PROJECT 2: Greedy versus Exhaustive

Submitted by:

ABIOLA GODO
Abiola@csu.fullerton.edu

Following are the two figures showing estimated time taken of the two given algorithms.

These results are taken by averaging 10 separate result values.

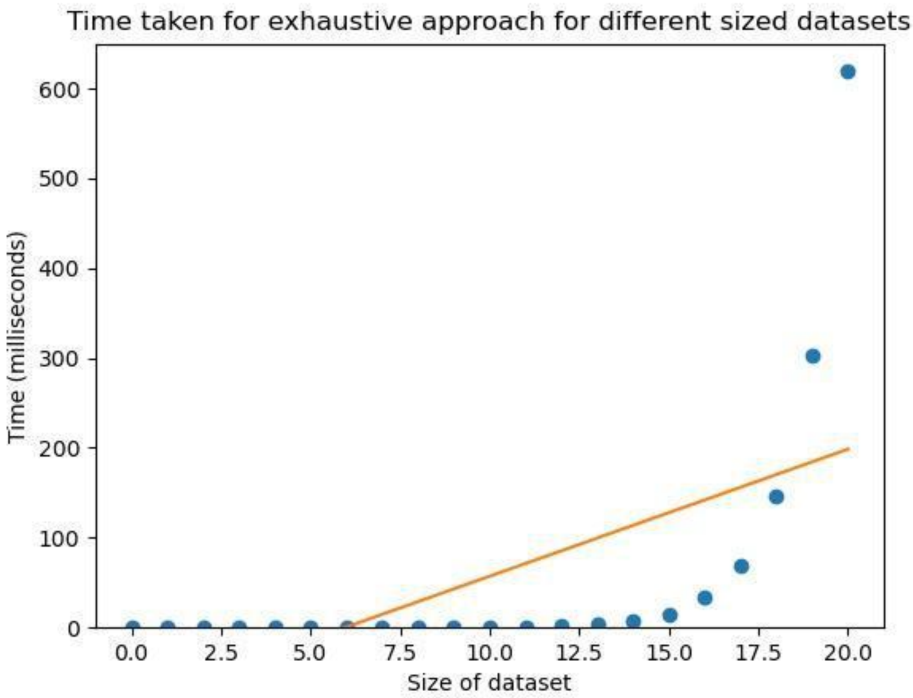

Figure 1: Time taken by the exhaustive algorithm for different values of n

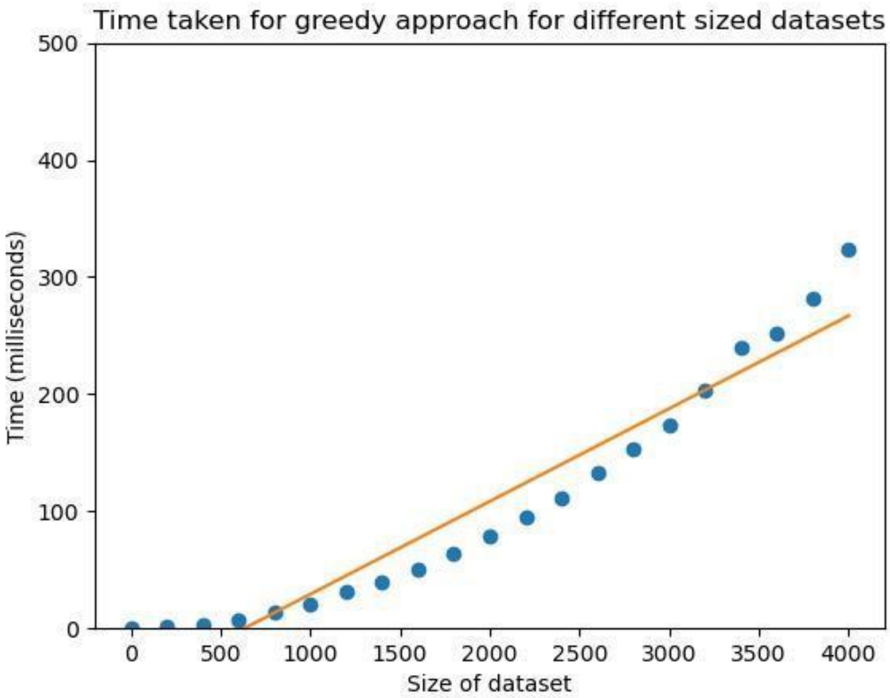

Figure 2: Time taken by the greedy algorithm for different values of n

Following are the answers of the asked questions.

a. Is there a noticeable difference in the performance of the two algorithms? Which is faster, and by how much? Does this surprise you?

   Yes, There is a noticeable difference in the performance of the two algorithms. The greedy approach gives answers so fast, but the exhaustive approach can not even run for the big size of input data. The Exhaustive approach always gives the best answer. On the other hand, the greedy approach gives either the best answer or a god answer, most of the time which is close to the best answer.

b. Are your empirical analyses consistent with your mathematical analyses? Justify your answer.

   From figure 1 and figure 2, we can have an idea about the complexity and runtime of those two algorithms. In the greedy approach, the time complexity is $O(n^2)$. Because in each loop, we have tried to find the value with the ratio possible ratio of time/cost. And er ran the loop n times. Thus the complexity becomes $\mathbf{O(n^2)}$. For the exhaustive approach, we considered all possible subsets of the dataset which has complexity of $O(2^n)$. And then we calculated output for all the subsets, which has a complexity of $O(n)$. Thus the total complexity of this algorithm becomes $\mathbf{O(n.2^n)}$. From the scatter plot of the greedy approach, we can see that the growth of the numbers can be related to $O(n^2)$. If we take the ratio of time/n^2, we will get time/n^2 ← constant for the each point in the scatter plot. On the other hand, by seeing the scatter plot of the exhausting approach, we can see its very fast growth. Also here, we will get a constant value if we take the ratio of time/$n.2^n$ for all the points on the graph. That provides strong proof of empirical analysis with respect to mathematical analysis.

c. Is this evidence consistent or inconsistent with hypothesis 1? Justify your answer.

   The first part of the hypothesis is wrong, though the second part is correct. It is true that an exhaustive search algorithm can always give the correct and optimal output, because it searches through all possible possibilities. But this is not feasible for implementation because of its so large complexity.

d. Is this evidence consistent or inconsistent with hypothesis 2? Justify your answer.

   Hypothesis 2 is totally correct. An exhaustive search algorithm is so slow that it can not be used for a bit of large data input. If we consider the problem of ours, it takes more than 10 minutes when the size of the input is greater than 40, which is not practical to use.