Theory of Computation
Due 10:00am, Monday, March 5, 2018

In general tutorial sessions are to discuss the problems you faced during solving these exercises. Solutions will in general not be presented but discussed during these sessions.

Exercise 1 Gradiance – Compulsory! Hurdle!
Sign up to the course (if you haven’t already) on Gradiance with Class Token: 8DDCA614. Please log in and complete the assigned homework “Chapter 03: Regular Expressions — Algebra and FA Equivalence”.

Exercise 2 Regular Expressions - I
Write regular expressions for the following languages:

(a) The set of strings over alphabet \{a, b, c\} containing at least one \(a\) and at least one \(b\)
(b) The set of strings of 0’s and 1’s whose tenth symbol from right end is 1.
(c) The set of strings of 0’s and 1’s with at most one pair of consecutive 1’s.

Exercise 3 Regular Expressions - II
Give English descriptions of the languages of the following regular expressions:

(a) \((1 + \epsilon)(00^*1)^*0^*\)
(b) \((0^*1^*)^*000(0 + 1)^*\)
(c) \((0 + 10)^*1^*\)

Exercise 4 Pumping Lemma
Show that the following languages over the alphabet \(\Sigma = \{a, b\}\) are not regular.

(a) \(\{ww \mid w \in \Sigma^*\}\)
(b) \(\{a^n \mid n = 2^k \text{ for some } k \in \mathbb{N}\}\)

Do (b) using the Pumping Lemma feature of JFLAP.

JFLAP is a Java program for experimenting with automata, formal grammars and related algorithms. Please download JFLAP from the course homepage (to be found in the section ‘Resources’).