

REPORT FOR 1DV516  
PROGRAMMING ASSIGNMENT 4  
ALGORITHMS AND ADVANCED DATA STRUCTURES

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# 1 Problem 4 - Dijkstra vs Bellman-Ford

To test the difference in between the two algorithms, I created a simple benchmark that generates a graph with random weights and then runs both algorithms on the graph. The benchmark is run 10 times, from the sizes 100 to 1,000 and the average time is calculated.

## 1.1 Expectations

Since we create a very dense graph (all edges are initialised with a random number), the Bellman-Ford algorithm is expected to be slower than Dijkstra's algorithm. This is due to the fact that Bellman-Ford has a time complexity of  $O(|V| \cdot |E|)$ , which means it has to iterate over all edges and vertices. This leads to the worst case scenario for the Bellman-Ford algorithm and can lead to  $O(V^3)$  time complexity.

## 1.2 Results

The results show that, as expected, the Bellman-Ford algorithm is slower than Dijkstra's algorithm. The results can be seen in figure 1. The results also show that the Bellman-Ford algorithm is slower than Dijkstra's algorithm, even for small graphs. This is due to the fact that the Bellman-Ford algorithm has to iterate over all edges and vertices, which is not the case for Dijkstra's algorithm.

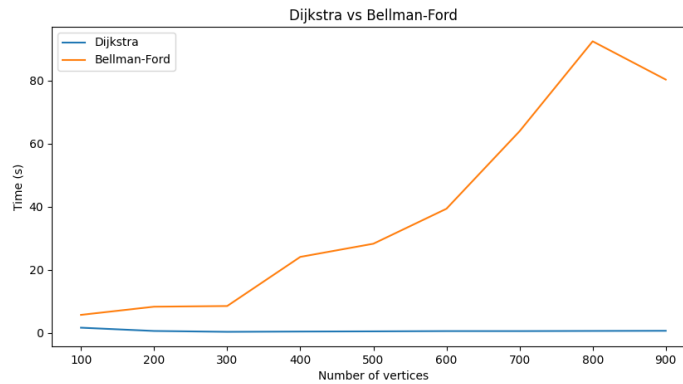


Figure 1: Dijkstra vs Bellman-Ford