# Homework 1

CS 4649/7649 Robot Intelligence: Planning
Instructor: Matthew Gombolay

Instructions:

- You may work with one or more classmates on this assignment. However, all work must be your own, original work (i.e., no copy+pasting code). You must list all people you worked with and sources you used on the document you submit for your homework
- All final solutions to written problem must be enclosed by a box to make it easy and unambiguous for the graders what your final answer is. If your answer is illegible, you will not receive credit. If you answer is not boxed, you will not receive credit.

Problem 1:

Consider the following graph (credit Knuth 2008, p. 15):
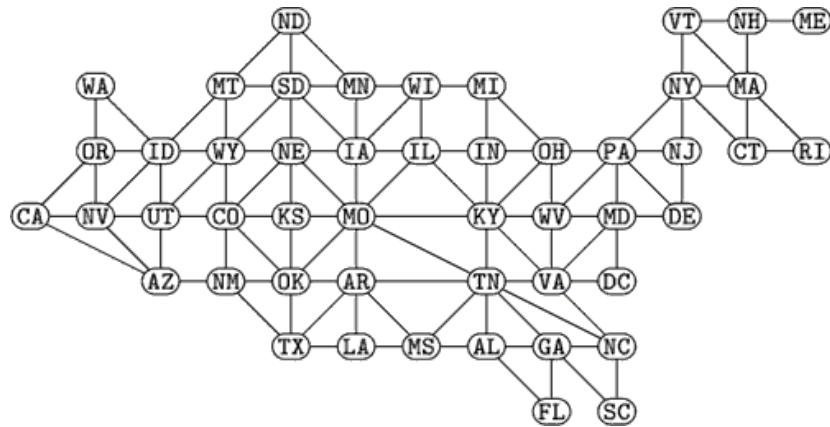

Write <u>three</u> Python scripts implementing depth-first search (DFS), breadth-first search (BFS), and iterative deepening (IDS), respectively, all using visited lists. Then use these algorithms to solve for a simple path from S → G, where S is Massachusetts (MA) and G is Georgia (GA). Ties will be broken in alphabetical order. Augment your implementation to be able to report the computational time, number of nodes visited, maximum queue size, and length of returned plan. You will have to manually define the graph yourself in python. **Fill in your results in a table with the following rows and columns:**

	Time (s)	# Nodes Visited	Max Queue Size	Path Length (Number of States) of Solution
DFS				
BFS				
IDS				

Furthermore, submit your code. You should have one Python file for each type of search, and the code should be clearly documented. Further, when the grader runs the python code, the script should print to the screen the relevant information reported in the table above. Remember, if it does not run, you do not receive credit.

Problem 2:

Consider the following directed graph:
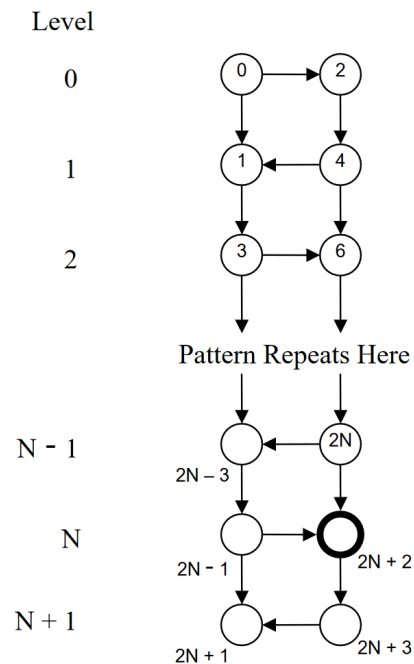
The start node is S = 0, and the goal node is G = 2N+2. During search, ties are broken by choosing the lower-index node. Assume N > 0. Assume a visited list is used unless otherwise noted.

Derive a precise analytical expression for the following prompts. Answers should be hand-written with pencil and paper, showing your work, with the final answer enclosed in a box.

A) The number of paths that DFS examines.
B) The largest number of paths for DFS that will ever be on the queue at any given time.

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C) The number of paths that BFS examines.
D) The largest number of paths for BFS that will ever be on the queue at any given time.

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E) The number of paths that BFS examines. Assume a visited list is **not** used.
F) The largest number of paths for BFS that will ever be on the queue at any given time. Assume a visited list is **not** used.