TOC , Jan-June 2021

ASSIGNMENT - 1

Q1.

Let $L = \{ab, aa, baa\}$. Which of the following strings are in L^*: *abaabaaabaa, aaaabaaaa, baaaaabaaaab, baaaaabaa?* Which strings are in L^4?

Q2.

Let $\Sigma = \{a, b\}$ and $L = \{aa, bb\}$. Use set notation to describe $\overline{L}$.

Q3.

Find grammars for $\Sigma = \{a, b\}$ that generate the sets of
(a) all strings with exactly one a.

(b) all strings with at least one a.

(c) all strings with no more than three a's.

(d) all strings with at least three a's.

In each case, give convincing arguments that the grammar you give does indeed generate the indicated language.

Q4.

Let $\Sigma = \{a, b\}$. For each of the following languages, find a grammar that generates it.
(a) $L_1 = \{a^n b^m : n \geq 0, m > n\}$.

(b) $L_2 = \{a^n b^{2n} : n \geq 0\}$.

(c) $L_3 = \{a^{n+2} b^n : n \geq 1\}$.

(d) $L_4 = \{a^n b^{n-3} : n \geq 3\}$.

(e) $L_1 L_2$.

(f) $L_1 \cup L_2$.

(g) L_1^3.

(h) L_1^*.

Q5.

Show that the grammars

$$S \rightarrow aSb|bSa|SS|a$$

and

$$S \rightarrow aSb|bSa|a$$

are not equivalent.

Q6.

For $\Sigma = \{a,b\}$, c onstruct dfa's that accept the sets consisting of

(a) all strings with exactly one a,

(b) all strings with at least one a,

(c) all strings with no more than three a's,

(d) all strings with at least one a and exactly two b's,

(e) all the strings with exactly two a's and more than two b's.

Q7.

Consider the set of strings on $\{0,1\}$ defined by the requirements below. For each, construct an accepting dfa.

(a) Every 00 is followed immediately by a 1. For example, the strings 101, 0010, 0010011001 are in the language, but 0001 and 00100 are not.

(b) All strings containing 00 but not 000.

(c) The leftmost symbol differs from the rightmost one.

(d) Every substring of four symbols has at most two 0's. For example, 001110 and 011001 are in the language, but 10010 is not since one of its substrings, 0010, contains three zeros.

(e) All strings of length five or more in which the fourth symbol from the right end is different from the leftmost symbol.

(f) All strings in which the leftmost two symbols and the rightmost two symbols are identical.

(g) All strings of length four or greater in which the leftmost three symbols are the same, but different from the rightmost symbol.