Assignment 1 is due at the start of class on **Wednesday, January 31**.

Instructions

Write the answers to the following exercises, in order. If you create a file containing your answers, print the file. Staple pages together, and include your name. Turn in your work in paper form at the start of class.

Exercises

1. Draw a state diagram (or "transition diagram") for a finite automaton that determines whether its input contains an "a" character, followed by **zero or more** "b" characters, followed by a "c" character. *Note: We covered how to do things like this in class. If you are not sure what to do, it may help to skim section 2.2.*

2. The following claims to be a proof that every positive integer is greater than 10.

> We prove that every positive integer is greater than 10, using induction.
>
> Let n be a positive integer. Suppose that $n > 10$. Then $n + 1 > n > 10$, and so $n + 1 > 10$.
>
> By induction, every positive integer is greater than 10.

What is wrong with the above "proof"?

3. Suppose we wish to prove that the languages that can be recognized by a DFA are precisely the languages that can be represented using regular expressions. How do we prove this? (Do not write a proof; merely tell what steps we take. What do we need to prove?) *Hint: To answer this exercise, you do not need to know what the terminology means. You* do *need to understand some of chapter 1 in the text.*

4. Consider the following statement.

> The sum of an odd integer and an even integer is always divisible by 3.

Prove this statement, or find a counterexample.

5. Consider the following statement.

> For each positive integer n, the sum of the integers 1 through n is $n(n+1)/2$.

Prove this statement, or find a counterexample.

6. Here is a problem.

> Given a graph, determine whether it can be colored with 4 colors.

The text indicates that every "problem" corresponds to some "language". What is the language corresponding to this problem?