

ECE 3544: Digital Design I  
Project 4 – Clock and Countdown Timer Alarm (Design project)

Student Name: Jacob Abel

Honor Code Pledge: I have neither given nor received unauthorized assistance on this assignment.



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**Grading: The design project will be graded on a 100 point basis, as shown below:**

*Manner of Presentation (30 points)*

\_\_\_\_\_ / 5 Completed cover sheet included with report

\_\_\_\_\_ / 15 Organization: Clear, concise presentation of content; Use of appropriate, well-organized sections

\_\_\_\_\_ / 10 Mechanics: Spelling and grammar

*Technical Merit (70 points)*

\_\_\_\_\_ / 5 General discussion: *Did you describe the objectives in your own words? Did you discuss your other conclusions and the lessons you learned from the assignment?*

\_\_\_\_\_ / 10 Design discussion: *Did you discuss the approach you took to designing and implementing the modules that make up your system, and how you synthesized the system from its components?*

\_\_\_\_\_ / 5 System controller state diagram: *Does your state diagram model a system that performs the required tasks? Connect this discussion to your design discussion.*

\_\_\_\_\_ / 5 System block diagram: *Connect the system block diagram to your design discussion – specifically, to a discussion of how your system employed communicating state machines to implement the tasks required by the specification.*

\_\_\_\_\_ / 5 Testing discussion: *What was your approach to formulating your test benches? How did you verify the correctness of the modules you designed? What were the results of the test of your counter's accuracy? Did you comment on the significance of these results?*

\_\_\_\_\_ / 10 Supporting figures: *Waveforms showing correct operation of the top-level module.*

\_\_\_\_\_ / 30 Validation of the final design on the DE1-SoC board

===== **Project Grade**

ECE 3544, Fall 2018, Project 4 Validation Sheet: Time-of-Day Clock and Countdown Timer Alarm (A Design Project)

GTA Validation Instructions:

Program the FPGA on the DE1-SoC board. In the following, unless it is explicitly stated to hold a key pressed down, “press a key” means to press and release the key.

1. Put the design in the reset state by pressing and holding down KEY0. Record the value of the rightmost four seven segment displays (HEX3:HEX0) as **four digits**: \_\_\_\_\_

Release KEY0 after recording the value.

2. Compare the four digits from step 2 to the last four digits of the student’s ID number on their ID card. *If the value does not match the last four digits of the student’s Student ID Number, stop the validation.*

For the remaining steps, you should have an external clock that shows seconds available (e.g., watch, cell phone, clock on the computer, or [time.gov/widget.html](http://time.gov/widget.html) on a browser). When you record values of the displays, any blank (totally off) digits should be indicated by a dash (-).

3. Press KEY0. Record the value of the seven segment displays immediately after leaving releasing KEY0 as **six hex digits**: \_\_\_\_\_

Note the time on your external clock.

4. Press KEY3 to switch to countdown alarm mode. Press KEY2 to start the countdown alarm, wait about 5 seconds according to your external clock, and press KEY2 again to stop the count. Record the value of the displays as **six hex digits**: \_\_\_\_\_.

Did HEX4 through HEX0 displays count down through the sequence 00100, 00059, 00058, 00057, 00056, 00055...? **Yes / No** (circle one) (The leading 0’s may be blank, so ignore them in answering the question.) If no, write down the sequence in the comments section at the end of the validation sheet.

5. Press KEY1 once. Record the value of the displays as **six hex digits**: \_\_\_\_\_.

6. Does HEX4 (next to leftmost display) flash? **Yes / No** (circle one). If no, write down the behavior in the comments section at the end of the validation sheet.

7. Press KEY3 once. Do HEX3 and HEX2 flash? **Yes / No** (circle one). If no, write down the behavior in the comments section at the end of the validation sheet.

8. Press KEY2 twice and then press KEY1. Record the value of the displays as **six hex digits**: \_\_\_\_\_.

9. Press KEY2. Does the countdown alarm begin counting down? **Yes / No** (circle one). If no, write down the behavior in the comments section at the end of the validation sheet.

10. Press KEY3 once. The seven segment displays should now show the time-of-day. Record the value of the displays as **six hex digits**: \_\_\_\_\_.

Compare the time elapsed since noting the time on your external clock after step 3 to the time elapsed on the time-of-day clock. Is the elapsed time what you would expect? **Yes / No** (circle one). If no, write down the behavior in the comments section at the end of the validation sheet.

# Project 4

ECE3544 CRN:82989

Jacob Abel

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## Objective

### Primary Control FSM Diagram

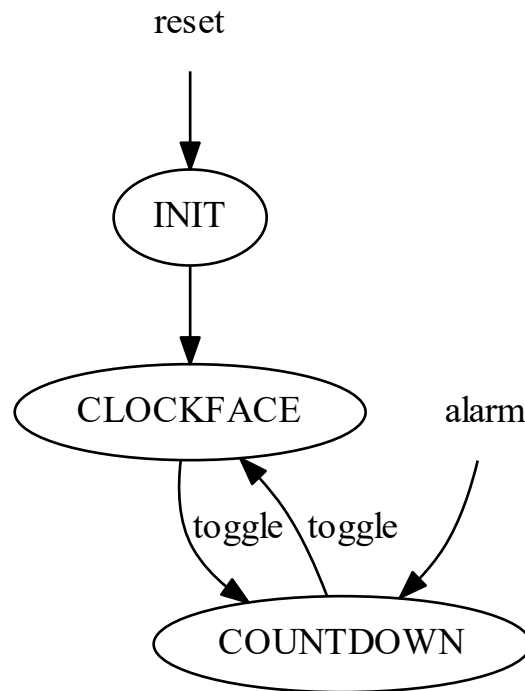


Figure 1: primaryControl Module FSM

## Countdown FSM Diagram

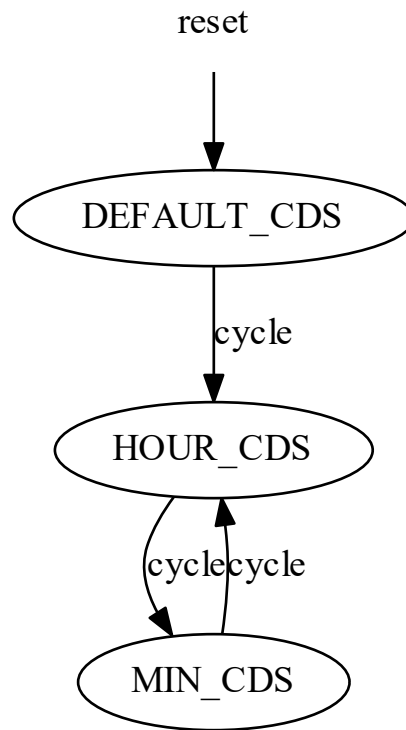


Figure 2: countdown\_setup Module FSM

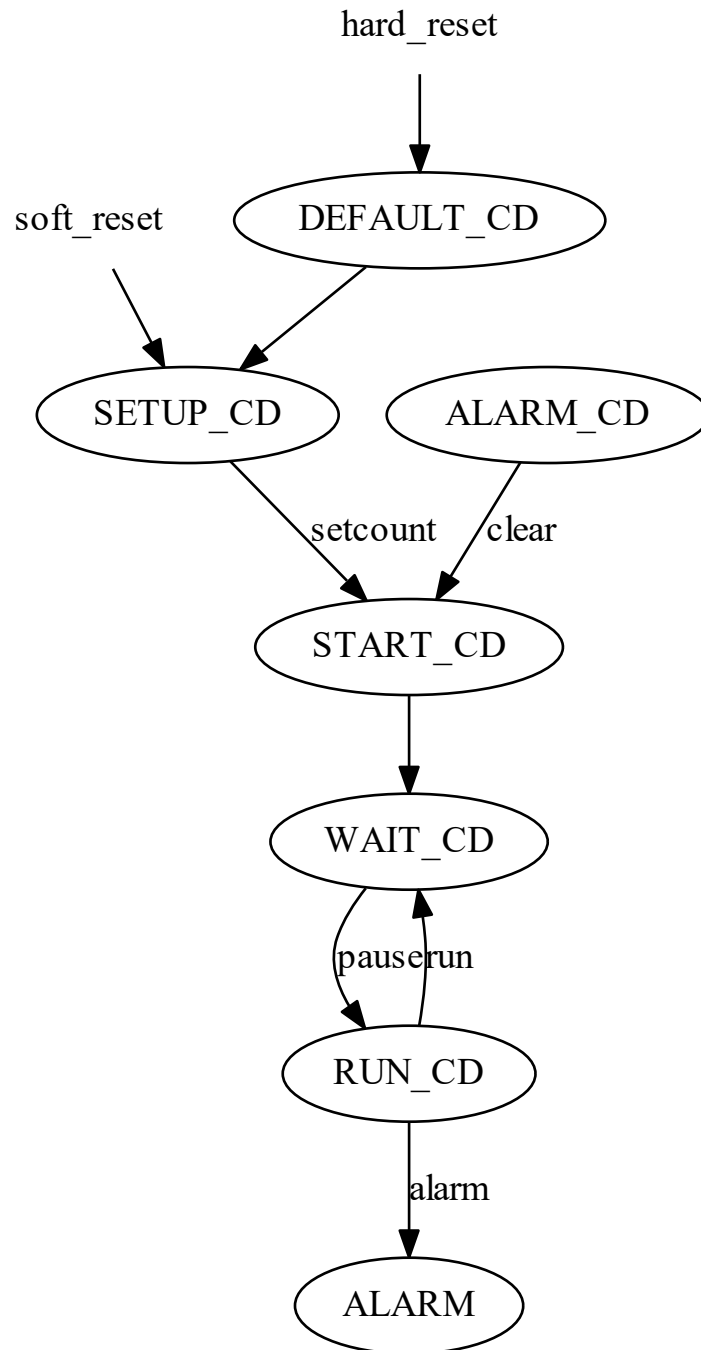


Figure 3: countdown Module FSM

## Clockface FSM Diagram

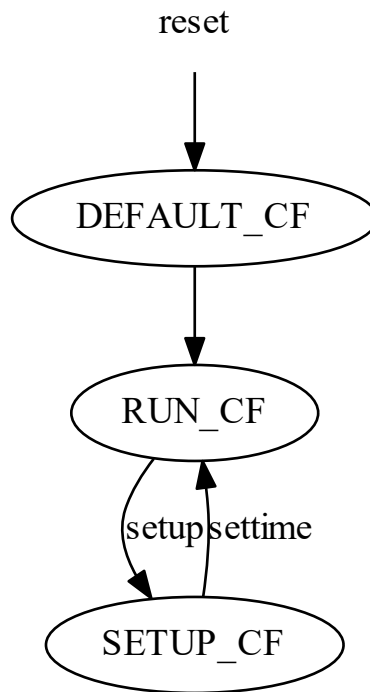


Figure 4: clockface Module FSM

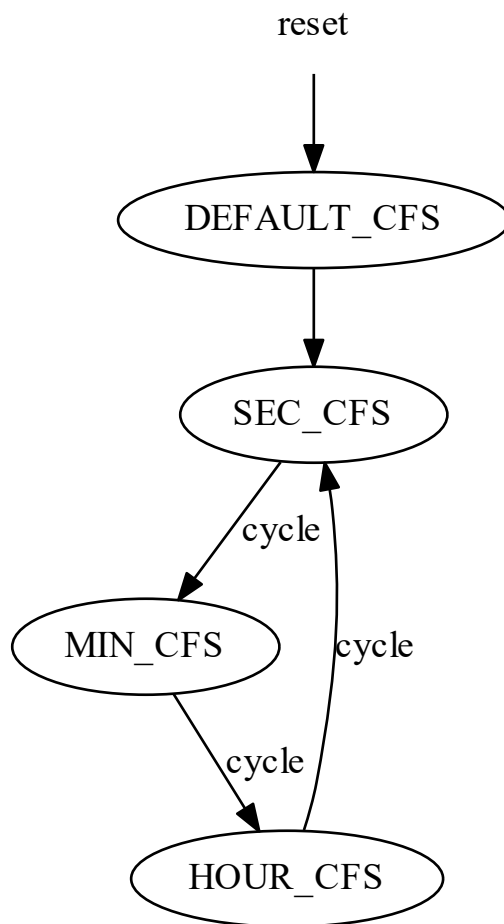


Figure 5: clockface\_setup Module FSM



## **FSM Module Design**

# **Project FSM Module Simulation**

## **Conclusion**

Unfortunately while the project was very pleasant to attempt, due to scheduling issues the final deliverable is largely non functional.