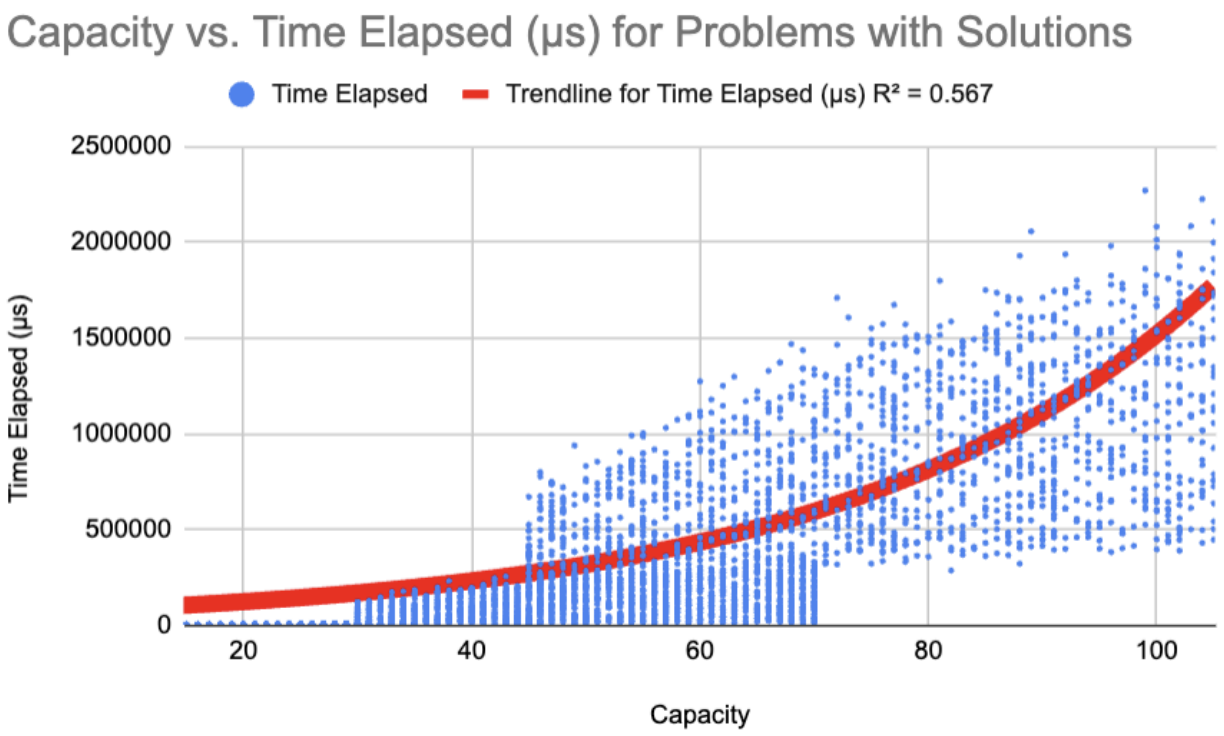
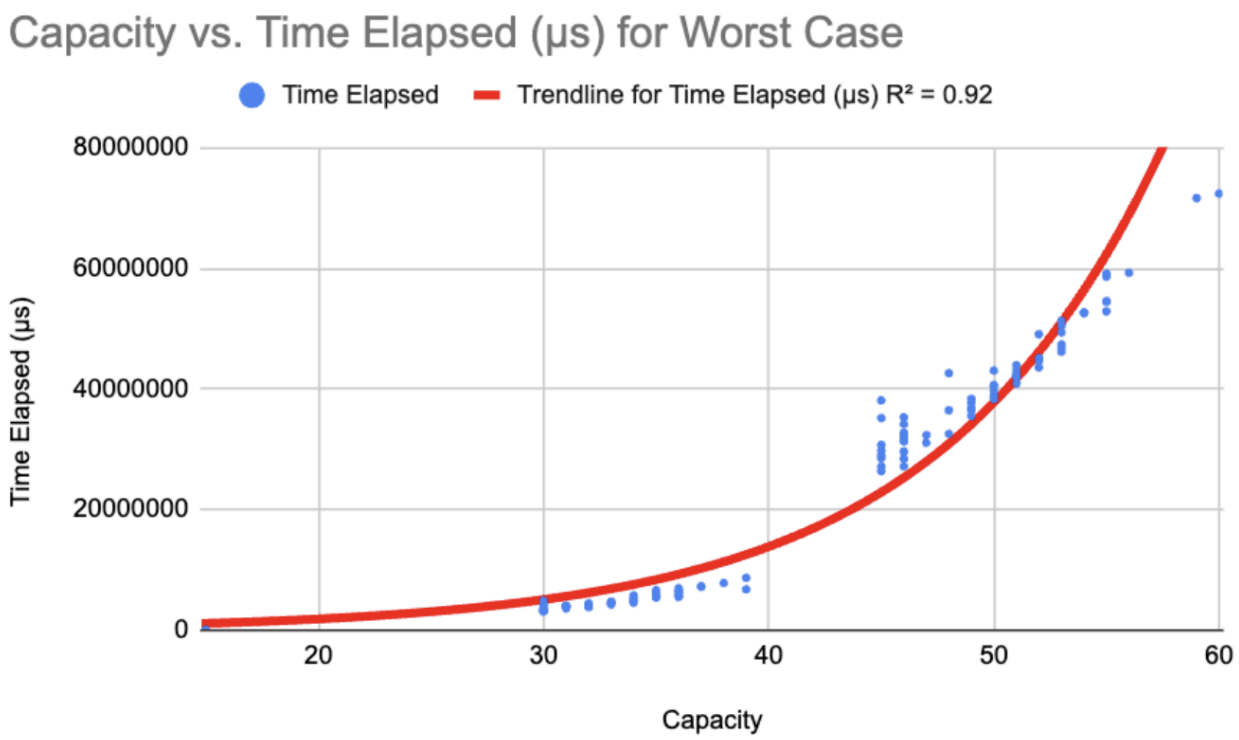
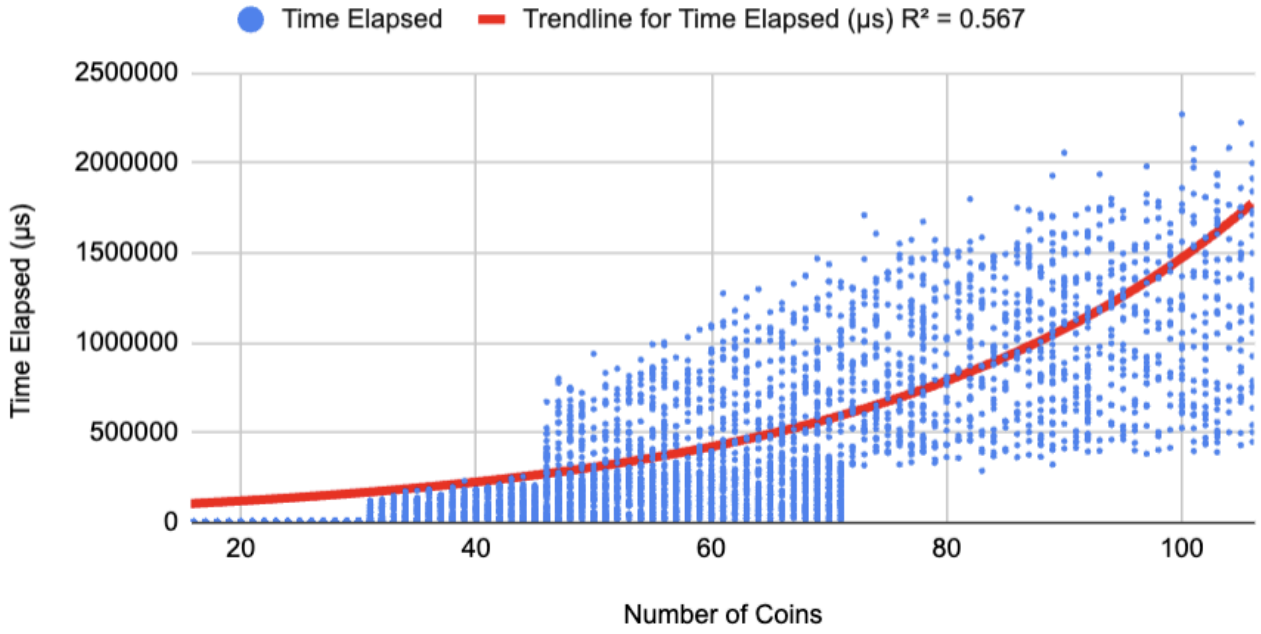
The graphs show an approximation of the time it takes for the program to find the combination of coins as the certain values tested increase. Each graph was taken from a sample of 5000 randomized test cases calculated by a program that I wrote. The goal was that by having lots of samples, a correlation would appear from the plotted data. Based on that data, I created 6 graphs to show the relationship between the values increasing and the time it takes for the program to run each case to completion. Each independent variable has 2 graphs because the times for the worst case scenario are so large that we can't see the growth for the cases where there are solutions to the problem. If I had overlapped the two into one graph, then the line for scenarios with solutions would look linear and constant. As we can see, each graph has an exponential relationship. The target graph is exponential because as the target increases, we have to solve for larger sums of coins, so the time it takes increases exponentially. The more important graphs are the capacity and number of coins relationship graphs. The capacity is a value that determines the maximum number of coins that can be put into the knapsack while the number of coins refers to the number of different types of coins. So for example, if the capacity is 10, and types of coins is 3, then all combinations must consist of only those 3 types of coins and there cannot be more than 10 coins in total. These two graphs also have an exponential relationship to time because as these variables increase, there are more subsets of coins that the program has to try out. Based on this reasoning, we can logically conclude that the rate at which the time increases is roughly 2^n because for n amount of coins, there are a total of 2^n possible combinations of coins. In other words, for every increase in these variables the time to compute the combinations doubles

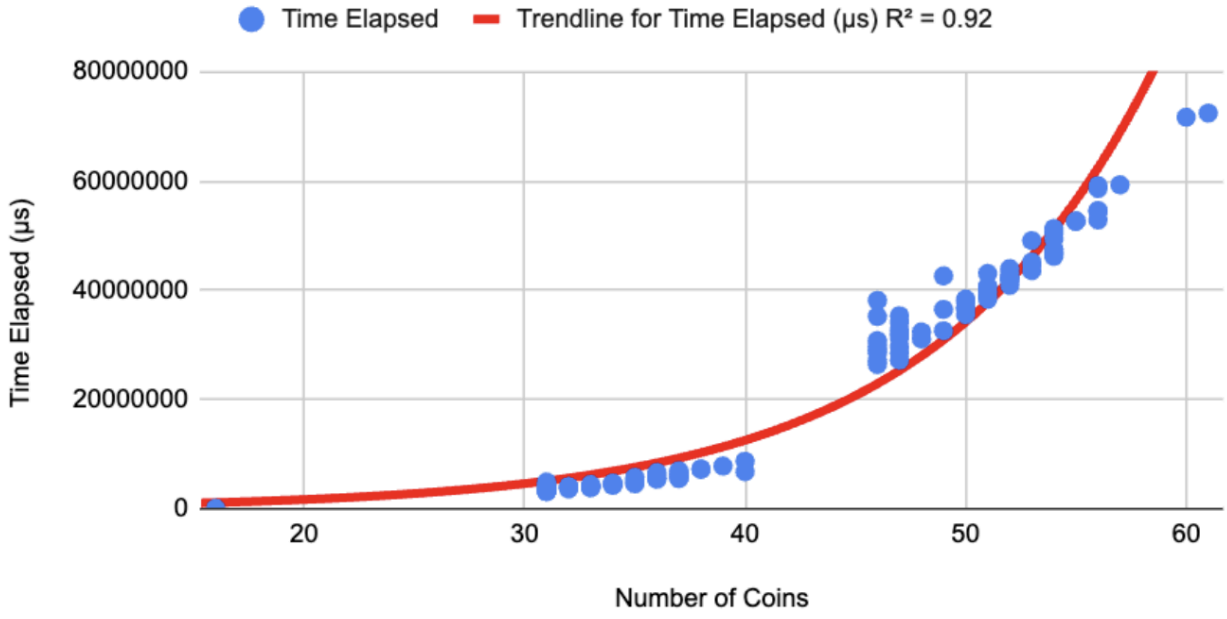

Capacity vs. Time Elapsed (µs) for Problems with Solutions
Time Elapsed
Trendline for Time Elapsed (µs) R² = 0.567
2500000
2000000
1500000
1000000
500000
0
Time Elapsed (µs)
20
40
60
80
100
Capacity

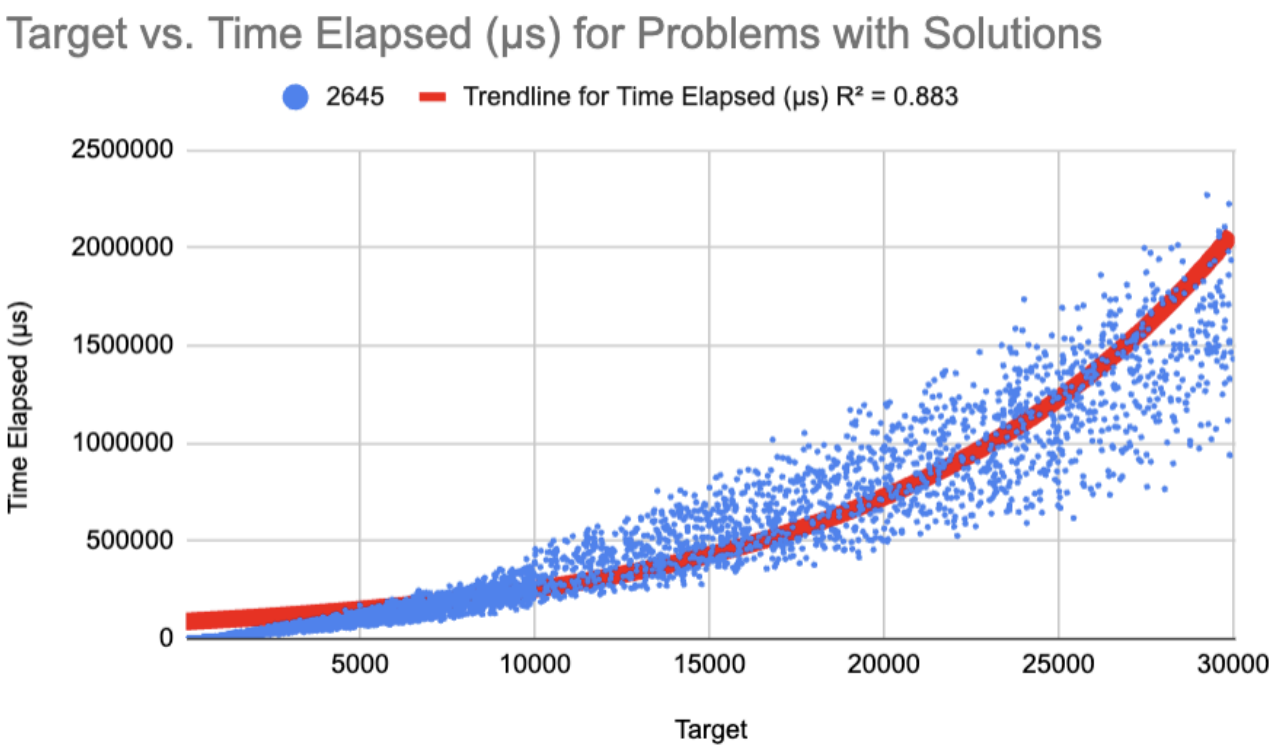

Capacity vs. Time Elapsed (µs) for Worst Case
Time Elapsed
Trendline for Time Elapsed (µs) R² = 0.92
80000000
60000000
40000000
20000000
0
Time Elapsed (µs)
20
30
40
50
60
Capacity

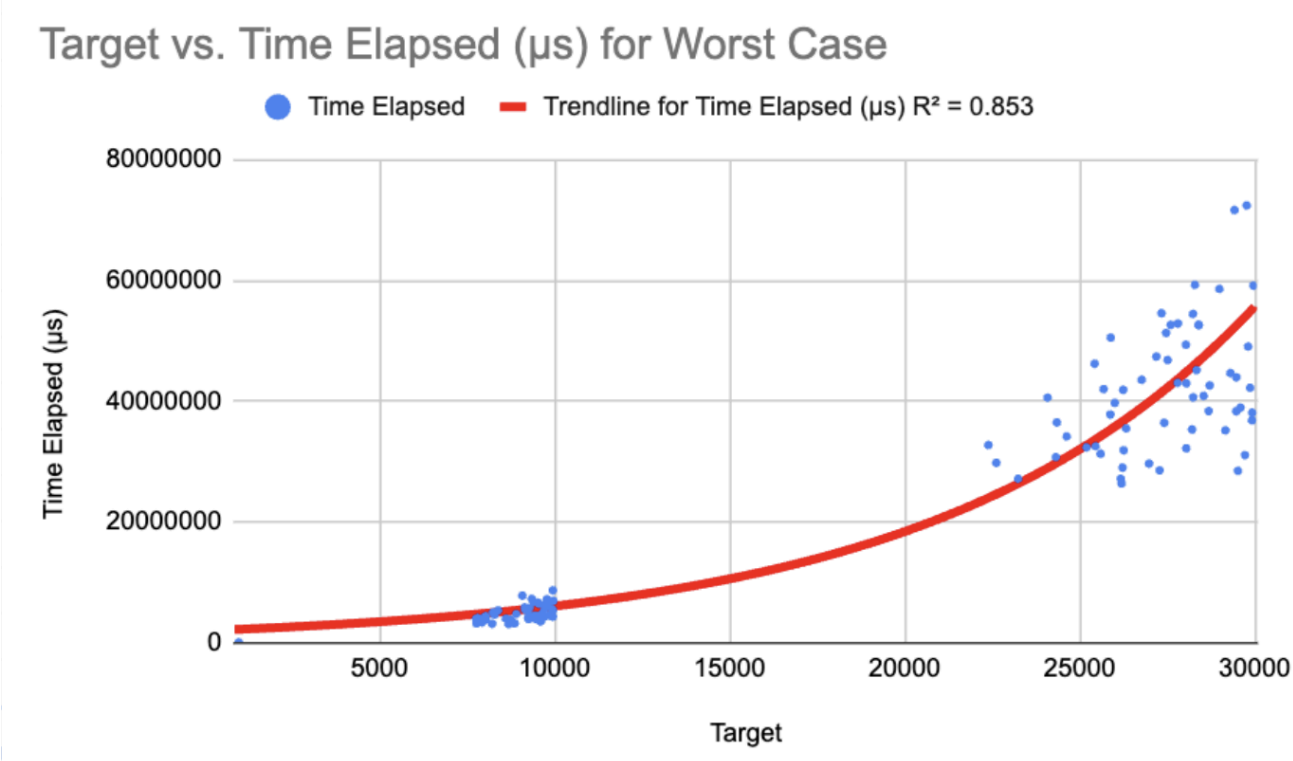
Number of Types of Coins vs. Time Elapsed (µs) for Problems with Solutions



Number of Types of Coins vs. Time Elapsed (µs) for Worst Case




Target vs. Time Elapsed (µs) for Problems with Solutions
2645
Trendline for Time Elapsed (µs) R² = 0.883
2500000
2000000
1500000
1000000
500000
0
Time Elapsed (µs)
5000
10000
15000
20000
25000
30000
Target


Target vs. Time Elapsed (µs) for Worst Case
Time Elapsed
Trendline for Time Elapsed (µs) R² = 0.853
80000000
60000000
40000000
20000000
0
Time Elapsed (µs)
5000
10000
15000
20000
25000
30000
Target