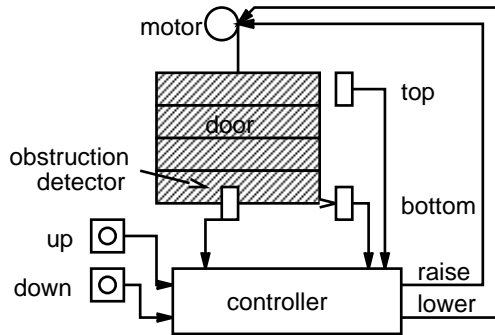


Assignment 4 - State Machines

due Friday, October 11

Question 1

Consider a controller for a simple garage door opener as shown in the following diagram:



The controller has five inputs: two pushbuttons to request that the door be opened (up) or closed (down), two switches that indicate when the door is at the top or bottom of its range and a switch that indicates that the door has hit an obstruction. The controller has two outputs that control a motor: one to raise and one to lower the door.

The operation of the controller is fairly simple: if the up or down switch is pressed (even momentarily) the door should be moved up or down until it is fully open or closed. If an obstruction is sensed at any time the door should be moved up until it is fully open. It should be possible to reverse the direction of the door while it is moving by pressing the appropriate button.

Design a state machine controller for the garage door opener. List the inputs and outputs. List a sufficient number of states and a name for each state. Give a table giving the output conditions for each state. Draw a state transition diagram showing the states and the logical conditions that cause transitions between them. Write out a tabular description of the state machine with the following columns: starting state, input, next state.

Question 2

The manufacturer decides to add an over-temperature detector to the motor to avoid burning out the motor. This sensor becomes an additional input to the controller. Redesign the controller state machine so that when the over-temperature sensor comes on the motor is turned off until it cools down again. When the motor cools down the door should continue with the operation that was in progress before it got too hot (opening or closing). You must switch to the appropriate direction of motion (without turning on the motor) if either the up or down buttons are pushed while the motor is cooling off. You may ignore the other inputs while the motor is cooling off. In other respects the controller should operate the same way as in Question 1.

As in Question 1, describe the state machine by giving the input and output names, the output values for each state, the state transition diagram and the state transition table.