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CSCI 4511W
Assignment 2
2/18/18

Problem 1.

Step 1: F:{(5,14)} E:{} Choose 5
Step 2: F:{ (8,21), (7,19)} E:{5} Choose 7
Step 3: F{ (8,20) } E:{5, 7} Choose 8
Step 4: F{ (1, 18), (2, 18)} E:{5, 7, 8} Choose 2
Step 5: F{ (1, 18), (4, 19), (3, 22)} E:{5, 7, 8, 2} Choose 1
Step 6: F{ (4, 19), (3, 22), (6, 24), (9, 23)} E:{5,7,8,2,1} Choose 4
Goal
Path: 57824
Actual Cost: 19

Problem 2:

1. Counterexample: h(8) = 15 where the actual cost is 14. IT is not admissible. Since it is not admissible, it is also not consistent
2. If hn is admissible then hn(node) <= cost(node)
   h1 is admissible
   h2 is admissible
   The mimimum of two values that are both less than a value c can only be less than c
   Therefore, h3 is admissible
   Consistency can go either way
      Consistent Example: Both sets of heuristics are all ones. Then h3 is consistent
      Inconsistent Example: 7--8: Cost = 1 h1(8)=15 h1(7)+cost = 16 Inconsistent but admissible
      h2(8)=16 h2(7)+cost = 16 consistent but admissible
      h3(8)=15 h3(7)+cost = 16 inconsistent but \
      Admissible

Problem 3:

1. Biking Bickering Children
   a. Relaxation: The children do not fight/sit on each other
   b. Optimal Solution: Bring the children over one at a time
   c. Heuristic: The number of trips to bring all children = the number of children
2. Puzzle-Loop
   a. Relaxation: The line doesn't have to be continuous and lines can cross
   b. Optimal Solution: Draw the number of lines around each cell that has a number
   c. Heuristic: The sum of numbers remaining, minus the number of lines drawn

Problem 4:

1. Worms AI: Local Search: Hill Climbing

We can set our score to be the damage done to an opposing worm. With hill climbing we attempt to maximize our score by picking the weapon that will do the most damage. Local maxima shouldn't be a problem. Our score can either go up by doing damage to a worm, or it can temporarily stay the same until a change in position occurs. Eventually it will reach the global maximum with all opposing worms being dead.

2. Plutonium: Local Search: Beam

   We can set our score to the radiation level in our geiger counter, since the closer we get to the plutonium, the higher the radiation levels will be. We can check the moves that will get us the highest scores at each distance unit we move, which should be towards the plutonium.

3. Maze: Uninformed Search: Depth-First

   In this one, we have limited information, only what we see around us, so we are uninformed as to which moves get us closer until we get to the goal. Depth-first search lets us check each path towards the goal until we pick the goal path. With other uninformed searches we would be checking almsot every path before we find the goal

4. Road Trip: Informed Search: A*

   We know the distance, fuel usage and price of all gas stations so we know the cost of filling up at each gas station. We can also create some heuristic relating the cost of filling up at a gas station to its straight-line distance away from the goal. This should give us an optimal path between gas stations to get to our goal. I wouldn't use uniform-cost search because of its possibility of taking us backwards to very close, gas stations.

Problem 5

1. 11 Queens
   a. Genetic: 4.506s
   b. Depth-First: 3.485s
   c. Iterative-Deepening: 14.234s
2. 20 Queens
   a. Genetic: 4.947s
   b. Depth-First: 16.730
3. 40 Queens
   a. Genetic: 7.507s
4. Depth first search was the fastest when the amount of queens was low, and quickly slowed down when the amount increased. Iterative deepening was just slow throughout, and was even too slow to even try to run on a higher amount of queens. The genetic algorithm stayed fast the whole time. The speed for the highest amount of queens was the slowest, but the rate of time increase was still fairly low. While iterative deepening might not be time efficient, I know that it is space efficient, and while the genetic

algorithm might be fast, I was taking a look at some of its solutions and found the some of them were incorrect.