

University of Illinois at Urbana-Champaign
Department of Electrical and Computer Engineering

ECE 362/CS 362/MATH 391 : LOGIC DESIGN

Spring 2002

Problem Set 11

State Machine Design, State Reduction, Design for Testability

Issued: Thursday, April 25th.

Due: Never.

Reading from McCluskey: Chapter 9, Chapter 10.

Announcement: The Final Exam will be held on Thursday, May 9th, from 1:30 to 4:30pm in 100 MSEB. The exam will cover all material from the beginning of the term. The corresponding material includes (but is not limited to) Problem Sets 1 through 11 and the following material from McCluskey:

- *Exam 1:* Chapter 2 (2.1-2.8), Chapter (3.1-3.6), Chapter 6 (6.1-6.10);
- *Exam 2:* Chapter 3 (3.6), Chapter 6 (6.10-6.13), Chapter 5, Chapter 7, Chapter 8 (8.1-8.2);
- *After Exam 2:* Chapters 8, 9 and 10.

During the exam, you can bring *three* 8.5 × 11-inch double-sided sheets of *handwritten* notes. Calculators are allowed but will not be necessary.

A copy of an old final exam can be downloaded from <http://courses.ece.uiuc.edu/ece362>. This exam does not necessarily resemble this year's exam (also notice that the material covered in this old exam is slightly different from the material covered in this year's exam).

Problem 11.1

Problem 9.1 from McCluskey.

Problem 11.2

Let M be a Moore finite state machine with 4 states and a pulse input x . Show that the state of the machine after 17 consecutive x -pulses, starting from any initial state, must be the same as the state of the machine after 5 x -pulses (starting from the same initial state).

Problem 11.3

Reduce the state table given in Table P9.3(a) on page 419 in McCluskey.

Problem 11.4

Problem 9.10 from McCluskey.

Problem 11.5

Problem 9.15 (part (a) only) from McCluskey.

Problem 11.6

Find a reduced state table for the machine with the following specification.

| | $x = 0$ | $x = 1$ | z |
|-----|---------|---------|-----|
| A | B | H | 1 |
| B | F | D | 1 |
| C | D | E | 0 |
| D | C | F | 0 |
| E | D | C | 1 |
| F | C | C | 1 |
| G | C | D | 1 |
| H | C | A | 0 |

Problem 11.7

For the following flow table determine (a) the pair table, (ii) the maximal compatibility classes, (iii) a minimal closed covering, (iv) a second minimal closed covering (if the first one is not unique), and (v) the corresponding reduced flow table.

| | x_1 | x_2 | x_3 |
|-----|--------|--------|--------|
| A | $C, 0$ | $E, 1$ | – |
| B | $C, 0$ | E, d | – |
| C | B, d | $C, 0$ | A, d |
| D | $B, 0$ | C, d | E, d |
| E | – | $E, 0$ | A, d |

Problem 11.8

Problem 10.1 from McCluskey.

Problem 11.9

Problem 10.2 from McCluskey.