**Lab 3: “Backwards” Dijkstra**

Graph with 5 vertices and 6 edges:

5 6

0 0 1

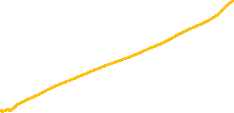
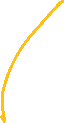
0 1 7

1 2 2

2 1 1

1 3 8

2 3 5



**Example 1**

**start:** 0

**end:** 3

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Step** | **queue** | **previous** | **distances** | **visited** | **current** | **next** | **cost** | **distance** |
| init | [3:0] | |  |  |  |  |  | | --- | --- | --- | --- | --- | | 0 | 1 | 2 | 3 | 4 | | - | - | - | - | - | | |  |  |  |  |  | | --- | --- | --- | --- | --- | | 0 | 1 | 2 | 3 | 4 | | ∞ | ∞ | ∞ | 0 | ∞ | | {3} | - | - | - | - |
| 1 | [] | ^ | ^ | ^ | 3 | - | - | - |
| 1.1 | [1:8] | |  |  |  |  |  | | --- | --- | --- | --- | --- | | 0 | 1 | 2 | 3 | 4 | | - | 3 | - | - | - | | |  |  |  |  |  | | --- | --- | --- | --- | --- | | 0 | 1 | 2 | 3 | 4 | | ∞ | 8 | ∞ | 0 | ∞ | | {1, 3} | ^ | 1 | 8 | 8 |
| 1.2 | [1:8, 2:5] | |  |  |  |  |  | | --- | --- | --- | --- | --- | | 0 | 1 | 2 | 3 | 4 | | - | 3 | 3 | - | - | | |  |  |  |  |  | | --- | --- | --- | --- | --- | | 0 | 1 | 2 | 3 | 4 | | ∞ | 8 | 5 | 0 | ∞ | | {1, 2, 3} | ^ | 2 | 5 | 5 |
| 2 | [1:8] | ^ | ^ | ^ | 2 | - | - | - |
| 2.1 | ^ | |  |  |  |  |  | | --- | --- | --- | --- | --- | | 0 | 1 | 2 | 3 | 4 | | 1 | 2 | 3 | - | - | | |  |  |  |  |  | | --- | --- | --- | --- | --- | | 0 | 1 | 2 | 3 | 4 | | 15 | 7 | 5 | 0 | ∞ | | ^ | ^ | 1 | 2 | 7 |
| 3 | [] | ^ | ^ | ^ | 1 | - | - | - |
| 3.1 | [0:14] | |  |  |  |  |  | | --- | --- | --- | --- | --- | | 0 | 1 | 2 | 3 | 4 | | 1 | 2 | 3 | - | - | | |  |  |  |  |  | | --- | --- | --- | --- | --- | | 0 | 1 | 2 | 3 | 4 | | 14 | 7 | 5 | 0 | ∞ | | {0, 1, 2, 3} | ^ | 0 | 7 | 14 |
| 4 | [] | ^ | ^ | ^ | 0 | - | - | - |

**^** = unchanged

After step 4 the path is created following the vertices in *previous* as follows: 0 -> 1 -> 2 -> 3

**Example 2**

**start:** 0

**end:** 4

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Step** | **queue** | **previous** | **distances** | **visited** | **current** | **next** | **cost** | **distance** |
| init | [4:0] | |  |  |  |  |  | | --- | --- | --- | --- | --- | | 0 | 1 | 2 | 3 | 4 | | - | - | - | - | - | | |  |  |  |  |  | | --- | --- | --- | --- | --- | | 0 | 1 | 2 | 3 | 4 | | ∞ | ∞ | ∞ | ∞ | 0 | | {4} | - | - | - | - |
| 1 | [] | ^ | ^ | ^ | 4 | - | - | - |

Because vertex 4 doesn’t have any inbound edges and there’s no vertices left in the queue the algorithm stops and the result is an empty path which means the path is not possible.

**Example 3**

**start:** 4

**end:** 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Step** | **queue** | **previous** | **distances** | **visited** | **current** | **next** | **cost** | **distance** |
| init | [1:0] | |  |  |  |  |  | | --- | --- | --- | --- | --- | | 0 | 1 | 2 | 3 | 4 | | - | - | - | - | - | | |  |  |  |  |  | | --- | --- | --- | --- | --- | | 0 | 1 | 2 | 3 | 4 | | ∞ | 0 | ∞ | ∞ | ∞ | | {1} | - | - | - | - |
| 1 | [] | ^ | ^ | ^ | 1 | - | - | - |
| 1.1 | [0:7] | |  |  |  |  |  | | --- | --- | --- | --- | --- | | 0 | 1 | 2 | 3 | 4 | | 1 | - | - | - | - | | |  |  |  |  |  | | --- | --- | --- | --- | --- | | 0 | 1 | 2 | 3 | 4 | | 7 | 0 | ∞ | ∞ | ∞ | | {0, 1} | ^ | 0 | 7 | 7 |
| 1.2 | [0:7, 2:1] | |  |  |  |  |  | | --- | --- | --- | --- | --- | | 0 | 1 | 2 | 3 | 4 | | 1 | - | 1 | - | - | | |  |  |  |  |  | | --- | --- | --- | --- | --- | | 0 | 1 | 2 | 3 | 4 | | 7 | 0 | 1 | ∞ | ∞ | | {0, 1, 2} | ^ | 2 | 1 | 1 |
| 2 | [0:7] | ^ | ^ | ^ | 2 | - | - | - |
| 2.1 | ^ | ^ | ^ | ^ | ^ | 1 | 2 | 3 |
| 3 | [] | ^ | ^ | ^ | 0 | - | - | - |
| 3.1 | ^ | ^ | ^ | ^ |  | 0 | 1 | 8 |

Because there’s no vertices left in the queue and the start vertex hasn’t been reached the algorithm returns an empty path which means the path is not possible.