Professor Fearing EECS150/Problem Set 9 Fall 1999

Due at 10 am, Fri. Nov. 12 in box outside 218 Cory Hall

(This problem set may be done individually or by a group of two people maximum.)

1. (35 pts)

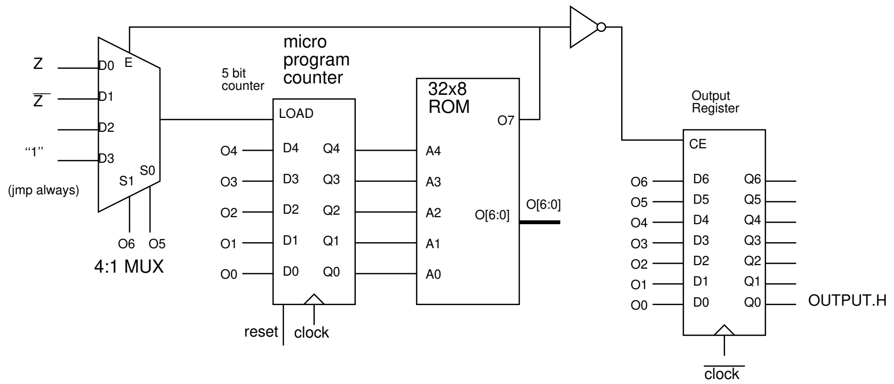
Katz Chap 11, problem 9.

2. Microcode for Simple CPU control (30 pts)

Using the micro-programed control unit (MCU) handed out in class, list, in symbolic form, the microcode needed to execute the *DJNZ* instruction from PS 8, problem 2. Describe any necessary changes to the MCU.

3. Microcode for FSM emulation (25 pts)

In this problem you will emulate a Moore type FSM for a sequence recognizer, using the micro-programmed control unit (MCU) shown below. The MCU should assert OUTPUT once for every (possibly overlapping) sequence "101" or "110" detected in the synchronized input data stream Z. The MCU clock is 3 times as fast as the input bit rate of Z, thus you have time to execute three instructions for every input bit processed. Let Z, and $\overline{Z}$ be connected to D0, and D1 respectively on the 4:1 mux. Write a micro-program which will emulate the sequence recognizer listing your program in mnemonic and numeric form. (Note that branches only occur when test variables are asserted; do not add any inverters. Also note that OUTPUT may not necessarily change states on the same clock edge as Z changes, and OUTPUT could be asserted from one to three clock cycles.) Show a timing diagram with the output register OUTPUT, CLOCK, microPC LOAD, Output Register CE, and ROM O7 for the input sequence Z = 101101. Label each clock period with the current address (micro-program counter contents).



4. Karnaugh Map (10 pts)

Simplify the following boolean expressions (given in sum of products form) using Karnaugh maps:

a. $F.H = \Sigma(0, 1, 5, 7)$, (3 variable K map)

b. $G.H = \Sigma(5, 6, 7, 10, 11, 13, 14, 15)$ (4 variable K map)