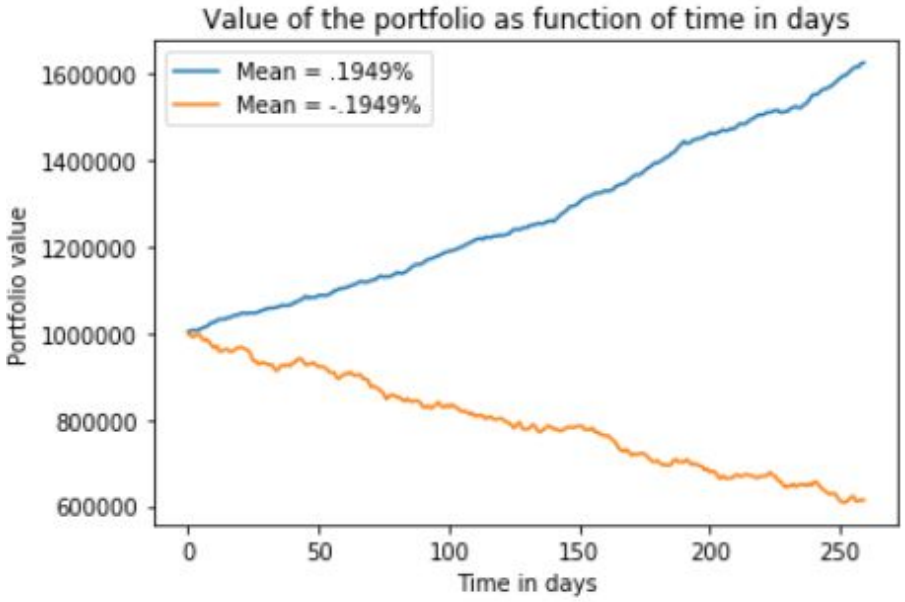
Problem 1 Report

For the first question , the random gaussian distribution was generated using python's libraries. For each step

$y_{new} = y + y * \text{random value from Gaussian distribution}$. If y_new is bigger than y, 3.333% if subtracted from the gain, which is y_new - y. This was done using both the positive and negative means of .1949% and -.1949%, and was done 260 times with each iteration representing a day. Each iteration of the calculation was stored in a list, and then plotted against the days. Because the gain follow a random Gaussian distribution, the values change for each run of the program. One such plot is shown below.



The graph with positive mean is smoother than the graph with negative mean because the variance is smaller. The graph with positive mean is increasing because

the average gain, which is the mean, is positive. The graph with negative mean is decreasing because the average gain, which is the mean, is negative.

Then, the value with both means, which is shown at the end of the graph is printed. For the above graph, the values are shown below.

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Portfolio value after 260 days with mean 0.001949 is 1626668.63.
Portfolio value after 260 days with mean -0.001949 is 613306.50.
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Problem 3 Report

This problem was solved using systems of equations. The system of differential equations is defined as:

$x' = -v_b * cos(\theta)$, with $cos(\theta) = \frac{x}{\sqrt{x^2+y^2}}$

$y' = -v_b * sin(\theta) + w(x)$, with $sin(\theta) = \frac{y}{\sqrt{x^2+y^2}}$

w(x) is the speed of the water flowing northward, and is defined in the problem.

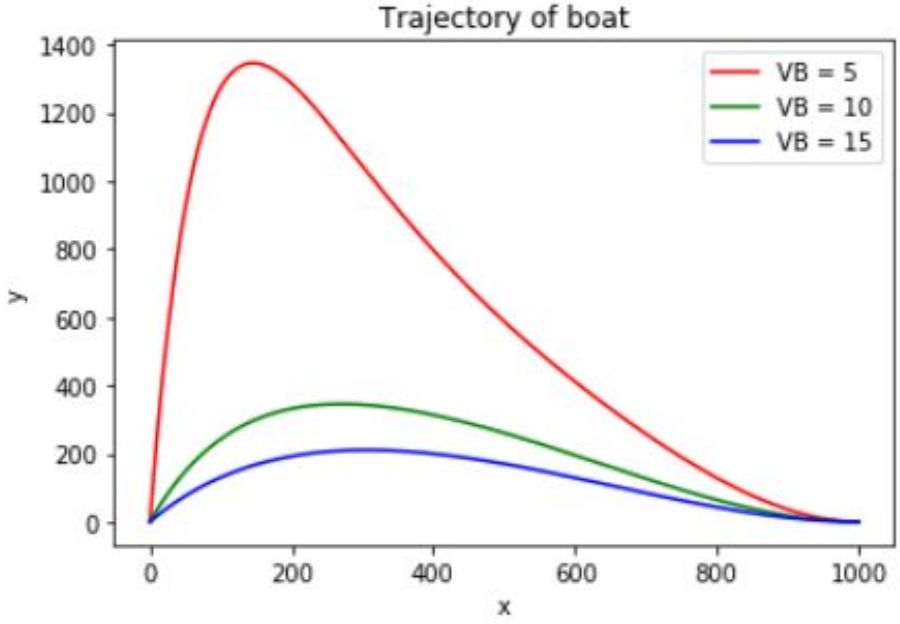
The starting position of the boat as defined in the problem is (1000,0). Each new step is found with Euler's method, with

$x_{new} = x + h * x'$

$y_{new} = y + h * y'$

h is the length of each step, and is defined as 0.01 for the sake of this problem.

Then, Euler's method is repeated from the initial x position to the final x position, which is 0. This is done with three of the boat velocities, 5, 10, and 15. The x and y values at each iteration of Euler's method is stored in a list, and those values are used to graph the trajectory of the boat. The graph is shown below.


Trajectory of boat
VB = 5
VB = 10
VB = 15
1400
1200
1000
800
600
400
200
0
y
0
200
400
600
800
1000
x