

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

**ECE 553: Testing and Testable Design of Digital Systems
Fall 2009**

ASSIGNMENT #4

Date: Tuesday, October 20, 2009

Due date : Tuesday, November 3, 2009

1. (Bushnell and Agrawal) Problem 8.2
2. (Bushnell and Agrawal) Problem 8.5
3. (Bushnell and Agrawal) Problem 8.6
4. For the finite state machine in Table 1,
 - (a) Is this a strongly connected machine?
 - (b) Is 1000 a synchronizing sequence? Is it the shortest synchronizing sequence? If it is not, find the shortest synchronizing sequence. Explain your answers.
 - (c) For the homing sequence 101, show the output sequence and final state associated with each of the possible initial states.
 - (d) Find all the 4-bit distinguishing sequences. Show your work.

Table 1: State Machine for Problem 4.

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

5. The finite state machine in Fig.1 has a single input, a single output, and 5 states.

- (a) Convert the state machine into a state transition table like the one given in Problem 4.
- (b) Find a shortest *synchronizing sequence* for this machine.
- (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) 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.

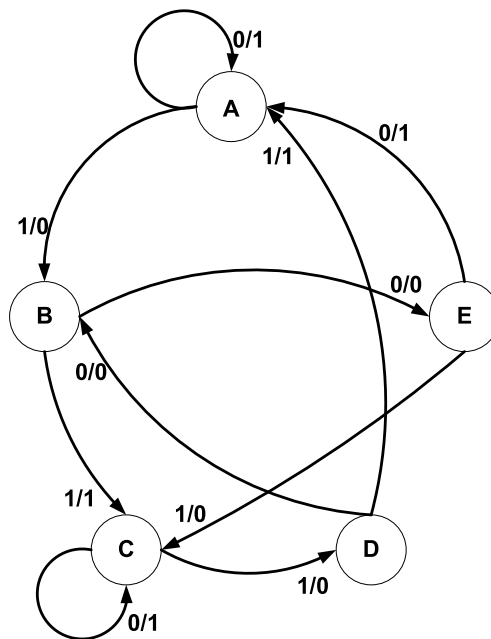


Fig 1. FSM for Prob. 5