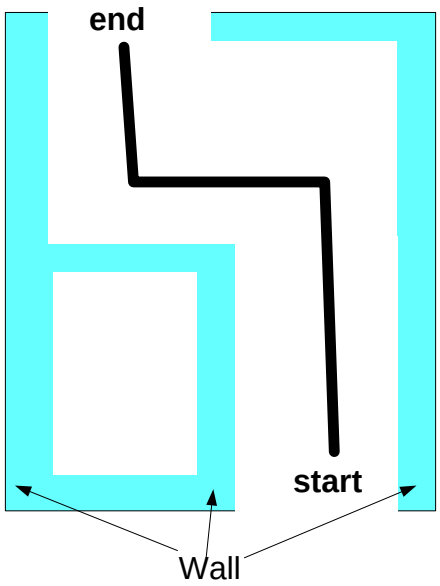
Lab #5 **EC262**

In this lab, you will be responsible for programming the brains of a robot. In particular, you will be given a robot, which includes 6 sensors, 2 motors, and a Niomite board which houses an FPGA. Three of these sensors are phototransistor reflective object sensors (QRB1134), which we will call **line sensors**. They are positioned across the front of the robot, pointing down. The three sensors are positioned, such that we have a left sensor, middle sensor, and right sensor. If there is a black line in front of them, they output a logical one (**LED = OFF**). The servo motors (HS-422) are controlled using digital control. If you output a logical one, then the motor is on. One motor is positioned on the left wheel, and the other is positioned on the right wheel. All inputs/outputs are wired into specific pin slots on the FPGA (see the robot supplementary notes). In addition to the sensor and motor controls, each robot also includes three input switches and three LED outputs that you may use at your discretion. The FPGA is a Cyclone II (EP2C8T144C7N). **Your task will be to design a controller to maneuver the robot through a line course as shown below**.



PRE-LAB

1. Read the robot supplementary notes.

2. List all the inputs and outputs of the controller.

LAB

1. Implement the robot controller using VHDL to navigate a serpentine line. Assume that the sensors will be aligned such that at most two of them will be active at a time. Furthermore, your robot will initially be centered on the line.

2. Compile, simulate and verify your design.

3. Assign the inputs and outputs and re-compile.

4. **Demonstrate your design. Note that you may need to adjust the sensors' sensitivity level by adjusting the three potentiometers.**