Lab 2

Lab Goals:

- Understand the creation and management of multiple threads,
- Understand the implications of shared address spaces across multiple threads, and
- Understand how semaphores can be used to protect shared data structures and to trigger background threads.

Lab 2: The Problem

- Many robots live within a grid world; they are one of three colors: red, green, and blue
- Many goals scattered around the world; they are one of four colors: red, green, blue, and black
- The task of the robots is to "eat" the set of goals. Robots may eat goals that are either black or of their own color.

World Physics

- Only one robot may occupy a grid cell at any one time
- Robots may not occupy cells that contain obstacles
- Robots may not occupy cells that contain goals they cannot eat
- At each step, robots may only move one cell up, down, right, or left (subject to surrounding obstacles, robots, and goals)
- If a robot has no more goals to eat, then it "dies" and effectively becomes an obstacle.

Partitioning the Problem

- There is one common data structure that contains information about the size of the grid, the obstacles, the goals, and references to all of the robot objects.
- One control thread for each robot.
- One thread for the "distance matrix" for each color (more on this in a second)
- One thread for updating the display at regular intervals
- One thread for writing to a log file (for automated checking)

The Challenges

- How to create and manage the set of threads?
- How to ensure that common data structures are accessed and updated atomically?
- How to decide which direction a robot should move?
- How to trigger the updating of the distance matrix?

What We Provide

- Abstract classes for the representation of goals, robots, and the distance matrices. In all cases (aside from the goals) you must extend these classes and add the appropriate functionality.
- A method for updating the distance matrix given the current location of the goals, obstacles and dead robots.
- A semaphore class. This is the only form of synchronization that you may use (more on what this means on Monday).