COMS2003: Application and Analysis of Algorithms II

A^3 Assignment

August 10, 2014

1 Question 2: Almost shortest path - 50 marks

One task that GPS's perform a lot is finding the shortest path between two points. The problem with this is that lots of people are using the same GPS, meaning that many people find the same route, causing a lot of traffic on this route. You would like to find the shortest path between two points that does not use any edges from the actual shortest path, because you would like to avoid the traffic but still use a short path. The easiest way to accomplish this is to find the shortest path first, and then remove all the edges that are on the shortest path. Then, in the new graph that has had some of its edges removed, perform the shortest path algorithm again, yielding the shortest path that does not use any edges from the original shortest path.

2 Input

You will be given input in the same form as the weighted graphs in the labs, except that the first line will have three parameters - the number of vertices in the graph, the vertex we want to find the shortest path from, and the vertex we want to find the shortest path to.

```
11,0,7
0,1,20
0,5,10
1,2,5
1,5,11
1,6,5
6,2,5
2,7,10
2,3,50
3,8,9
4,5,12
5,6,30
6,7,4
7,8,4
5,9,16
5,10,12
10,6,1
10,7,8
-1
```

3 Output

You must output a list of vertices defining the path from the source vertex to the target vertex. In the input given above, we are trying to find the almost shortest path from vertex 0 to vertex 7. The algorithm should first find the path 0,5,10,6,7 as this is the shortest path in that graph (try to confirm this by hand). Then, it should remove all the edges on this path and rerun the shortest path algorithm, so that it ends up with the following output:

```
0
1
2
7
```