

## MA/CSSE 474 Homework #3 (33 points total)

Submit to drop box on Moodle.

2.1 means Exercise 1 from Chapter 2.

You only have to turn in the problems that are highlighted in yellow, but you should still think about the others.

Please **reread the instructions** that precede the problem list in the HW1 assignment sheet. They apply here also.

1. (t-6) 5.2(j) *aa and bb as substrings* [If you need simpler practice (and you probably do!), do some other parts of 5.2 first]. For this and other similar problems, you do not need to give the entire formal definition of your FSM.  
A transition diagram or transition table is sufficient.
2. (t-6) 5.2(l) *no more than one pair of consecutive 0's and 1's* (that's part *el*, the letter that comes between *k* and *m* in the English alphabet)
3. 5.3 *Rock, Paper, Scissors*
4. (t-3) 5.4 *L(M) contains  $\varepsilon$*  The answer is simple and straightforward, so don't look for anything complicated or tricky.
5. (t-6) *divisible by 3* Let  $L$  be  $\{w \in \{0, 1\}^* : \exists n, k \in \mathbb{N} (w = \langle n \rangle \wedge n = 3k)\}$ . I.e. the set of binary representations of natural numbers that are divisible by 3. Leading zeroes are allowed. Recall that  $0 \in \mathbb{N}$ .  
Draw the transition diagram or a transition table for a DFSA that accepts  $L$ . [Hint: think about remainders *mod* 3. Another hint: There are not many states].
6. 5.5 *determine membership in L(M)*
7. 5.6(a) *FSM to accept a simple language*
8. (t-6) 5.6(c) *decimal encoding of integer with a substring divisible by 3* Note that this one is decimal, while problem 5 is binary. Also notice the "contains a substring" part.
9. (t-6) 5.7 *three identical symbols in a row*

Some past questions and answers from Piazza:

### Minimize FSM?

Q: Should we try to minimize our FSM on the homework or does it matter?

A: Trying to write your DFSA's with as few states as you can is a good idea, but it is not required for this assignment. Later this week we will look at an algorithm for doing that.

## Pair of consecutive 1s/0s Problem 2

Q: For Problem #2 in HW 3 (2 I), does 111 constitute as 1 or 2 pairs of consecutive 1s? You could count the 2nd 1 as the 2nd 1 in the 1st pair or the 1st 1 in the 2nd pair.

A: There are indeed two pairs in the three 1's.

## HW3 Problem 5: Are the binary strings fed with the most significant bit first?

Q: Does it not matter?

A: Unless a specific problem specifies otherwise, assume that binary strings are written with the most significant bit/digit first.

## Empty string in HW 3 problem 5

Q: For problem 5 (binary representations of integers divisible by 3), can we consider the empty string a representation of 0, or should we avoid this?

A: The machine should not accept the empty string.