# EE2T21 bonus assignment 2

Christian van den Berg, Marijn Adriaanse & Guus Dohmen

### The assignment:

The goal of this assignment is to calculate the optimal path in an Erdös Rényi random graph using the Bellman-Ford pathfinding algorithm. To accomplish this we have chosen to use Python, due to the familiarity and easy of use of this language. For performance reasons we’ve investigated a possible conversion of the code to C, however the choice was made not to develop this further due to time constraints.

### How to run the program:

We have precalculated all the data for the program, since it takes about 30 minutes to compute everything. The results of the experiment can be found in the CSV file.

### The results:

Below the graph of the number of vertices versus the time it takes to calculate the path. The algorithm performs V-1 iterations, in which it iterates through E≈<k>V edges. This means the total time complexity of the algorithm is O(VE)=O(V²<k>). As <k> is constant throughout the simulations, this means the duration should be linearly proportional to the V². By taking V=2^z, we find a time complexity of O((2^z)²)=O(4^z) in relation to z. This is an exponential relationship between the number of nodes and the time spent on the calculation, which can also be seen in the graph below.

Chart, line chart

Description automatically generated