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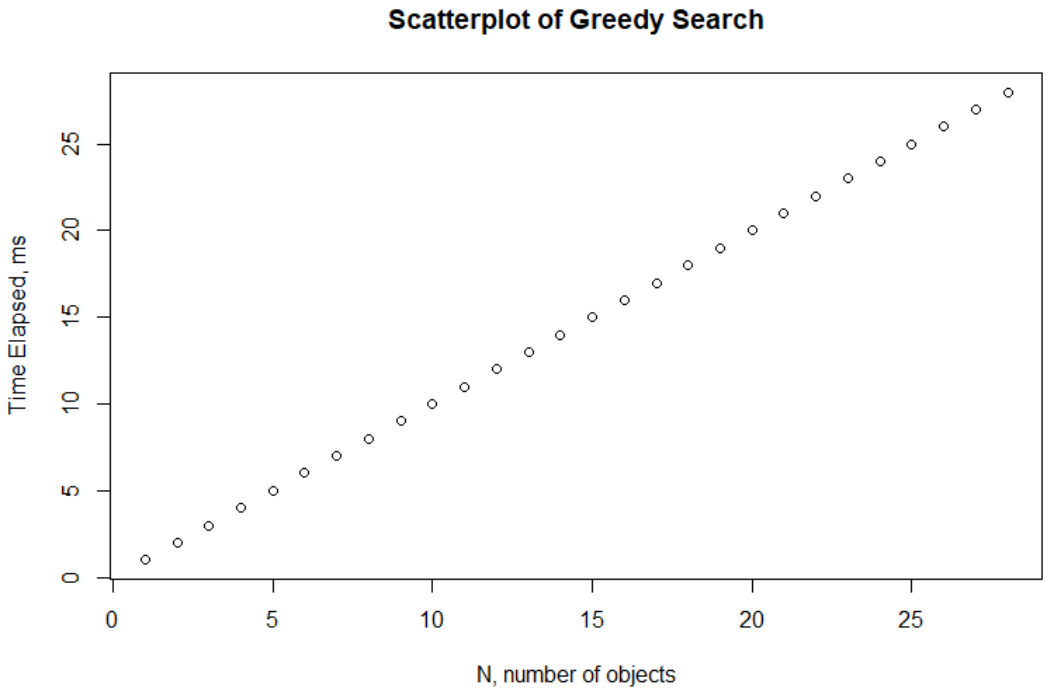
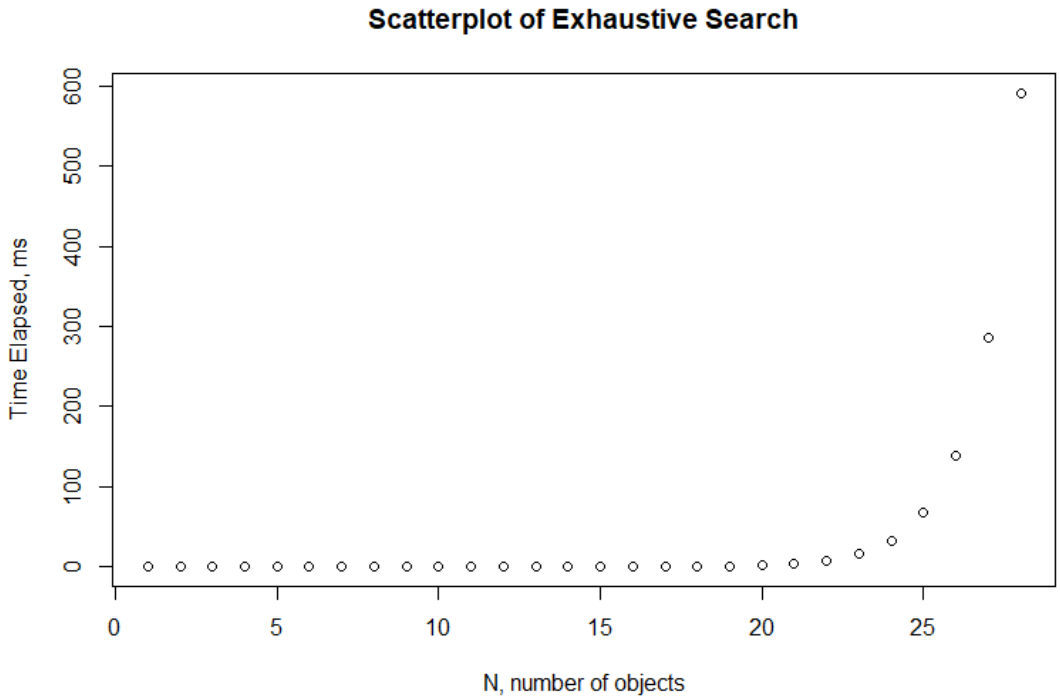
# Project 2 - Greedy vs Exhaustive



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There is a notable difference in the speed of algorithms, with the Greedy Algorithm completing within hundreths of a second where n = number of rides in the input vector $< 30$, while the Exhaustive Algorithm would complete after several minutes with the same n. This is surprising given the dramatic difference in completion speed.

Our empirical analyses are consistent with our mathematical analyses, given that at n=28, the Big-*O* efficiency classes of the two algorithms are:

Greedy Algorithm = $n^2 = 28^2 = 784$
Exhaustive Algorithm = $2^n * n = 2^{28} * 28 = 7{,}516{,}192{,}768$

This would suggest such an extreme difference in completion time as seen by our actual test cases. This presented evidence is consistent with both of our initial hypotheses. Specifically, it is consistent with Hypothesis 1, as the Exhaustive Search method would not only produce correct outputs, but could even produce a more efficient output than the Greedy Search. As shown by our scatterplots, the results of the data of the Greedy Search showed that there is a linear, positive relationship between the number of inputs as time elapsed. As stated earlier, the Big-O efficiency of the Greedy Algorithm is $n^2$ which, given the scatterplot, best illustrates both the empirical and mathematical analysis by showing a positive slope.

However, our findings are also consistent with Hypothesis 2, as our Exhaustive Search algorithm, having an exponential running time, produces output after significantly long run times - to the point that using the algorithm to its maximum potential input of n=64 is unrealistic due to it's long time to completion. In the case of the scatterplot of the Exhaustive Search, there is a steep curve that is best described as being almost elliptical in nature in which there is a close, almost straight edge along the x-axis before it rises steeply in a positive slope.