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1. [10 points] In the PDF report, explain the time complexity of both implementations of the algorithm by showing and summing up the complexity of each subsection of your code.

Heap implementation

Get_next= $O(\log(V))$

Update_key = $O(V)$

Dijkstra runs V times

Update key runs $O(V^2)$ at the worst case

In total $O(V^3)$ because of the update key

Bad for highly connected components

Array implementation

Get_next= $O(V)$

Update_key = $O(1)$

Dijkstra runs V times

Update key runs $O(V^2)$ at the worst case

Get_next is run V times

In total $O(V^2)$ because of the update key

[20 points] For Random Seed 42 – Size 20, Random Seed 123 – Size 200 and Random Seed 312 – Size 500: include a screenshot in your PDF report showing the shortest path (if one exists) for each of the three source–destination pairs (see the images included at the bottom of this document).

- For Random seed 42 – Size 20, use node 7 (the left–most node) as the source and node 1 (on the bottom toward the right) as the destination, as in the first image below.