Homework 10 : Algorithms and Data Structures

Digdarshan Kunwar

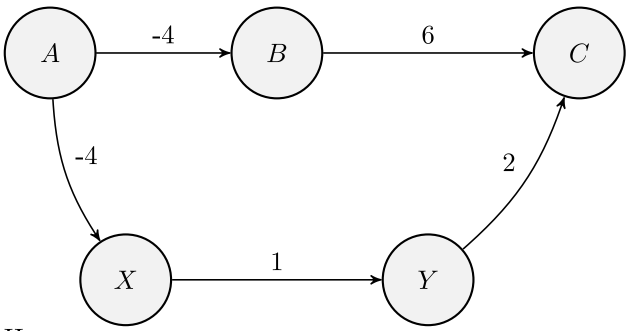
May 2019

!! NOTE !!
Implementation of different algorithms are in different folders.
References for doing the homework are given at the bottom of this sheet.

Problem 11.1

Shortest Path Algorithm

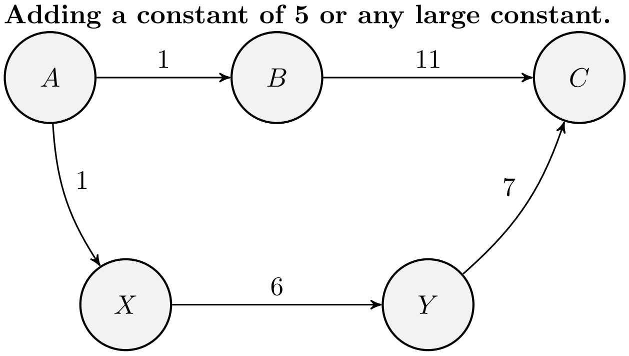
(a)



Here:
Considering the case above we have the minimum cost to get to the point C from A as -1.
That is because it follows the path that is
$A \rightarrow X \rightarrow Y \rightarrow C$ and cost is (-4+1+2)=-1.
The alternative path :
$A \rightarrow B \rightarrow C$ cost is (-4+6)=2.
So the optimal cost to C is -1.

So if we try to fix this by adding a constant that is greater than the absolute value of the min weight or just a large constant.Then we could have the situation as below:

Adding a constant of 5 or any large constant.



Considering the second case above we have the minimum cost to get to the point C from A as 12.
That is because it follows the path that is
$A \to X \to Y \to C$ and cost is (1+6+7)=14.
The alternative path :
$A \to B \to C$ cost is (1+11)=12.
So the optimal cost to C is 12.

Here we observe that the shortest path in the second case is clearly wrong this is because the path with more nodes which was actually the shortest path now has more total cost because it has more edges that we add the constant weight to.Thus number of edges in the $(A \to B \to C)$ is less thus has a lower cost.
Therefore this wouldn't be a wise /tangible solution to my friend's problem.

Problem 11.2

Optimal Meeting Point

(a) The solution is within the folder: OptimalMeetingPoint

The implementation is in OMP.cpp
\$: make all
\$: make run
\$: make clean

Problem 11.3

Number Maze

(a) We could use depth first search (DFS) starting from node at (0,0) and we can find the paths that are all possible for that particular cell. We can find the path that takes the shortest to reach the last bottom right corner cell (n-1,n-1) as the solution for the problem

Considering the following examples:
We have :

1	2	3
3	4	5
1	2	**2**

$(0,0) \mid\to (0,1) \to (1,0)$
$(0,1) \mid\to (1,2)$
$(0,2) \mid\to$ **NULL**
Other possible paths for the player in a particular cell to move To :
....
....
....
....

(b) The solution is within the folder: NumberMaze

(c) The solution is within the folder: NumberMaze

References :

Cormen, T. H., Leiserson, C. E., Rivest, R. L., Stein, C. (n.d.). Introduction to algorithms.
https://www.geeksforgeeks.org/
Discusion with friends for the approach to solve the algorithm.
http://www.cplusplus.com/forum/general/97256/
https://codereview.stackexchange.com/questions/91178/console-maze-program
https://stackoverflow.com/questions/38963729/number-maze-solving-algorithm