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CS380 Assignment 3

Part 1: Written Problems (40 points)

Consider the unbounded version of the regular 2D grid shown in Figure 3.9. The start state is at the origin (0,0), and the goal state is at (x,y).

1. What is the branching factor *b* in this state space?

   Branching factor would be 4.

2. How many distinct states are there at depth *k* (for *k* larger than 0).

   4k because at depth k it is a square rotated at 45 degress. And since it's a square there are 4 boundaries so 4k.

3. What is the maximum number of nodes expanded by breadth-first tree search?

   Exponential time complexity, so b^d

4. What is the maximum number of nodes expanded by breadth-first graph search?

   It would have to open every vertex and then go to every edge of the vertices so O(|E| + |V|).

5. Is $h = |u - x| + |v - y|$ an admissible heuristic for a state at (u,v)? Explain.

   Yes because this is the Manhattan distance, and the textbook proves for us that this is in fact admissible.

6. How many nodes are expanded by A* graph search using *h*?

   Exponential b^d nodes, or log(h()*n)

7. Does *h* remain admissible if some links are removed?

   Yes removing links does not make h inadmissible, if anything it would cause some nodes to take longer to get to the goal.

8. Does *h* remain admissible if some links are added between nonadjacent states?

   No, if the links added creates a shorter path than what the Manhattan distance estimates for us, we would have to change the h.