TOC-Assignment # 1 (Topics: Preliminaries, Regex, FA)

1. Write down the formal proof that $\sqrt{3}$ is irrational.

2. Can there exist an algorithm that can find out whether a given program of C halts on a given input x? Justify your answer for yes/no.

3. Given the languages $L_1 = \{\varepsilon, 0, 1\}$ and $L_2 = \{\varepsilon, 01, 11\}$, find out $L_1 \cap L_2$, $L_1 \cup L_2$, L_1^*, L_2^*, $L_1 \circ L_2$, and $L_1 - L_2$.

4. Can you think of an algorithm to decide if any two arbitrary regular expressions represent the same language? (In other words, is equivalence of two regular expressions decidable?)

5. Which of the following statements about regular expressions are True/False? Justify.

   (a) $(R + S)^* = (R^* S^*)^*$

   (b) $(R + S)^* = (R^* + S^*)$

   (c) $(RS + R)^* RS = (R + S)^*$

6. Find regular expressions corresponding to the following regular sets:

   (a) $\{a, ab, abb, abbb, abbbb, \dots\}$

   (b) $\{ab, abb, aab, aabb\}$

7. Describe the language accepted by the automaton corresponding to the transition diagram given in figure 1. Also, give its regular expression.
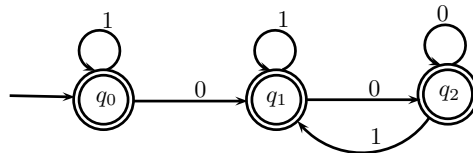

Figure 1: DFA.

8.

9. Find the finite automata for each of the following regular expressions:

   (a) $aa^* bb^* cc^*$

   (b) $(aba^* ba^* b)^*$

10. Determine the regular expression for the automaton shown in figure 2.

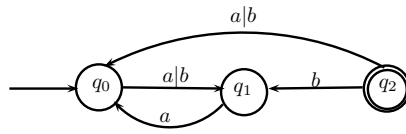11. Construct a finite automation to simulate an elevator for a 10 story building.

Figure 2: DFA.

Note: (1) Submission deadline **Aug. 23, 2015** *as softcopy online by email till 11:59PM, to kr.chowdhary@iitj.ac.in, with subject as TOC-Rollno. (2) The document should be in pdf form, preferably edited in latex and then compiled and converted to pdf.*