Indian Institute of Technology Bhilai
CS203: Theory of Computation I
Tutorial Sheet 1

• *Solve the following problems before the Tutorial.*

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1. For strings x and y, prove $(xy)^R = y^R x^R$.
2. For language L_1 and L_2, prove $(L_1L_2)^R = L_2^R L_1^R$ and $(L_1 \cap L_2)^R = L_1^R \cap L_2^R$.
3. For language L, prove $L^+ = L^*$ if and only if $\epsilon \in L$.
4. Let $L = \{ab, aa, baa\}$. Which of the following strings are in L^*: *abaabaaabaa*, *aaaabaaaa*, *baaaaabaaaab*, *baaaaabaa*? Which strings are in L^4?
5. Let $\sum = \{a, b\}$ and $L = \{aa, bb\}$. Use set notation to describe $\overline{L}$, complement of L.
6. Let $L_1 = \{\varepsilon, a\}$ and $L_2 = \{a, b\}$. List the elements of the following sets.
   (i) L_1^2
   (ii) L_2^3
   (iii) L_1L_2
   (iv) L_1^+
   (v) L_2^*
7. Find Kleene star (L^*) of the language $L = \{\varepsilon, 0, 01\}$.
8. Prove distributive properties for the languages L_1, L_2, L_3
   (i) $(L_1 \cup L_2)L_3 = L_1L_3 \cup L_2L_3$
   (ii) $L_1(L_2 \cup L_3) = L_1L_3 \cup L_1L_3$
9. Prove $L^*L = LL^* = L^+$.
10. Write the regular expressions corresponding to the following languages:
    (i) The set of all strings over some alphabet $\sum = \{0, 1\}$ with even number of $0'$s.
    (iii) The set of all strings over some alphabet $\sum$ that have an a in the 5th position from the right.
    (iv) The set of all strings over some alphabet $\sum$ with no consecutive a's.
    (v) The set of all strings over $\{a, b\}$ in which every occurrence of b is not before an occurrence of a.