

COMS 4701: Artificial Intelligence

Homework 1 Sample Solutions and Comments

1 Problem 1

1. States may track the cards or value of the agent's hand, and same of the dealer's hand. Actions are to hit or to draw.
2. (a) Partially observable, since there is information that would help the agent make its decisions but that it cannot see (e.g., the dealer's hidden card).
(b) Multi-agent (player and dealer).
(c) Stochastic, since there are actions without predetermined outcomes (e.g., drawing a card).
(d) Sequential, since future decisions depend on current ones (e.g., drawing cards changes the value of the hand).
(e) Static, since the environment does not change while the agent deliberates.
(f) Discrete, since all game components are finite.

2 Problem 2

General feedback:

- The problem requires both the sequence of states expanded and the final solution.
 - Search terminates after the first goal state is checked (after it's popped from the frontier).
1. DFS: States Expanded: S, a, b, d, (G1). Final Solution: S, b, d, G1.
BFS: States Expanded: S, a, b, c, d, (G1). Final Solution: S, c, G1.
UCS: States Expanded: S, c, b, d, (G2). Final Solution: S, b, d, G2.
 2. Admissible: $0 \leq h \leq 2$. If $0 \leq h \leq 1$: expanded states are S, b, c, d, (G2); otherwise, expanded states are S, c, b, d, (G2). Solution in either case is S, b, d, G2.
Inadmissible: $h > 2$. If $2 < h \leq 3$: expanded states are S, c, b, d, (G2); solution is S, b, d, G2. Otherwise, expanded states are S, c, (G1); solution is S, c, G1.
Note that it is possible to return the optimal solution even when the heuristic is inadmissible but only when it is a lower value. Otherwise, G1 will be found before G2, giving us a suboptimal solution.

3 Word Ladder

Feedback on coding portions:

- Nodes are only expanded after they get popped off of the frontier and fail the goal test. In other words, nodes are expanded when we invoke the `expand()` function on them. Goal states are not expanded.
- “max_frontier” represents the largest size of the frontier at any point in running the algorithm. Note that the frontier size decreases when nodes are popped from it and increases when nodes are pushed to it.
- Note that “node” is a map that encapsulates many pieces of information and should be distinguished from “node[‘state’]”. Also note that “node[‘cost’]” describes the cumulative cost.
- The cost of changing FROM a vowel is 2. Not TO a vowel.