Programming Assignment HW5

This assignment aims to unveil the similarities between the DFS and BFS procedures you've recently learned about and generalize to new search procedures.

This assignment will involve solving binary mazes $M\,[1..m, 1..n]$. Each entry in the maze is either a 0, indicating a wall, or a 1, indicating an open cell. The RandomMaze class (utils/RandomMaze) is used to represent (randomly generated) $m \times n$ Mazes. The class has only two methods that you need to care about - start_position() and goal_position() denoting the position - (row,col) tuple - of starting and ending points in the maze. As the class overrides __getitem__, the usual maze[position] notation can be used to retrieve an entry of the underlying maze.

The maze solving class, MazeSearch (hw5/algorithm.py) searches through a maze by iteratively visiting a "reccomended" position. This position is proposed by a datastructure, passed on instantiation of the class. You will implement three different datastructures, each influencing the behavior of the search routine. The algorithm then adds the yet-to-be discovered neighbors of the position to the datastructure, and the process repeats. Each datastructure has two important methods - get_next_position() which proposes (and removes) a position to continue the search from, and add_position(pos) which adds a new position ot the structure.

The three datastructures you will implement will mimic DFS, BFS and BestFS. For the BFS datastructure, you may use the collections.deque class, and for the Best First Search procedure, you may use the heapq package (both are imported in the code). The running times of each method are listed in the corresponding doc-string.

Your job is as follows:

1. Complete the maze solving code located in hw5/algorithm.py (see TODO's) (8 points)

2. Implement the three storage classes found in hw5/datastructures.py (see TODO's) (7 points)

3. Run the code in comparison.py and complete the #TODO by analyzing and explaining each generated plot for each datastructure. Please explain any discprepencies in the plots and justify/provide rationale for the observed behavior. (5 points)