CS 3520—Assignment 2: Prolog Games

Do not use any library predicates other than those defined and/or described in lectures or in the textbook. If you need help understanding how these problems work, talk to me. Looking up solutions to these problems on the web is cheating, even if you do not copy the code that you found.

Missionaries and cannibals

Recall the man, wolf, goat, cabbage problem that was demonstrated in lecture. For review, here is the solution that was presented:

```prolog
change(e,w).
change(w,e).

move([X,X,Goat,Cabbage],wolf,[Y,Y,Goat,Cabbage]) :-
  change(X,Y).
move([X,Wolf,X,Cabbage],goat,[Y,Wolf,Y,Cabbage]) :-
  change(X,Y).
move([X,Wolf,Goat,X],cabbage,[Y,Wolf,Goat,Y]) :-
  change(X,Y).
move([X,Wolf,Goat,C],nothing,[Y,Wolf,Goat,C]) :-
  change(X,Y).

oneEq(X,X,_).
oneEq(X,_,X).

safe([Man,Wolf,Goat,Cabbage]) :-
  oneEq(Man,Goat,Wolf),
oneEq(Man,Goat,Cabbage).

solution([e,e,e,e],[]).
solution(Config,[Move|Rest]) :-
  move(Config,Move,NextConfig),
safe(NextConfig),
solution(NextConfig,Rest).
```

A similar problem is the missionaries and cannibals problem as stated here:

Suppose there are three missionaries and three cannibals who need to cross to the far side of a river using a single boat that can carry one or two people at a time. Both groups will cooperate and can paddle back and forth freely, but old habits will lead the cannibals to eat the missionaries if the missionaries are ever outnumbered on either side of the river.

The problem is to find a way to get all of the missionaries and all of the cannibals safely across the river.

Write a prolog program to find suitable solutions.

Start by defining a representation of the current state (where the missionaries and cannibals are at any given time), the goal, what moves are legal from a given state, etc.

The solution may be a list of moves or a list of states; it is up to you. Your choice of representation may make the problem harder or easier.

Adventure game

Add the following features to the adventure game from the slides:

- There is a gate between the fork in the path and the mountaintop. The gate is a separate location; that is, the player must move from `at(you, fork)` to `at(you, gate)` and then to `at(you, mountaintop)`.

- To move forward through the gate the player must first unlock it with a key.

- The key is somewhere in the maze. The player must find it and explicitly pick it up.
• If the player tries to pass through the gate while still holding the key, he or she is killed by lightning. (To get the treasure, the player must first open the gate, then put down the key, and then pass through).

Start from the code in the slides:

• adventure.pl

Part of your implementation should be a general way for the player to pick things up, carry them, and put them down. Design your solution so that it would be easy to add additional objects for the player to pick up and put down.