Theory of Computations
Assignment 1

Regular Expressions

1. Construct a regular expression for all words in which 'a' appears tripled, if at all. This means that every clump of a's contains 3 or 6 or 9 or 12… a's.

2. Construct a regular expression for all words that contain at least one of the strings s1, s2, s3, or s4.

3. Construct a regular expression for all strings that have exactly one double letter in them.
   Note: 'exactly one double letter' implies two equal touching letters; triples etc are excluded.

4. Construct a regular expression for all strings in which the letter b is never tripled. This means that no word contains the substring bbb.
   Note: Words can be empty and start and end with a or b. A compulsory 'a' is inserted between all repetitions of b's.

5. Construct a regular expression for:
   - (ii) all words that do not have both the substrings bba and abb.

6. Construct a regular expression for:
   - all strings in which any b's that occur are found in clumps of an odd number at a time, such as abaabbbab.
   - all strings that have an even number of a's and an odd number of b's.
   - all strings that have an odd number of a's and an odd number of b's.

7. State whether each pair of regular expressions are equivalent or not.
   - (a*b*) and (ab)*
   - (ab) a* and a(ba)*
   - (a * + b)* and (a + b)*

- (a* + b *) * and (a + b)*

8. Describe in English the languages represnted by the following RE:
   - (a(a + bb)*)*
   - (b(bb)*)*(a(aa)*b(bb)*)*
   - ((a+b)a)*

9. Describe in English phrases the languages associated with the following regular expression:
   - baa + abbb + bababa
   - a(a + bb)*
   - (a(aa)*b(bb)*)*
   - (b(bb)*)*(a(aa)*b(bb)*)*
   - ((a + bb)a)*
   - (a + b)*(aa + bb)(a + b)*
   - (a + b)*a(Λ + bbbb)

Submission :

- Deadline is Thursday 20-May @11:59PM
- The assignment is individual.
- Cheating could lead to serious consequences.