Chapter 3

Lexical Analysis

(Section 3.3)

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Exercises 3.3.2: Describe the language denoted by the following regular expressions:

a) \( a(a|b)^*a \)
All strings of a’s and b’s begin and end with a.

b) \( ((\in |a)b^*)^* \)
All strings of a’s and b’s.

c) \( (a|b)^*a(a|b)(a|b) \)
All strings of a’s and b’s, with an a in the 3rd letter from the right.

d) \( a*ba*ba*ba* \)
All strings of a’s, with just three b’s.

e) \( (00|11)^*((01|10)(00|11)^*(01|10)(00|11)^*)^* \)
All strings of even number of 0’s and even number of 1’s

Exercises 3.3.3: In a string of length \( n \), how many of the following are there?

a) Prefixes
\( n+1 \)

b) Suffixes
\( n+1 \)

c) Proper prefixes
\( n-1 \)

d) Substrings
\( \sum_{i=0}^{n} i + 1 \)

e) Subsequences
\( 2^n \)

Exercises 3.3.4:

\( (S|s)(E|e)(L|l)(E|e)(C|c)(T|t) \)
Exercises 3.3.5: Write regular definitions for the following languages.

a) All strings of lowercase letters that contain the five vowels (a, e, i, o, or u) in order.
Letter → [b-d f-h j-n p-t v-z]
String → (Letter|a)* (Letter|e)* (Letter|i)* (Letter|o)* (Letter|u)*

b) All strings of lowercase letters in which the letters in are in ascending lexicographic order.
String → a*b*c*d*………..z*

c) Comments, consisting of a string surrounded by /* and */, without an intervening */,
unless it is inside double-quotes("")
Character → [a-zA-Z0-9]
Comment → /* (Character|“*/”|(*|/) Character)* */

d) All strings of a’s and b’s that do not contain the substring abb.
b* (a (∈ |b))*

e) All strings of a’s and b’s that do not contain the subsequence abb.
b* a*(∈ |b) a*

Extra Exercises: Write regular definitions for the following languages.

a) All strings of a’s and b’s with an even number of a’s.
b*(a b* a b*)*

b) All strings of a’s and b’s with an odd number of b’s.
a* b (a* b a* b)* a*

c) All strings of a’s and b’s that contain at least two b’s.
(a|b)* b (a|b)* b (a|b)*

d) All strings of a’s and b’s that contain at most two b’s.
a* (∈ |b) a* (∈ |b) a*

e) All strings of a’s and b’s that contain just two or three b’s
a* b a* b a* b a*

😊 Best Wishes😊