

**Department of Electrical and Computer Engineering  
University of Wisconsin–Madison**

**ECE 553: Testing and Testable Design of Digital Systems  
Fall 2011**

ASSIGNMENT #4

Date: Thursday, October 25, 2011

**Due date : Thursday, November 3, 2011**

1. (Bushnell and Agrawal) Problem 8.2
2. (Bushnell and Agrawal) Problem 8.4
3. (Bushnell and Agrawal) Problem 8.6
4. (Bushnell and Agrawal) Problem 8.12
5. The finite state machine  $M7$  in Table 1 has a single input, a single output, and 5 states.
  - (a) Is this a strongly connected machine?
  - (b) Find a shortest *synchronizing sequence* for this machine. (To make grading easier, please designate the **left branches** of your tree correspond to  $Input = 0$  for all trees in parts (b), (c), and (d).)
  - (c) Find a minimum length *distinguishing sequence*. Tabulate the output responses, initial and final states of applying your distinguishing sequence to the machine in each of the 5 starting states.
  - (d) Find a minimum length *homing sequence* which is different from the distinguishing sequence found in part (c).

Table 1: State Machine  $M7$  for Problem 4.

	Input	
	0	1
A	A/1	C/1
B	E/0	E/1
C	C/1	D/0
D	D/1	B/0
E	E/0	A/1

6. The finite state machine in Fig.1 has a single input, a single output, and 5 states.
- Convert the state machine into a state transition table like the one given in Problem 4.
  - Find a shortest *synchronizing sequence* for this machine.
  - Find a minimum length *distinguishing sequence*. Tabulate the output responses, initial and final states of applying your distinguishing sequence to the machine in each of the 5 starting states.
  - Design a *checking sequence* for this machine such that the total length of the sequence is small. Note that you can achieve this by choosing appropriate transfers while designing the checking sequence. You may use  $SS$  to denote the synchronizing sequence you found in part (a) and  $DS$  to denote distinguishing sequence you found in part (b). Likewise, you may use  $T_{ij}$  to denote transfer sequence from state  $i$  to state  $j$ . However, you have to clearly indicate what the sequences are in terms of inputs, and the states after the application of the sequences. In addition, also indicate the expected outputs whenever the outputs are to be observed.

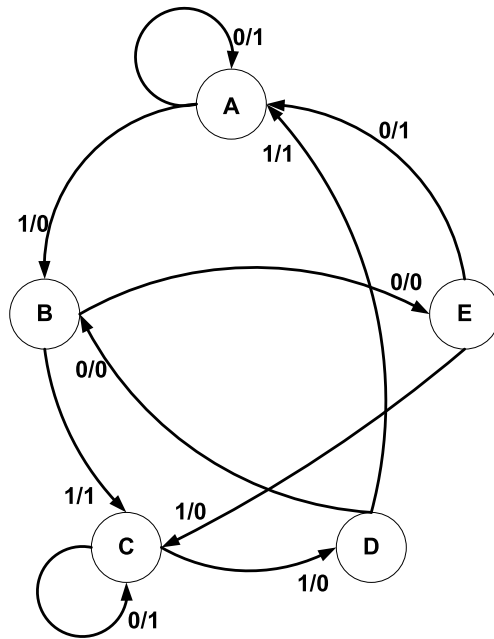


Fig 1. FSM for Prob. 5