Project #4 Report

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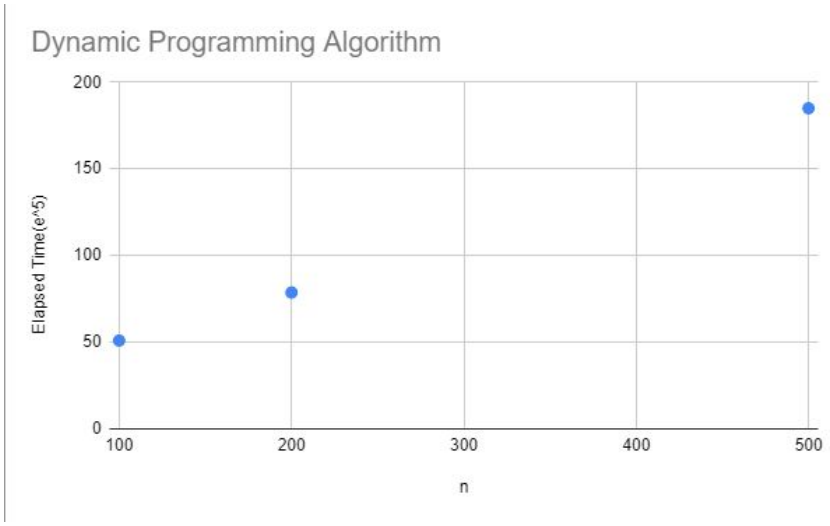
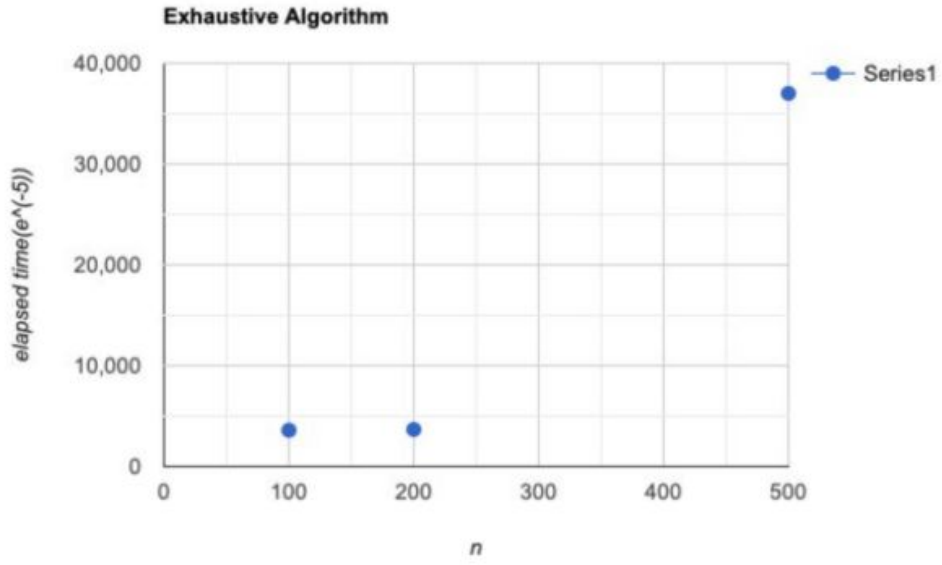
Scatter Plots:

Dynamic Programming Scatter Plot

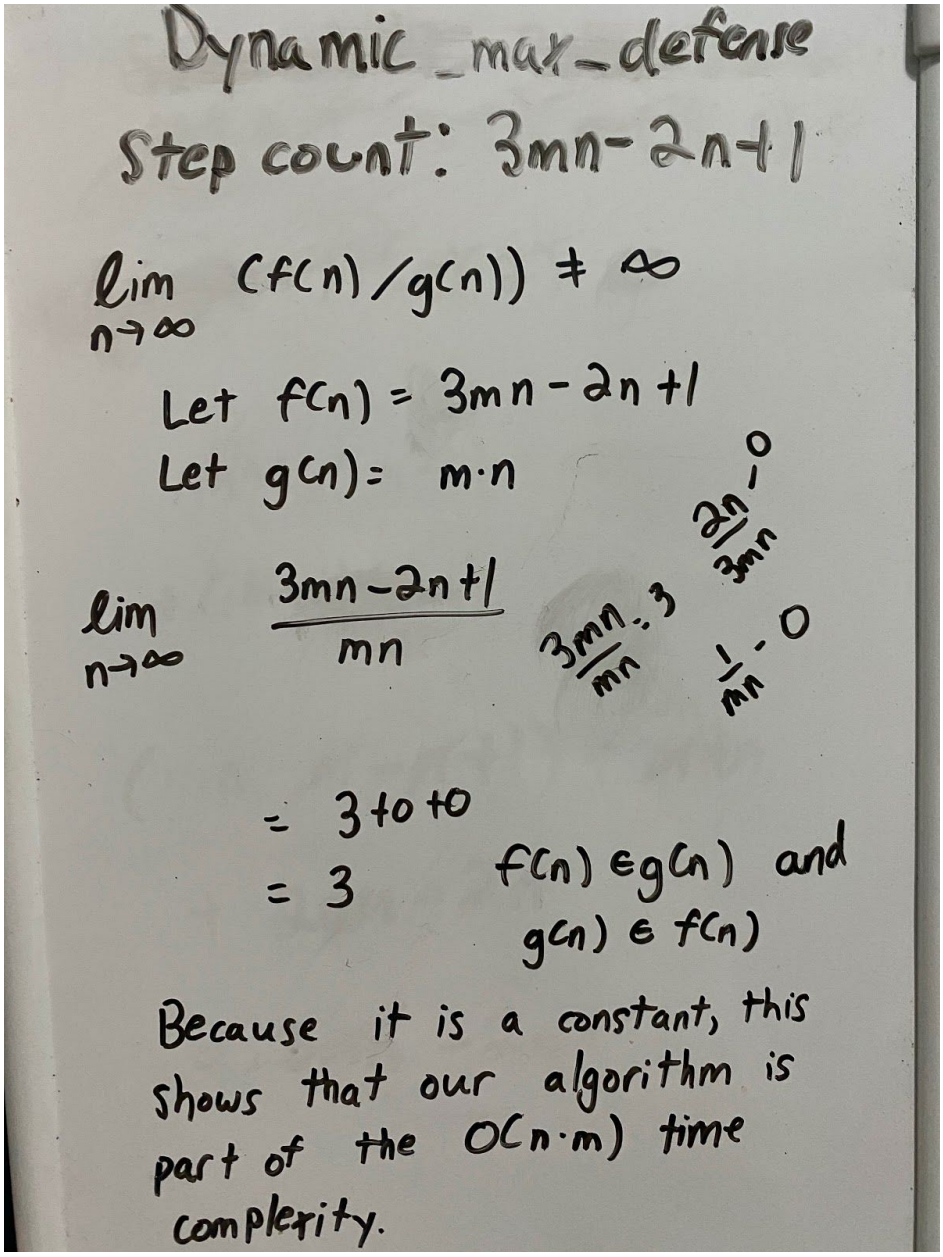


Exhaustive Scatter Plot



Mathematical Analysis:

Dynamic Programming:



Exhaustive:

Two functions, f(n) and g(n), such that $0 <= f(n) <= C\ (g(n))$.

$0 <= 5n(2^n) + 5(2^n) + 5n + 21 <= C(2^n)$, $C >= 21$.

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?

There is a noticeable difference in the performance between the dynamic programming and exhaustive algorithm. The dynamic programming algorithm is a lot faster than the exhaustive algorithm because there was less computing needed for the dynamic programming algorithm. This is not surprising because the time complexity of the

dynamic programming algorithm is O(n*m), while the exhaustive algorithm is O(2^n * n). This means that the dynamic programming algorithm is faster than the exhaustive algorithm.

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

Yes, our empirical analyses were consistent with our mathematical analyses. Based on the scatter plots, we can already conclude that the exhaustive algorithm is slower than the dynamic algorithm. This justifies our answer on the computation times between the two algorithms. For the exhaustive algorithm, we can see that the empirical analysis follows an exponential distribution, which is consistent with our mathematical analyses stating that it is a O(2^n*n) time complexity. For the dynamic programming algorithm, we also see that the empirical analysis follows more of a linear distribution, which is consistent towards the O(n*m) time complexity we calculated earlier.

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

Yes, the evidence is consistent with hypothesis 1. Exhaustive algorithms are easily implemented but the downside is that they also take extremely long to execute. Based on the code, the exhaustive algorithm was able to produce correct results in exchange for a longer amount of time.

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

Yes, the evidence is consistent with hypothesis 2. Our dynamic programming algorithm proved to be faster than the exhaustive algorithm, with a time complexity of O(2^n*n), based on the results of the scatter plots above. We can see that the exhaustive algorithm takes an exponential amount of time compared to the dynamic programming algorithm.