

Assignment 1 Problem A

Q1)

The DFS search algorithm performs as expected, continuing further along one path and expanding nodes in the same direction (west) first, and continuing down this same path until the goal is found. Pacman does not visit all of the explored nodes, he only visits nodes once along a single path to the goal.

Q4)

b)

The euclidean distance heuristic is admissible because it never overestimates the cost to the goal. It will at most return the exact correct cost to the goal, if pacman has a straight shot to the goal, or it will underestimate the cost, if pacman has to make multiple turns to reach the goal (diagonal path) or if there is a wall in between pacman and the goal. The random distance heuristic is not admissible because it can overestimate the cost to the goal. For instance, if pacman is close to the goal and has a path that costs any less than 10 the random heuristic could still return a cost of 10 and would then be overestimating the cost.

c)

The three heuristics implemented for A\* search, manhattan distance, euclidean distance, and random, all produced similar solution lengths on the big maze but differed in the amount of search nodes expanded. The manhattan and euclidean distance algorithms both found a solution of length 210, but the A\* search using the manhattan distance heuristic expanded 8 less search nodes in the process. The A\* search using the random heuristic expanded over 100 more nodes in the search and found solutions that were sometimes longer than the other searches.

Q5)

Various search strategies produce different results on the open maze. Breadth first search and uniform cost search both produce similar results, nodes closer to the start are explored earlier and the frontier is expanded gradually around all of the edges. A\* search (using the random heuristic) produces similar results, with some random noise in which nodes are explored in which order. In contrast, A\* (using the manhattan or euclidean heuristics) had similar search patterns to BFS and UCS, in that they both expanded outward first, but the heuristics guided the search and the algorithm did not expand nodes that only moved pacman further from the goal. Finally, DFS produced a search pattern and solution that was the least effective, searching west first and returning a path where pacman makes switchbacks completely east and west until he finally reaches the goal.