



CS 2001: Data Structure

Assignment No. 5

Instructions:

1. Submit your assignment within the due date and time. Copy all your code in an MS Word file along with screenshots of your output and submit it. Late submission will result in a deduction of marks. No excuse or resubmission is permissible.
2. Mention your names and roll numbers clearly on your document.
3. Name your zip or folder/file, that you want to submit, according to the following format: **DS_A5_RollNo_FirstName**
4. Solve each task of the assignment **individually** and on your own.
5. **Plagiarized code will be penalized by a negative marking.**

Question No. 1: Graphs (Robot Navigation System)

Design and implement a **robot navigation system** where starting state and the goal state have been given which are basically the coordinates of the grid of size 15x15 as shown in Figure 1. For example, the start state has the coordinates (1,2) and the goal state has the coordinates (15,14).

Consider the **following assumptions** during the implementation of the robot navigation system:

- The robot can only **move**,
 - **Up** one cell with step cost 2,
 - **Right** one cell with cost 2,
 - **Diagonally Up** towards the right with cost 3.
- The robot cannot move downward one cell.
- The obstacles are color-coded and the robot cannot be in those cells.
- The system will take a text file as input having information for the provided grid.

Your task is to implement the following algorithms,

1. Breadth-first search
2. Depth-first search

Final Outputs

Your designed system should output the followings:

1. The complete path as well as the traversal if the goal is reachable otherwise mention failure with some solid reasons.

- (b) Given an undirected Graph of N vertices, 1 to N and M edges in the form of a 2D array. The array **Arr** [], where every row consists of two numbers X and Y , which denote that there is an edge between X and Y .

Input: $N = 8, M = 7, \text{Arr} [] [] = \{\{1, 2\}, \{2, 3\}, \{4, 5\}, \{1, 5\}, \{6, 1\}, \{7, 4\}, \{3, 8\}\}$

Your output will be:

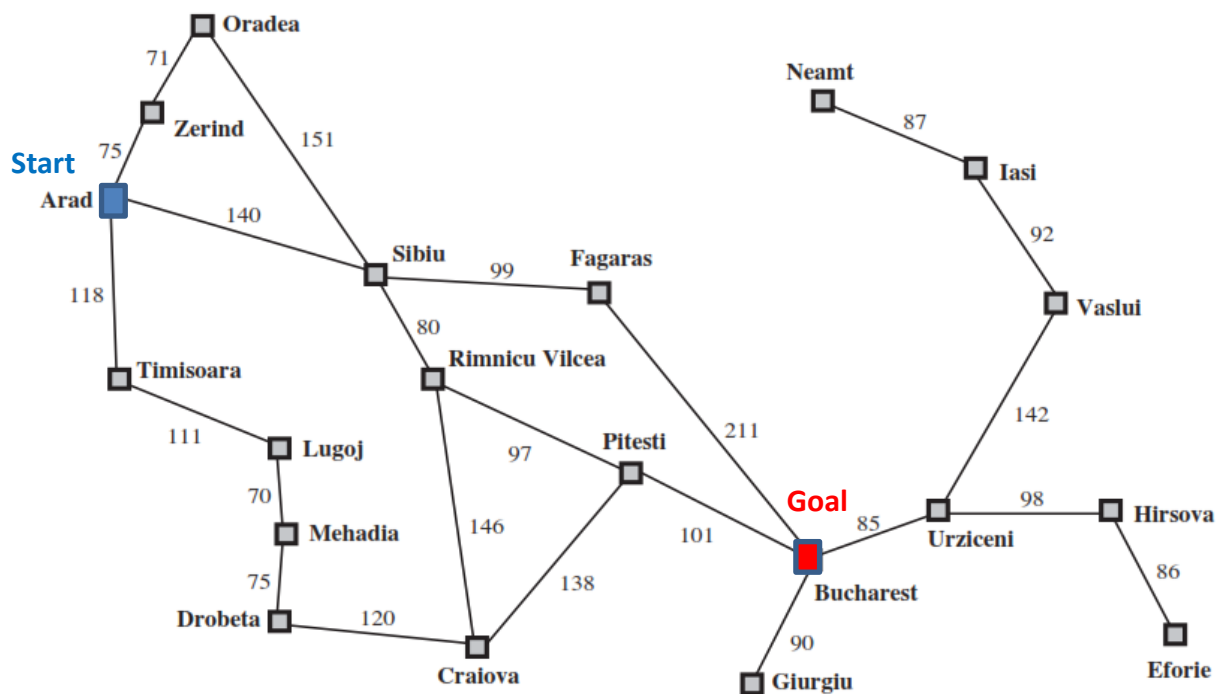
0	1	0	0	1	1	0
1	0	1	0	0	0	0
0	1	0	0	0	0	0
0	0	0	0	1	0	1
1	0	0	1	0	0	0
1	0	0	0	0	0	0
0	0	0	1	0	0	0
0	0	1	0	0	0	0

Considering the above information, perform the following tasks:

- Write a program to create an Adjacency Matrix of the given Graph.
- Write a program to create the Adjacency List of the above matrix.

Question No. 3: Graphs: BFS and DFS

Consider the graph given below and find the paths from starting node (Arad) to the Goal node (Bucharest) with both strategies BFS and DFS. Also, write a code to find these paths with both strategies.



Question No. 4: Heap

Write a program to take N elements and do the following:

- a.** Insert them into a heap one by one.
- b.** Delete them from that heap one by one.