Homework 1
COSE312, Fall 2015

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Due: 09/24, 17:00 (in class)

Problem 1 (20 pts) Write a regular expression to describe each of the following languages:

1. Strings over the alphabet $\{a, b, c\}$ where the first a precedes the first b.
2. Strings over the alphabet $\{a, b, c\}$ with an even number of a's.
3. Binary numbers that are multiples of four.
4. Any sequence of tabs and blanks (i.e., whitespaces)
5. Comments in the C language that begin with delimiter `//` and run to the end of the current input line.

Problem 2 (30 pts) Consider the regular expression:

$$(01 \mid 10 \mid 00)^*11$$

1. Convert the regular expression into an equivalent NFA.
2. Compute ϵ-closures for each of the NFA states.
3. Convert the NFA to DFA using the subset construction algorithm in lecture slides. Show δ_D, D, and W for each iteration of the loop.

Problem 3 (20 pts) A list of integer is constructed in two ways. First, nil is an empty list. Second, given a list l and an integer n, appending n in front of l gives a new list, i.e., $n \cdot l$. For instance, $1 \cdot \mathsf{nil}$, $1 \cdot 2 \cdot \mathsf{nil}$, $1 \cdot -2 \cdot 3 \cdot \mathsf{nil}$, ... are lists of integers.

1. Give an inductive definition for lists of integers.
2. We can define the set L of all lists of integers by a least fixed point of some function F, i.e.,
$$L = \mathit{fix}F.$$
Define F.