GEORGIA INSTITUTE OF TECHNOLOGY
SCHOOL of ELECTRICAL and COMPUTER ENGINEERING

ECE 8813A Spring 2017
Problem Set #4

Assigned: 9-Feb-17
Due Date: 16-Feb-17

Watch the following videos:

(a) `https://youtu.be/C-BXzVBoJ3U` : Algorithmic State Machine

(b) `https://youtu.be/5EcYI0NfvXg` : Watching from time 0 to 21 minutes is required. The rest of the video is optional.

You are responsible for the content contained in these videos and the content may be asked on a quiz or an exam.

PROBLEM 4.1:

Given: Farmer John has given some additional design clarifications. There are 10 zones that he wants to control. Each zone has different requirements for water, so he wants to be able to configure the times for each zone. The water pump is only large enough to water one zone at a time and so it is very important to only water 1 zone at a time regardless of the timing that is programmed. If more than one zone is set to be watered at time you must set the output to only water one zone and set the *error_out* value to 1.

GPS control will be used for this design and a state machine to change zones. The state machine must be designed with an Algorithmic State Machine (ASM) diagram. Please turn in you ASM diagram and your block diagram at the start of class. The code will due turned in to T-Square.

The module declaration should be as follows:

```
module hw4_sprinkler(clk, rain_sensor_in, gps_data_in,
                     gps_valid_in, program_valid_in, program_zone_in,
                     program_time_in, zone_active_out, error_out)
    //Inputs
    input clk;
    input rain_sensor_in;
    input [7:0] gps_data_in;
    input gps_valid_in;
    input program_valid_in;
    input [4:0] program_zone_in;
    input [31:0] program_time_in;

    //outputs
    output [9:0] zone_active_out;
    output error_out;
```

Where *program_zone_in* is set according to Table 1. The value of *program_zone_in* is passed as an unsigned value from 1 to 20. The value of *program_time_in* is set in the format *hhmm* in ASCII format. The *program_valid_in* must be held high for 1 clock cycle to indicate the data on the *program_zone_in* and *program_time_in* are valid.

Table 1: Programming Zone Description

Value	Description	Value	Description
1	Zone 1 Start Time	2	Zone 1 End Time
3	Zone 2 Start Time	4	Zone 2 End Time
5	Zone 3 Start Time	6	Zone 3 End Time
7	Zone 4 Start Time	8	Zone 4 End Time
9	Zone 5 Start Time	10	Zone 5 End Time
11	Zone 6 Start Time	12	Zone 6 End Time
13	Zone 7 Start Time	14	Zone 7 End Time
15	Zone 8 Start Time	16	Zone 8 End Time
17	Zone 9 Start Time	18	Zone 9 End Time
19	Zone 10 Start Time	20	Zone 10 End Time

A file (*zone_program.txt*)has also been attached to this assignment. Farmer John provided this file as an example watering schedule. The first column of the file is the *program_zone_in* and the second column is the *program_time_in* that should be passed to the module in ASCII format.