Problem Set 2: Due January 23

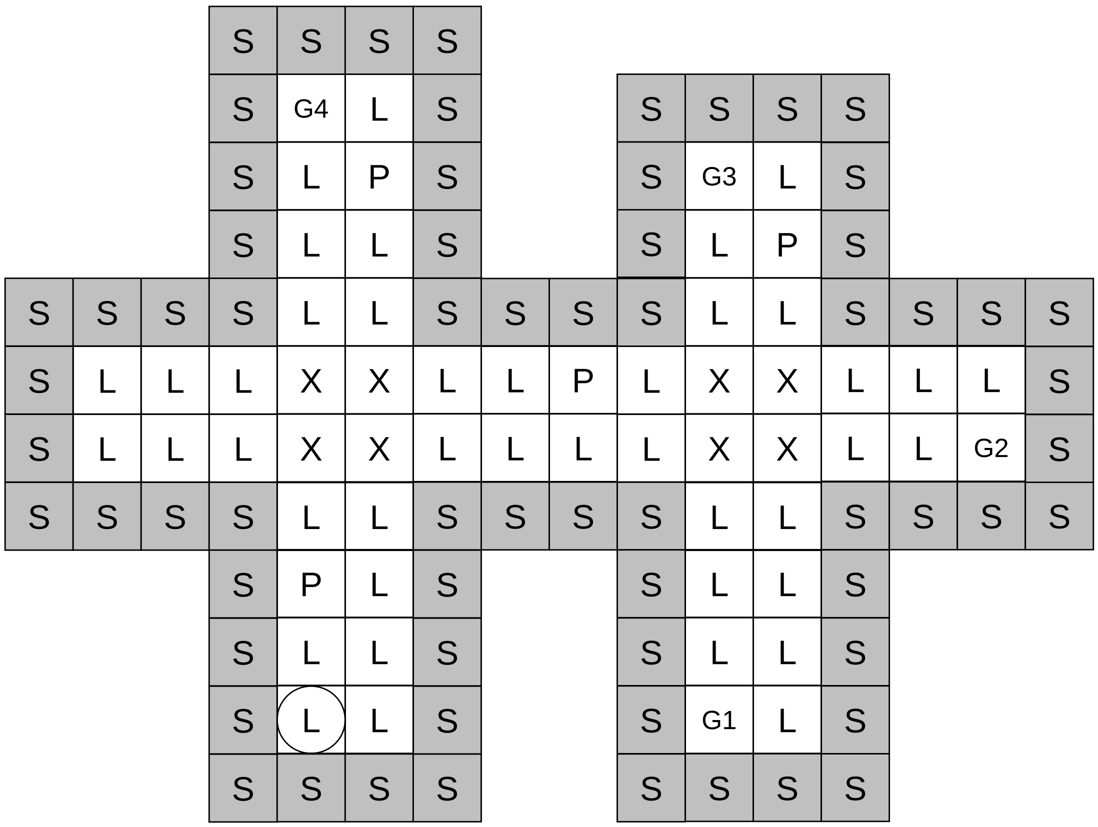

Figure 1: An instance of the Road World problem

1. (10 points) Consider the Road World environment from Problem Set 1 (if you forgot the details, you can look at PS1 on the website). Suppose now that there are multiple agents on the road, and you have been given the post of traffic Czar. As Czar, you have the authority to impose coding guidelines on all agent programmers. Specify a set of constraints (e.g., table entries) that if incorporated into all agents will ensure there are no collisions. You may assume 1) Fantasy Road World conditions (i.e., no potholes) and 2)that agents are not initially colliding with one another. However, you may not assume that the agent has additional sensing/acting capability beyond the 1 bit of state described in PS1. Your rules may limit the functionality of agents, but must allow travel, which is to say that even the traffic Czar cannot outlaw the forward action.

2. (10 points) Does your new rule set limit the functionality of potential agents? If so, give a precise description of a task that could be done previously which can no longer

be performed. If not, describe as precisely as possible why the rules have no negative impact.

3. Consider a graph with three vertices (V1, V2, V3) and edges connecting all pairs of vertices. Assume that the edges indicate adjacency relationships. The goal is to find a way to color the vertices such that no adjacent nodes have the same color. Nodes may be colored **R**ed, **G**reen or **B**lue. Until a color has been selected, their color is **U**ndefined. A valid solution is one in which all vertices have a valid color, and no adjacent vertices have the same color. On each sense/act cycle, the map-coloring agent can read the map and color one vertex whose color has not yet defined. If more than one vertex is uncolored, the agent has must choose which to act upon. Initially, the map is completely uncolored.

   (a) (5 points) Describe how you might compactly represent the state in a program. Provide the initial state, pseudo code to recognize a goal state, and an example of a state satisfying the goal condition.

   (b) (5 points) Indicate the set of actions and the resulting next states for an agent presented with the sensory input of V1 = **R**, V2 = **U**, V3 = **U**.

   (c) (10 points) Show the first twelve nodes in the breadth-first search tree starting at the initial state. Label each node to indicate when it is expanded. Below each node, indicate the contents of the open-list just after expansion.

   (d) (10 points) Show the first twelve nodes in a depth-first search tree starting at the initial state. Label each node to indicate when it is expanded. Below each node, indicate the contents of the open-list just after expansion.

   (e) (5 points) What, if anything, can we determine from the problem statement about where we will find nodes in the search tree that satisfy the goal state for this problem? Be as precise as possible; after addressing the 3-vertex map, address the n vertex map.

   (f) (10 points) Discuss the pros and cons of depth first, breadth first, and iterative deepening on this particular problem.