CS 480: Compiler Design
Problem Set 1

Due: 06/04/2017

Instructions:
I leave plenty of space on each page for your computation. If you need more sheet, please attach your work right behind the corresponding problem. If your answer is incorrect but you show the computation process, then partial credits will be given. It is prefered that you type up your solution (you can use the DocHub extension on Google Drive to edit pdf files and insert images without using LaTeX) and upload your solution onto blackboard for grading.

First Name:

Last Name:

Score: **/110**

Problem 1 Introduction : 10 pts

(a) Please briefly describe the seven processing stages for modern compilers.

(b) Which stage of the seven stages is of most interest to you and why ?

Problem 2 DFA| NFA | : 20 (10/5/5) pts

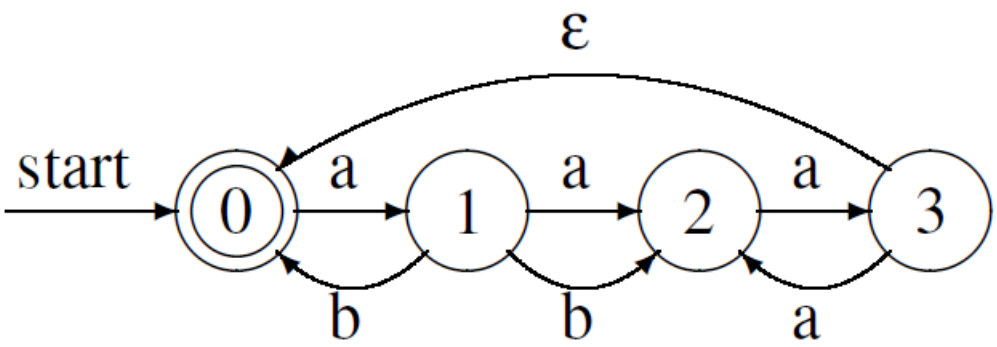
Given the regular expression $a^*(a|b)aa$:
(a) Construct an equivalent NFA

(b) Convert the above NFA into DFA

(c) What would the NFA look like if we have $(a^*(a|b)aa)^*$

Problem 3 DFA | NFA | Regular Expression : 20pts

Given the following NFA:

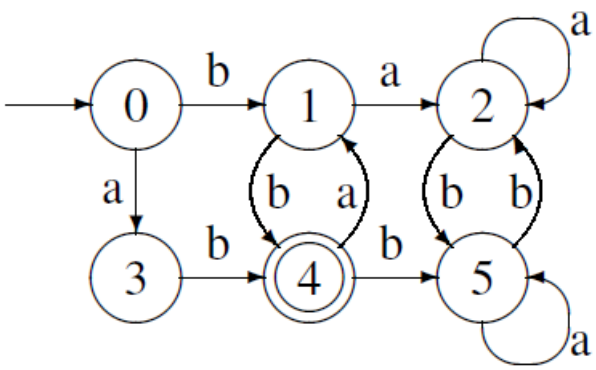


(a) Make a DFA equivalent to the above NFA

(b) What is the regular expression for this finite automata?

Problem 4 DFA | NFA | Regular Expression : 10pts

Given the following DFA:



(a) What is the regular expression for this automata?

(b) Minimize the DFA

Problem 5 DFA | NFA | Regular Expression : 30 (10/10/10)pts

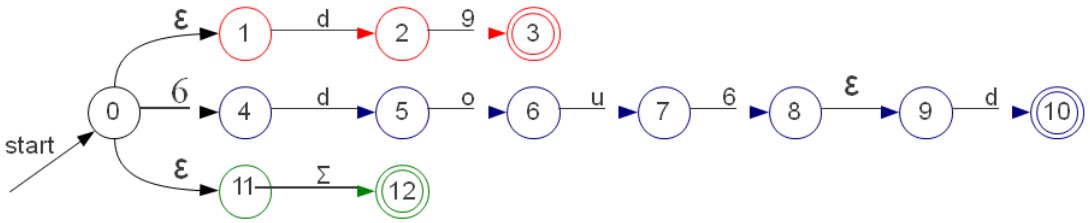
Given that binary number strings are read with the most significant bit first and may have leading zeroes, construct DFAs for each of the following languages: a) Binary number strings that represent numbers that are multiples of 4, e.g., 0, 100 and 10100.

b) Binary number strings that represent numbers that are multiples of 5, e.g., 0, 101, 10100 and 11001. (Hint: Make a state for each possible remainder after division by 5 and then add a state to avoid accepting the empty string.)

c) Given a number n, what is the minimal number of states needed in a DFA that recognises binary numbers that are multiples of n ? (Hint: Write n as $2b$ where a is odd)

Problem 6 DFA | NFA : 20 (3/10/7)pts

Let $\Sigma = \{a, b, \cdots, z\}$ and $d = \{0, 1, \cdots, 9\}$. Given the following NFA (assuming the d in the image means digit, not the letter d):



(a) Give an accepted string for state 3, 10 and 12, respectively.

(b) Convert this NFA to DFA

(c) What is the regular expression for this automata?