Programming Assignment 1

(100 points)

Assigned Date: Thursday, February 16, 2017

Due Date: 4:00 PM Thursday, March 2, 2017

Educational Goal

Become familiar with informed search strategies.

Requirements

Implement the Greedy Search and A* Search on a typical path finding problem. Nodes and connections are given by file pa1.in (this file always in the same directory as source code).

The path finding problem is:
Given a graph contains n nodes and several one-way connections, all connections have distances at least 1.
Initial State: Cursor at the first node of the graph(node 0)
Goal State: Cursor at the last node of graph(node n-1)
You can move cursor from one node 'a' to another node 'b' as long as there is a connection from 'a' to 'b'.
The cost of the move is the distance of the connection.
Report the solution path which is the moves from the Initial State to the Goal State.

You can use the Sample Input in the following section as "pa1.in" file to test your program. When grading your assignment, TA will use another "pa1.in" file which contains a different graph.

- Greedy Search: Search in an order imposed by a heuristic function, measuring cost to go.
  Heuristic function h —— A function of the current state to the goal state, not the moves from initial state to current state.
  Design a reasonable h function to make your program be able to find a low cost path.

- A* Search: Search in an order imposed by f = g + h. Which g = distance from start and h = estimated distance to goal. A* can find an optimal solution if h never over estimates.
  Design another h function to make your program be able to find an optimal(lowest cost) path.

- You should NOT use the same h function for both search algorithm.

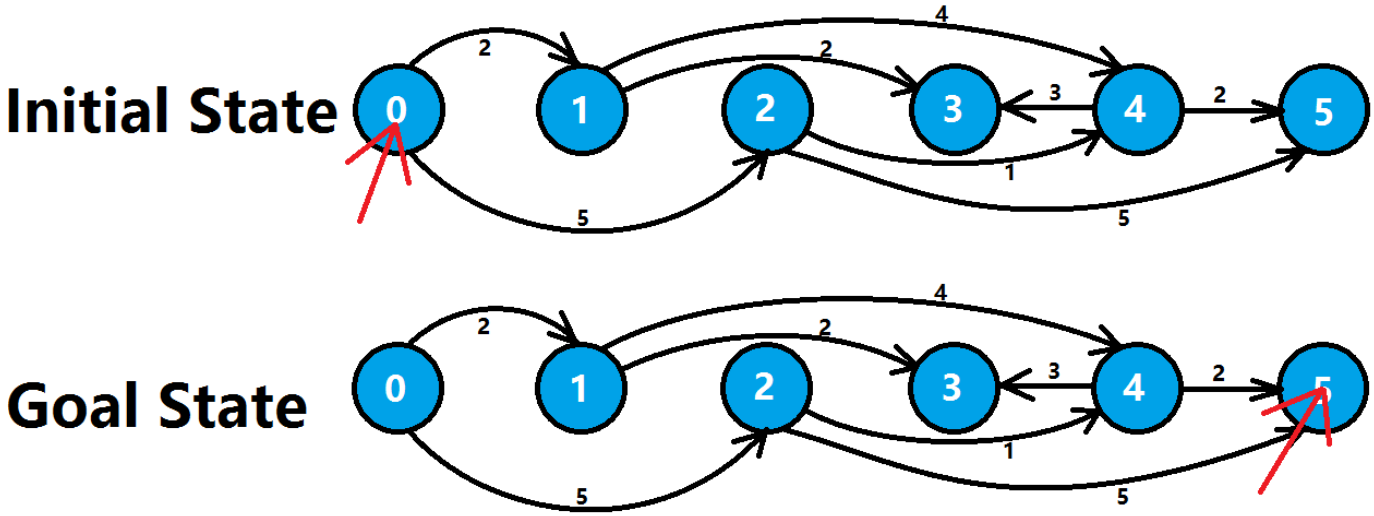
Input

The first line includes an integer which is the number of nodes in the graph.
The following lines contain sets of numbers (a b c) which means a path from a to b with distance c.

Output

The first line is a path from node 0 to the last node searched by Greedy Search.
The second line is a path from node 0 to the last node searched by A* Search.

All nodes are spread by ">".



Sample Input

```
6                <- There is totally 6 nodes which is 0,1,2,3,4,5
0 1 2            <- A path from node 0 to 1 which distance is 2.
0 2 5            <- All following lines have the same format
1 3 2
1 4 4
2 4 1
2 5 5
4 3 3
4 5 2
```

Sample Output

```
0>2>5            <- This line depends on how you set up heuristic function, not fixed.
0>1>4>5          <- This line should always be same if run your program with the sample input.
```

Submission Requirements

1. Your program should be well-documented. Variable names and function names should be self-descriptive. Major functions should be explained clearly in comments. The program outputs should be presented in a clear sequence.
2. Turn in the paper copy and soft copy of all the files of this assignment(Source code, a txt file contains a copy of your program output with the sample input, and a readme file if you need explain something). Submit a single zipped file of all the files of this assignment through your UMassOnline account. Submit the paper copy along with the cover page in class. Paper copy should be bound firmly together as one pack (for example, staple, but not limited to, at the left corner). 5 points will be deducted for unbounded homework.
3. Name your file with AI_ lastname_firstname_pa1. For example, student John Smith should name his file as AI_Smith_John_pa1.zip.
4. No hard copies or soft copies results in 0 points.