Final Report

4b. The Euclidean Heuristic is admissiable it because it never overestimates the distance from a neighboring vertex to the goal state. A heuristic is consistent or monotone when the heuristic estimate is less than or equal to the distance from the neighboring vertex to the goal state plus the cost of reaching that neighbor. is The Euclidean Heuristic is consistent because when we are using the concepts of euclidean geometry we know that the length of our hypotenuse using the euclidean distance formula is less than or equal to the sum of leg a(y2-y1) and leg b(x2-x1) so we underestimate this value. Since we are simply calculating straight line distance from point A to point B we always have to be underestimating since we aren't taking account for obstacles. The Random Heuristic is not admissible or consistent because we choose a random integer as our heuristic and we don't know if it underestimates or overestimates our distance from the neighboring vertex to the goal state. By definition if something is not admissible it is not consistent either since being consistent is a stronger claim that encompasses admissibility.

The manhattan heuristic had a search space of 549 nodes, the euclidean heuristic had a search space of 557 nodes, and the random heuristic had a search space of 624 nodes. This shows us that in this game the manhattan heuristic performs the best and the random performs the worst. This makes sense because the manhattan distance simply uses the cost between moving from one space to an adjacent space which is exactly what we're doing in pacman. Other heuristics such as using the distance formula(Euclidean Heuristic based on Euclidean Geometry) and random selection of a heuristic do not work well with this space by space movement of the pacman game.

5. We can see based on the results that DFS does the best with a search node expansion of 576 and the rest (BFS, UCS, A Star) all have a search node expansion of 682. This is because DFS explores the depth of the open maze first allowing it to not have to explore as many nodes before reaching the goal state. The other search methods are all based on doing BFS or exploring nodes level by level. UCS and A star are simply variations of BFS. Since we have to explore each level, it takes us longer to get to the depth where our goal state is located. This explains the results and deems DFS superior when there is an Open Maze that requires exploration to a deeper level of nodes in a tree.