

Homework 1

CS 5233 – Fall 2007
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assigned August 27, 2007
due midnight, September 5, 2007

1. (40 pts.) In the Tower of Hanoi problem, there are 3 pegs and n disks of different sizes. One disk can be moved at a time (from one peg to another). A larger disk cannot be placed on a smaller disk. The initial state is all n disks on peg number 1. The goal state is all n disks on peg number 3. Your problem is to display the whole state space for $n = 2$. Hint: there are 9 states and 12 bidirectional edges.
2. (20 pts.) For the Tower of Hanoi problem with $n = 2$, show the sequence of states that are visited for breadth-first search (BFS) and iterative deepening (ID). A state is visited if it is expanded. The search terminates when a goal state is about to be expanded.

Assume that BFS does not visit any state twice (p. 82 talks about a “closed list” and an “open list” to implement this). Assume that ID does not visit the same state in two moves (i.e., no state should be the same as its grandparent). This check is intended to avoid redundant search from reversible operators.

3. (30 pts.) Suppose a state space has the following structure:

Each state has 3 neighbors.

All edges are bidirectional.

Between any two states, there is exactly one simple path.

For this state space, do the following:

- (a) Draw a portion of the state space, specifically, all states within distance 3 of a given state.
 - (b) How many states (exactly) are within distance d of a given state?
 - (c) How many states (exactly) would be searched by DFS with depth limit d if there is no checking for repeated states from reversible operators? Assume that no goal state is found.
4. (10 pts.) Estimate the average number of states visited by the `8-puzzle` program when the solution path has length 10. Do this in the following manner.

Assuming `$A` points to the directory of binary files of my agents software, run:

```
$A/interact "$A/slide -r 3 -c 3 -m 10" $A/8-puzzle
```

10 times where the solution path has length 10, and calculate the average.

5. (100 pts., shared extra credit) [Shared extra credit means that the 100 pts. will be distributed among all the students who do this exercise correctly.]

Change the `8-puzzle` program to use `idsearch` rather than `idastar`. Redo the exercise above. Be sure you use the same instances for both exercises by using the same 10 random number seeds (the `-s` option for the `slide` program).