# Name: Section:

# Homework Assignment: submit via gradescope

Design the control unit for the keyboard scancode converter started in lecture 11, based on the given mini-C code (slide 22) using the methods taught in lesson 10 and the state machine code style taught in lesson 9.

1. while(1) {

2. busy=0;

3. while (kb\_clk == 1);

4. busy=1;

5. for (count=0; count<33; count++) {

6. while(kb\_clk == 1);

7. shift = (shift << 1) | kb\_data; // right or left shift?

8. while(kb\_clk == 0);

9. } // end for

10. scan = shift[9-2]

11. } // end while 1

Line 10 of the mini-C "scan = shift[9-2]" implies the variable "scan" should be a register. Make the 8-bit output scan code be the output of an 8-bit register in your datapath, such that on system reset its value is 0x00 and it does not change until the final 8-bit scan code is known (and the following clock cycle, busy goes low [Line 2], indicating to the user that scan code can be used). On the class website for lecture 11, you are given the VHDL code for: lec11\_tb.vhdl, keyboard.vhdl, lec11.vhdl, and lec11\_dp.vhdl to use. You need to write the VHDL code for lec11\_cu.vhdl.

**Turn in**:

1. Datapath using BBBs
2. State diagram for the control unit FSM.
3. Control Word (CW) output table for your control unit.
4. Your Control Unit VHDL code uploaded to your bitbucket repo.
5. Run the simulation long enough to simulate at least two key presses. Include an image of your testbench simulation showing the following signals - remove all other signals.

clk

reset

keyboard clock

keyboard data

control unit state

Status word

Control word

busy signal

shift register

scan code

keyCntr

1. What is the code for the 1st two keys pressed? What keys on the keyboard to they correspond to? Hint: look inside keyboard.vhd

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