Practice problems for Midterm. These will NOT be graded.

**Problem 1.** Write a MIPS program that reads a word from location $1000_{10}$, reverses the bits in the word, and then writes the word back (to location $1000_{10}$).

Assume, for example, the original the word is

$$00000000000000000000011011001.$$  

It should finish as

$$100110110000000000000000000000.$$  

**Problem 2.** Write a MIPS program that reads an integer from location $1021_{10}$ and determines if it is prime. If so the program writes a 1 back to the location; otherwise it writes a 0.

**Problem 3.** Assume we would like to produce a computer circuit for the following:

The circuit stores a three digit binary number that is guaranteed to have an even number of 0’s (001, 010, 100, 111). While value $v$ is stored, the circuit “outputs” a two-bit number $z = z_1z_0$ that represents the index of the middle 1. So, 001 outputs 00, 010 outputs 01, 100 outputs 10, and 111 outputs 01.

At each clock pulse $x$ can potentially change. There is an input $x$, which is a three-bit number that says whether the associated bit of $v$ should be inverted (where a 1 means invert the bit). So, for example, $x = 110$ would mean invert the leftmost two bits $v$; thus $x = 110$ would change $v = 010$ into $v = 100$.

(a) Draw the Mealy machine associated with this circuit.
(b) Give the excitation table using D flip-flops.
(c) Draw the circuit using D flip-flops.
(d) Give the excitation table using T flip-flops.
(e) Draw the circuit using T flip-flops.