

ENEE 244 (01**). Spring 2006

Homework 6

Due back in class on Wednesday, May 10.

1. Design a modulo-6 counter, which counts 0,1,2,3,4,5,0,1,..... The counter counts the clock pulses if its enable input, w , is equal to 1. Use D flip flops in your circuit. If the circuit ever finds itself in an unused state (6 or 7), it should transition to state 0 with the next clock trigger to avoid being stuck in an unused state. Use a formal design procedure. No credit for doing an intuitive design!
2. Design a counter with T flip flops that goes through the following binary repeated sequence 0,1,3,7,6,4. Show that when the states 010 and 101 are considered as don't care conditions the counter may not operate properly.
3. Design a circuit that is a serial even parity generator. The circuit has two bits of input x and s , where x is the data input and s is the start. The input number is applied bit-by-bit to the x input. The start signal s is supposed to be set to 1 by the user to indicate the start of a new number. The new number's first bit is applied *at the same time* as $s=1$. A signal $s=0$ implies that the old number is continuing and x is the next bit of the old number. There is one output bit p which outputs the even parity bit of the number seen so far beginning from the cycle of the most-recently seen $s=1$ signal. In this way, this circuit can be used to compute the even parity of numbers of any length desired by the user. At startup, until the first $s=1$ is seen, the output is undefined. Design a Moore machine using JK flip-flops. Use a formal design procedure. Draw the resulting circuit. Recall that an even parity bit is such a bit that makes the number of 1s in the number seen so far, including the parity bit, to be even (i.e, the number of bits in the number seen so far is odd).
4. Design a three-bit up/down counter using T flip flops. It should include a control input called Up/Down. If Up/Down =0, then the circuit behaves as an up counter. If Up/Down =1, then the circuit should behave as a down counter. Do not use a formal design procedure; instead use your intuition or a variant of a design in the book.
5. Design a 4-bit binary synchronous counter with D flip flops. Use an intuitive design procedure or a variant of a circuit in the book.