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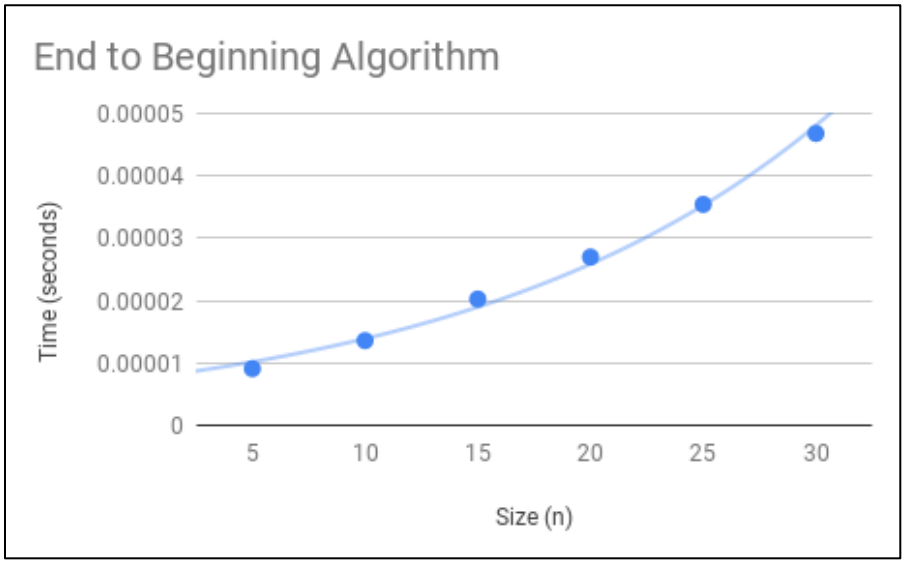
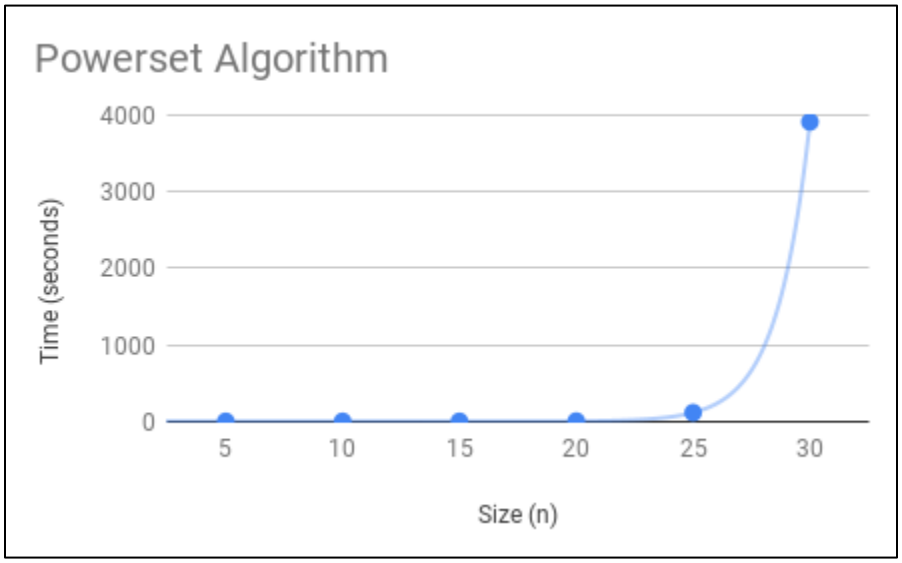
335 Project 2

Empirical Analysis

Scatterplots





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Pseudocode

End to Beginning

```
end_to_beginning(sequence A)
    n = size of A
    vector H set to all zeros
    for i from n-2 to 0 //decrement
        for j from i+1 to n //increment
            if A[j] is larger than A[i]
                and H[i] is less than or equal to H[j]
            H[i] = 1 + that numbers H value

    max = max element in H
    vector R of size max

    index = max - 1
    j = 0

    for i from 0 to n //increment
        if H[i] == index
            R[j] = A[i]
            index--
            j++

    return sequence(R)
```

Powerset

```
powerset(sequence A)

    n = size of A
    sequence best

    while (true)
        generate candidate
        if cand is increasing and size of candidate is larger than best
            best = candidate

    return best
```

The efficiency class for the End to Beginning algorithm is $O(n^2)$ and the efficiency class for the Powerset algorithm is $O(n \cdot 2^n)$.

There is a noticeable difference in speed of each algorithm. The End to Beginning algorithm is way faster than the Powerset algorithm. This does not surprise me because the Powerset is an exhaustive optimization algorithm which means it needs to generate every single candidate (powerset) to find the longest increasing subsequence.

The best fit lines on my scatter plots are consistent with these efficiency classes because the End to Beginning scatterplot clearly shows a quadratic line and the Powerset scatterplot shows a much faster growing line, exponentially faster.

The data supports the hypothesis because the exhaustive search algorithm used here was implemented correctly and produced correct outputs. Also, the Powerset algorithm took an extremely long time to find the longest increasing subsequence; it is too slow for practical use.