PDM - Assignment1

Graph Search

Xiaotong Li 5965373

November 2023

Contents

1 Graph Search

Consider a directed graph $G = (V, E)$, with distances $d(e)$ for each $e \in E$, and consider two nodes $s, t \in V$. For each node v we define the function $P_s(v)$, which gives the length of the shortest path from s to v. Similar we define the function $P_t(v)$, which gives the length of the shortest path from v to t.

1.1 Question1.1

Show that for every edge $e = (u, v)$, the length of the shortest path from node s to node t that uses the edge e is $P_s(u) + d(e) + P_t(v)$.

Answer: Since G is a directed graph, so if you want to get to node t via edge $e = (u, v)$ from node s, you must first get to node u from node s, then get to node t from node v. Since $d(e)$ is fixed, it is obvious that the shortest path from s to t is $P_s(u) + d(e) + P_t(v)$.

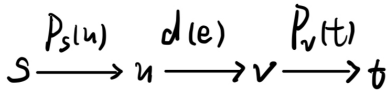

Figure 1: Shortest path from s to t

1.2 Question1.2

Let Q be the shortest path between the nodes s and t. Use the property obtained in Question 1.1, to propose an algorithm that finds the second shortest path from s to t (i.e., considering all paths that are not exactly equal to Q)

Answer: My algo

2 Map to Graph

3 Dijkstra and A*

3.1 Question3.1

3.2 Question3.2

3.3 Question3.3

4 Dijkstra

4.1 Question4.1

4.2 Question4.2