Project Four: Food Pantry Part 2

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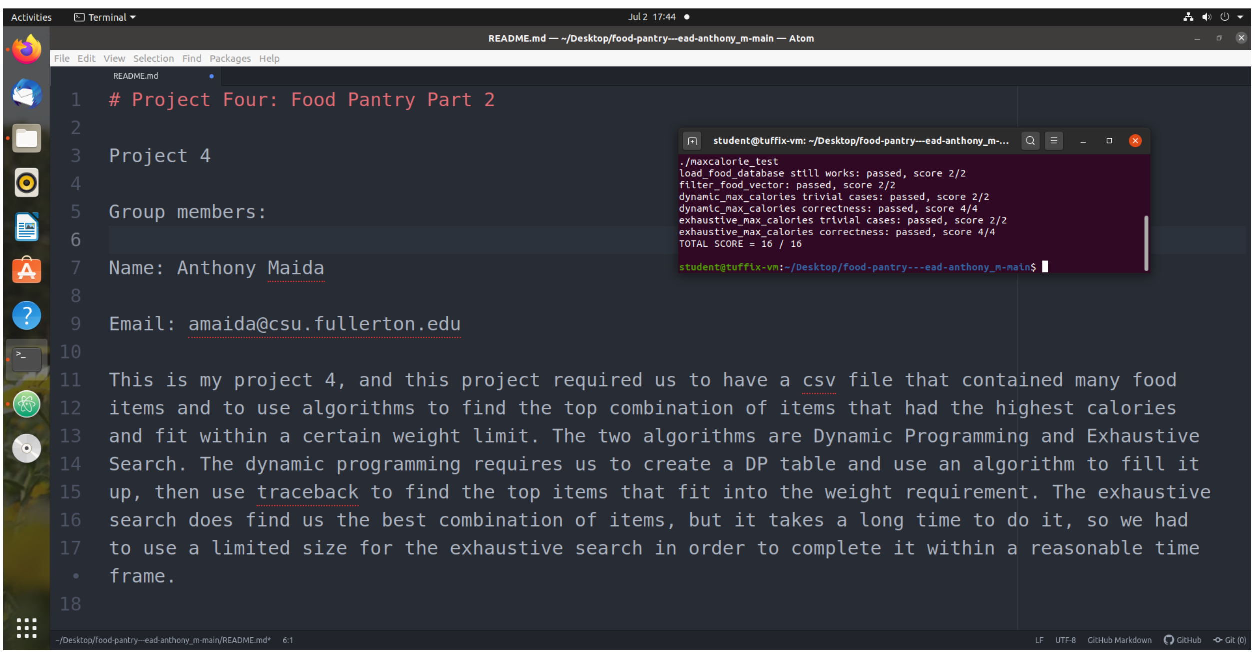
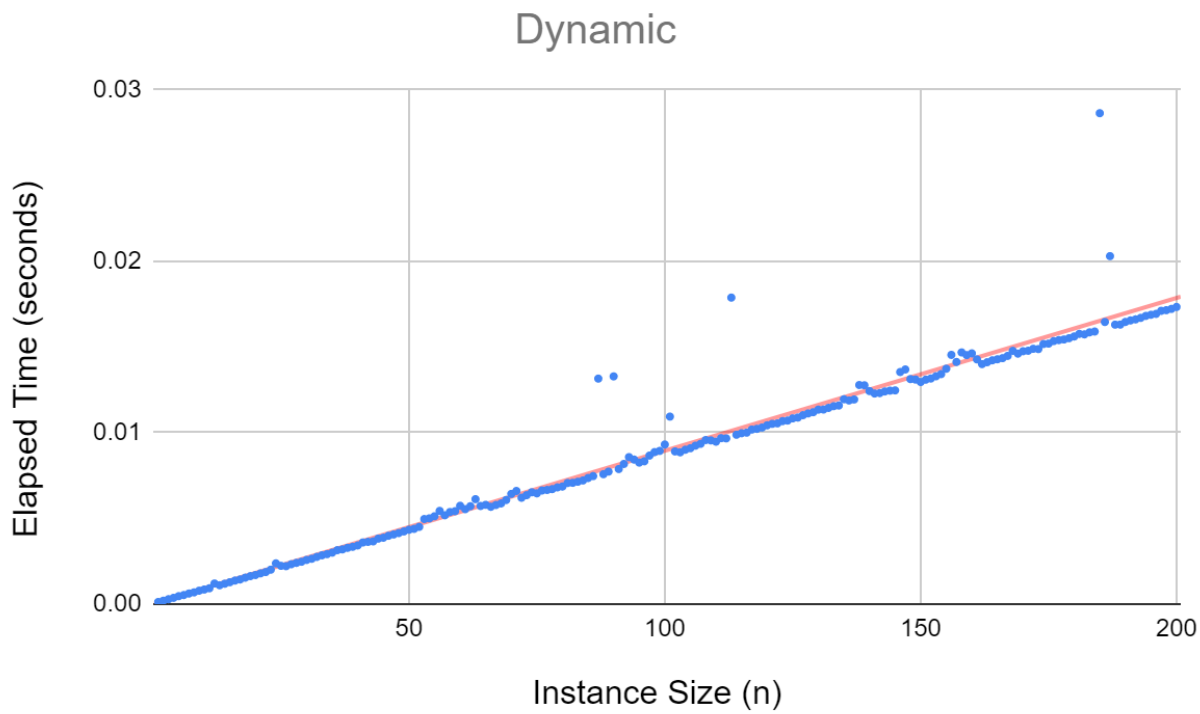
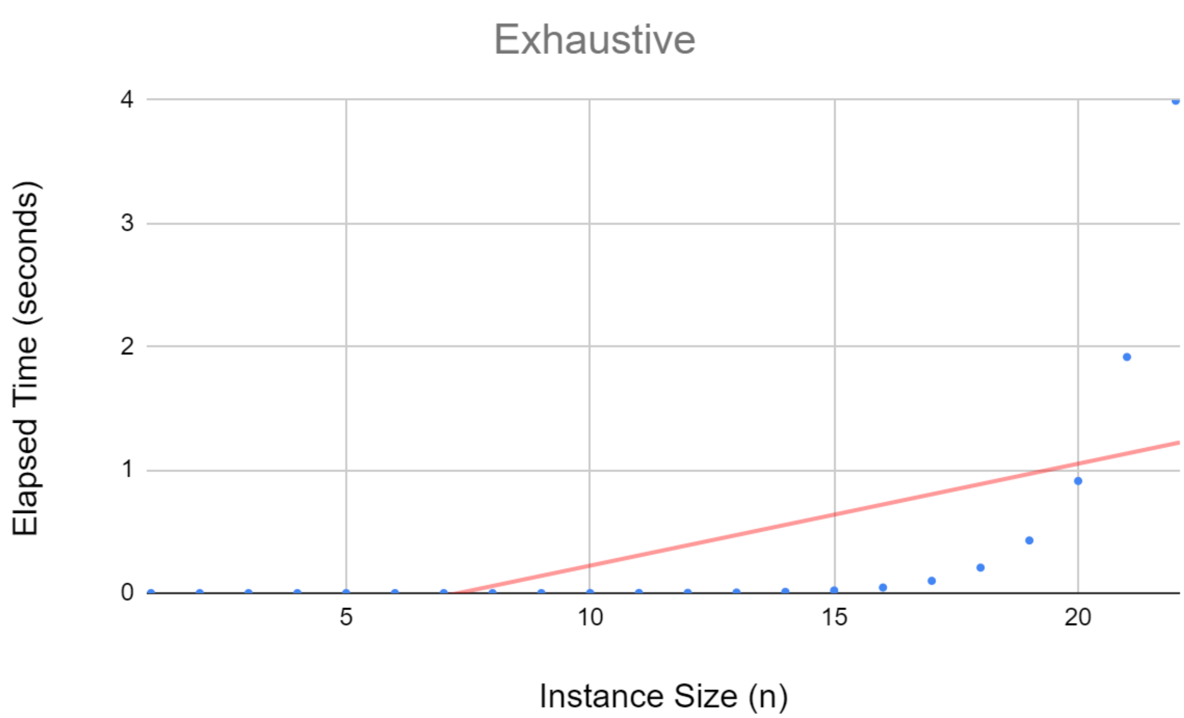
This is my project 4, and this project required us to have a csv file that contained many food items and to use algorithms to find the top combination of items that had the highest calories and fit within a certain weight limit. The two algorithms are Dynamic Programming and Exhaustive Search. The dynamic programming requires us to create a DP table and use an algorithm to fill it up, then use traceback to find the top items that fit into the weight requirement. The exhaustive search does find us the best combination of items, but it takes a long time to do it, so we had to use a limited size for the exhaustive search in order to complete it within a reasonable time frame.

Atom Screenshot in Tuffix:



Scatter Plots:





Questions And Answers:

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

There is a noticeable difference in the performance of the two algorithms. The dynamic is much faster and it is by around a little under 4 seconds, based on the scatter plots. This does not surprise me because dynamic is meant to be faster with an O(nW).

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

The empirical analysis is consistent with the mathematical analysis. Plugging in the values for n into our mathematical formulas show that they are consistent. Also looking at the scatter plot also shows how similar it is to our formula. The Exhaustive has an O(2^n *n), which really shows why it gets so steep as the n increases, and is why it also makes sense for the dynamic and how consistent they are with an O(nW).

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

The evidence is consistent with the statement that exhaustive search algorithms are feasible to implement, and produce correct outputs. It is a simple format to follow and straightforward with what you plug in to the algorithm. It does produce correct outputs because it looks through every possible combination of items to get you the best results.

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

The evidence is also consistent with the statement that algorithms with exponential running times are extremely slow, probably too slow to be of practical use. Our scenario for using exhaustive search didn't have us using too much data, but in scenarios with a lot of data, it would take much longer to give a result, compared to using dynamic programming and creating a DP table.

Step Count:

Dynamic Programming Algorithm:

7nW +7n + W + 35 ∈ O(2^n + n)

Exhaustive Algorithm:

30 * 2^n +10n * 2^n + 10n + 35 ∈ O(2^n + n)