

# CS 154 - Introduction to Automata and Complexity Theory

Spring Quarter, 2001

Assignment #1 - Due date: Wednesday, 4/18/01

**Problem 1.** (10 points) Consider the DFA described in Exercise 2.2.11 on page 55 of the textbook. Informally describe the language of this DFA. (*You do not need to prove the correctness of your answer.*)

**Problem 2.** (10 points) Construct a DFA to recognize the following language over the alphabet  $\Sigma = \{0, 1\}$ .

The set of strings in which the number of 0's is divisible by 3 and the number of 1's is divisible by 2.

**Problem 3.** (25 points) Solve Exercise 2.2.8 on page 54 of the textbook.

**Problem 4.** (25 points)

(a). Consider the language described in Exercise 2.3.4(c) on page 67 of the textbook. Construct an NFA for this language.

(b). *For this part, you should consider the language in part (a) modified to not allow 0 to be a multiple of 4. That is, the language consists of all strings in which there are two 0's separated by  $4k$  positions for some value  $k > 0$ .*

You should be glad that I did not ask you to construct a DFA for this language. To truly appreciate this, prove that any DFA for this problem must have at least  $2^4$  states. How does this compare with your NFA? What are the implications for the relative power of NFAs and DFAs?

**Problem 5.** (30 points) Solve Exercise 2.3.3 on page 67 of the textbook.

## Reading Assignment:

Each homework will specify a set of readings from the textbook — these are generally a required reading to follow the material presented in the lectures.

1. In Chapter 1, we have only covered Section 1.5 in class. But read Chapter 1 anyway; you really need to be familiar with the background material in this chapter.
2. By now, we have covered Chapter 2.1, 2.2, and 2.3 in class. Read these and Chapter 2.4 for an interesting application.
3. We will be covering Section 2.5 and portions of Chapters 3 in the next couple of lectures.