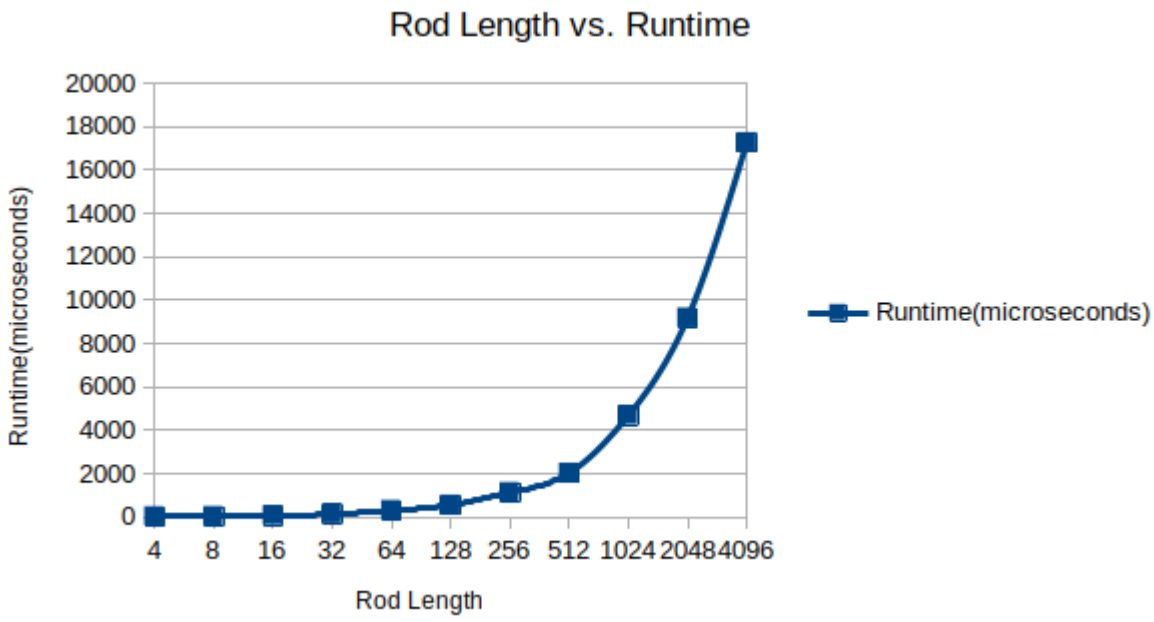
Wyatt Shinkle Algorithm HW4

Q1 Write-Up:

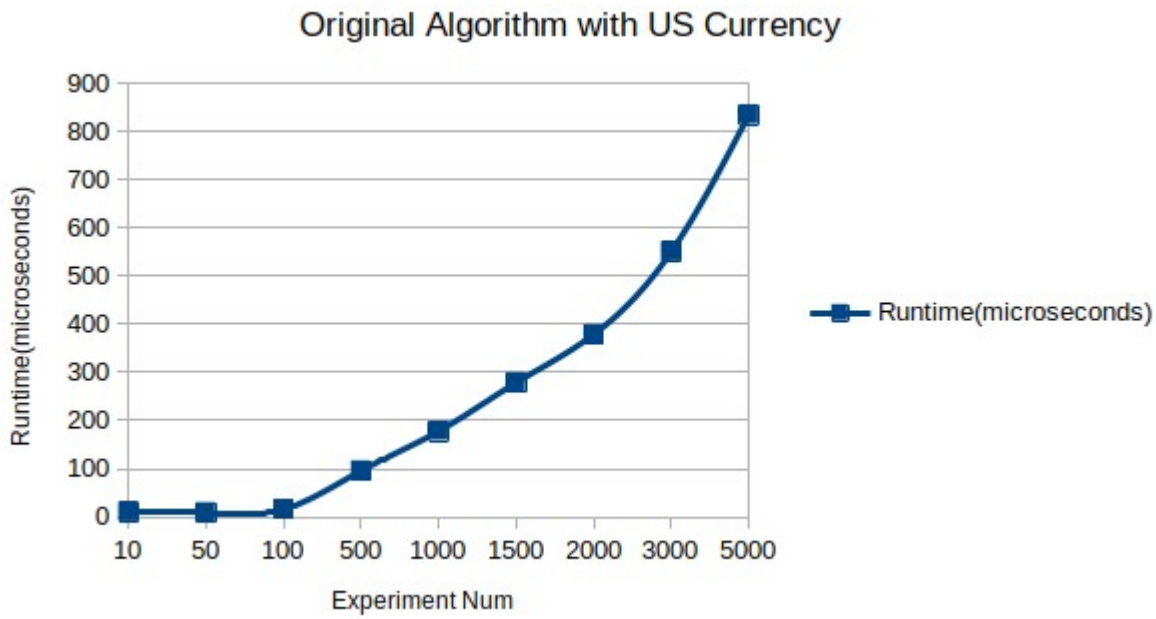
In order to make the cutRod algorithm to work with a list of prices that is not continuous I had to modify the algorithm slightly. In order to do this I made a unordered map that contains both the rod lengths and their respective prices. This helps keep the time complexity down and also makes it easier to look up the price for a certain rod length. I also initialize an unordered-map within the modified algorithm in order to keep track of the new max revenue. At the end of the function it returns the value in this map with the key with a length of the experiment. The overall time complexity of this was O(n^2). After running each experiment I was able to produce the following chart:

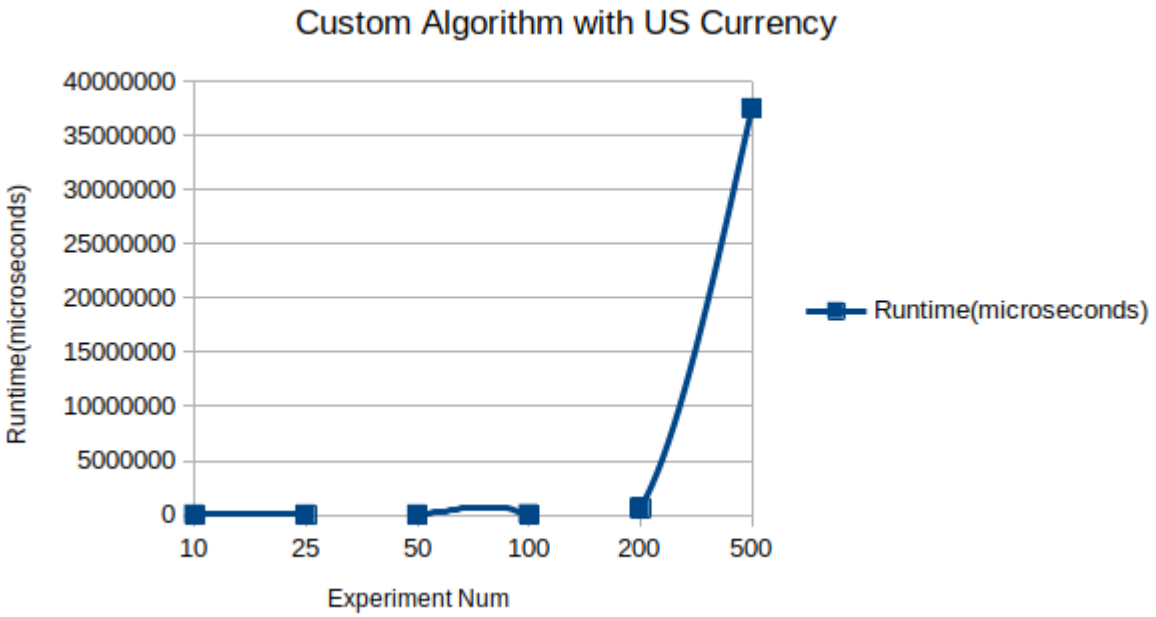


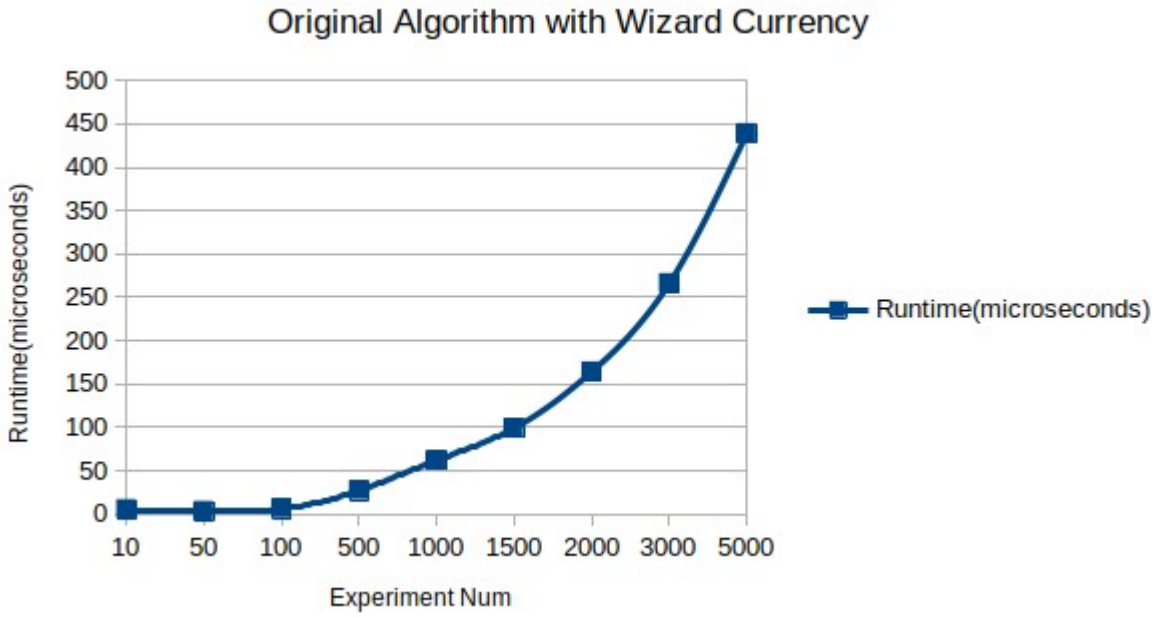
This chart shows pretty much what I was expecting as the chart roughly matches the time complexity of the program.

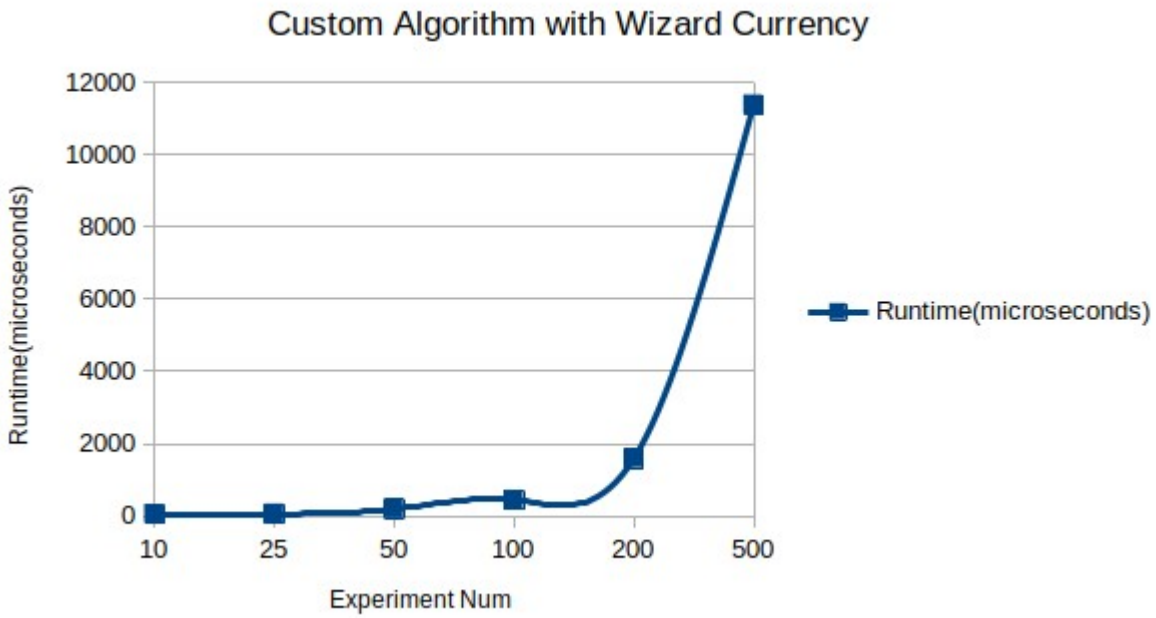
Q2 Write-Up:

In order to have the coin change problem also print the different combinations several changes had to be made. One thing that I did was initialize a vector of vectors of vectors of integers in order to store all the combinations. After this another for loop was required in order to keep all of extra information that was need to print the combinations. This made the overall time complexity O(n^3) because of the extra for loop. After running each experiment I was able to produce the following charts:


Original Algorithm with US Currency
Runtime(microseconds)
900
800
700
600
500
400
300
200
100
0
10
50
100
500
1000
1500
2000
3000
5000
Experiment Num
Runtime(microseconds)


Custom Algorithm with US Currency
Runtime(microseconds)
40000000
35000000
30000000
25000000
20000000
15000000
10000000
5000000
0
10
25
50
100
200
500
Experiment Num
Runtime(microseconds)





From these charts we can see that the original algorithm is roughly matches it's time complexity of O(n^2) whereas the custom algorithm is more like O(n^3) which matches the program time complexity. The chart for the custom algorithm with US currency is slightly broken because of the large differences in run time but still does a good job showing how quickly the run time begins to grow.