Homework 06: Weighted Graphs

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Exercise 1

Implement the array-based version of the Dijkstra's algorithm.

The implementation of the array-based version of the Dijkstra's algorithm can be found in the code `src/dijkstra.c` in the function `dijkstra`.

Exercise 2

Implement the binary heap-based version of the Dijkstra's algorithm by using the library `binheap` that was developed during Lesson 6, Lesson 7 and Lesson 8.

The implementation of the heap-based version of the Dijkstra's algorithm can be found in the code `src/dijkstra.c` in the function `dijkstra_heap`. In order to build a priority queue based on a heap I used the implementation of the binary heap done in the Homework 02, which provides an array-based implementation of binary heaps.

Exercise 3

Test the implementations on a set of instances of the problem and compare their execution times.

Once provided the correctness of the previous two implementations I proceeded to test the performance of these two versions of the Dijkstra's Algorithm. The following plot in Figure 1 reports the result.
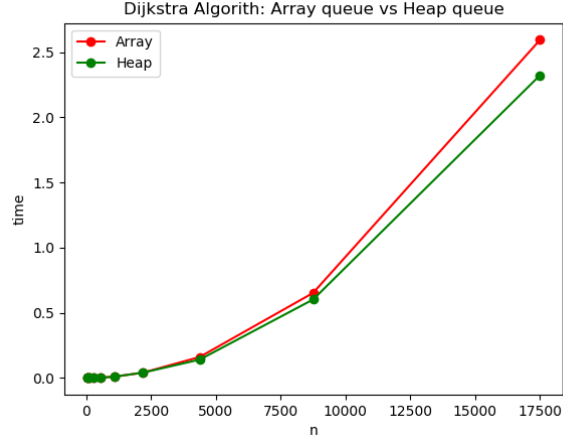
Figure 1: Time performance of the two implementations of the Dijkstra's Algorithm

The plot shows that the heap version performs better than the array version, especially for larger sizes. This is expected, since the asymptotic complexity of the first version is $\Theta(|V|^2 + |E|)$, while the second is $O((|V| + |E|) \cdot \log(|V|))$ [1].

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[1] $|V|$ and $|E|$ are respectively the number of the vertex and the edges inside a graph.