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EECS 150 R. H. Katz
Spring 2001

Problem Set # 6 (Assigned 1 March, Due 9 March)

1. Design the logic for a 3-bit counter that follows the following sequence: 000, 111, 001, 110, 010, 101, 011, 100, 000 and repeats. Design the counter so when Reset is asserted, the counter enters the state 000.
2. Design the logic for a 3-bit counter that follows the following sequence: 001, 010, 100, 101, 110, 001, and repeat. Design the counter so that it is self-starting, i.e., whatever state it comes up in, it will eventually get into the sequence as shown above.
3. Consider the design of a simple digital alarm clock. The clock can display the current time in HH:MM notation along with a single LED that is illuminated when the time is PM (it is NOT lit up in the AM). There are several control inputs for setting the current time and the alarm time. The TIME SET HH button allows you to rapidly advance through the hours 1 through 12 AM and 1 through 12 PM. The time advances one hour for each time the button is pressed. The TIME SET MM button does the same thing for the minutes 00 through 59. In addition, the clock has a toggle input that indicates CLOCK in one position and ALARM in the other. This refers to which time is being set by the TIME SET buttons: either the current time (CLOCK) or the alarm time (ALARM). If the ALARM button is set, the clock displays the last set alarm time. Finally, there is another input controlled by a push button: ALARM ON when pushed in and ALARM OFF when popped out. Your job is define the state diagram for the clock controller. It should support normal clock display (when CLOCK is set), alarm display (when ALARM is set), set current time (CLOCK + TIME SET buttons), set alarm time (ALARM + TIME SET buttons), and of course, the alarm should sound when current time equals alarm time.
   (a) Identify your inputs, outputs, and name and describe your states.
   (b) Draw a symbolic state diagram for your design, labeling all state transitions.
4. Professor Katz has one of those incredibly complicated European Miele clothes dryers. The machine has dryer settings for three mutually exclusive option settings, one of which MUST be selected: *Cotton fabrics* (Extra Dry, Normal+, Normal, Hand Iron, Hand Iron Damp, Machine Iron Wet), *Permanent Press fabrics* (Normal+, Normal, Hand Iron), or *Timed Drying* (15 minutes, 20 minutes, 30 minutes). Presumably the dryer has some kind of embedded humidity sensor that can determine just how wet the wash is, and when this sensor value is reached, the dryer can advance to the next phase. This is *Cool Down*, which turns off the drying action until the clothes reach a predetermined "cool" temperature. The final stage is *Anticrease*, which intermixes a tumbling action with periods for which nothing happens (e.g., 10 second spin followed by 30 seconds of nothing). This goes on for five minutes. The machine then advances to *Stop*, and is ready for the next load.
   (a) Identify your inputs, outputs, and name and describe your states.
   (b) Draw a symbolic state diagram for your design, labeling all state transitions. Write down any additional assumptions you are making.