Bahria University Lahore Campus

Department of Computer Sciences

THEORY OF AUTOMATA

ASSIGNMENT # 01

Marks: 20

SOLUTION

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Program: BSCS 4A,4B

Q.1 Consider the following recursive definition of PALINDROME:

a. Rule 1. *a* and *b* are in PLANILDROME
   Rule 2. If *x* is in PALINDROME then so are *axa* and *bxb.*
   Unfortunately the words defined by the rules have odd lengths. Fix the problem such that all appropriate words are included.

Answer:

The Set of Palindrome = [^,a,b,aa,bb,aaa,aba,bab,bbb,…….}
We have added the Null string to rule 1 it allows us to have strings of the form aa such that Null string can be placed for x in axa (So as per rule 2 if x is Palindrome and Null string meets the requirements). SO, Once we proved that aa is Palindrome all other even can be proved.
Examples
Axa, Aaxaa, aaaa

Q.2 Consider the language S*, where S = {ab,ba}.
How many words does this language have of length 4? of length 5? of length 6? What can be said in general?

Answer:

Here S is not an alphabet but also it is a set of substrings. That's why we should take length of bb as 2 instead of 1.

Strings of length 4 = 2^2 = 4
Strings of length 5 = 0
Strings of length 6 = 2^3 = 8
Strings of length 7 = 0

In general, number of EVEN length strings will be $2^{N/2}$ and number of ODD length strings will be always 0. (N denotes length of string).

Q.3 Construct a regular expression defining each of the following languages over *{a, b};*

a. All strings such that the number of a's is a multiple of 3.

Answer:

b*|(b*ab*ab*ab)*

b. All strings such that the number of a's is odd.

Q.4 Construct a regular expression over *{a, b}* of all words that do not have both the substrings *bba* and *abb.*

Answer:

a*(baa*)*b* + b*(a*ab)*a*

Q.5 Clarify the difference between valid and in valid words.

Answer:

While defining an alphabet of letters consisting of more than one symbols, no letter should be started with the letter of the same alphabet. One letter should not be the prefix of another. However, a letter may be ended in the letter of same alphabet *i.e.* one letter may be the suffix of another. For example

- Σ_1= {B, aB, bab, d}
- Σ_2= {B, Ba, bab, d}

Σ_1 is a valid alphabet while Σ_2 is an in-valid alphabet.

The End