

Theory of Languages:

Assignment 1:

1) Consider the language defined $\Sigma = \{a, b\}$ of words having at least one a . Maybe expressed by a regular expression $(a+b)^* a (a+b)^*$

$$L(a+b)^* a (a+b)^* = (a/b)^* a (a/b)^*$$

$$(a+b)^* = \{a, ab, abb, abbb, \dots\}$$

$$\{a, ab, abb, abbb\} a \{a, ab, abb, abbb\}$$

2) Consider the language defined.

$\Sigma = \{a, b\}$ of words having at least one a and b maybe expressed a regular expression

$$(a+b)^* a (a+b)^* b (a+b)^* + (a+b)^* b (a+b)^* a (a+b)^*$$

$$L(a+b)^* = \{a, b, ab, \dots\}$$

$$\therefore \{a, b, ab\} a \{a, b, ab\} b \{a, b, ab\} + \{a, b, ab\} b \{a, b, ab\} a \{a, b, ab\}$$

consider the following regular expression

$$r_1 = (a+b)^* (aa+bb)$$

$$r_2 = (a+b)^* aa + (a+b)^* bb$$

$$r_1 = \{aaba, babba, baaabbaa, \dots\} (aa+bb)$$

$$= \{aaba, baabba, baaabbaa, aababb, baababb\}$$

$$r_2 = \{aaba, baabba, baaabbaa, aababb, baababb\}$$

$$\therefore r_1 = r_2$$

Assignment

- 1) Construct a CFG to represent set of all strings over $\{a, b\}$ which are palindrome of length even.

Example

Valid

aabbaa

aabbbb'aa

a a a a b b b b a a a a

a a a a b b a a a a

a a b b b b b b c a

Invalid

a b a a b

a b b a a

b b a a a a

a b b b a a

a a b a

- 2) Construct a grammar $L = \{a^n b^n c^k d^k / n \geq 1, k \geq 1\}$

Valid

a a b b c c d d

a a a b b b c c d d

a b c d

a a b b c c d d d d

a a b b c d

Invalid

a a c c d d b b

a b b c d d

a c d b

a a c c b b b d

a b b c c d

3) construct a grammar $L = \{a^n b^k c^h d^n / n \geq 1, k \geq 1\}$

valid

Invalid

aabced

aabbcd

abed

adbc

abbccd

aaabbbcd

aaabcedd

aabced

abbbcccd

acbbbd

4) construct a grammar for (a^* / b^*)

valid

Invalid

ab

aab

aaab

baaa

aaaabbb

abbb

aaaaabbbb

aaaab

aaaaaabbbbb

aaaaabb

5) construct a grammar for $(aa)^* (bb)^*$

valid

Invalid

aabb

aabbb

aaaaabbbb

aaaaabbb

aaaaaaaaabbbbb

bbaaaa

②

$aaaaaaabbbbbb$
 $aaaaaaaaabbbbbbb$

$aabbb$
 $aaaab$

6) Construct a grammar for $a^n b^{2n} / n \geq 1$

valid

abb

$aabbb$

$aaabbbb$

$aaaaabbbbb$

$aaaaabbbbbbb$

Invalid

$aabb$

$bbbbaa$

$abbb$

$bbbaa$

$aaabbbb$

7) Construct a CFG to represent set of all palindromes over $\{a, b\}$

valid

$aabbaa$

$abba$

$abba$

$aaabbaaa$

$abbaaba$

Invalid

$aabb$

$abab$

$aaabaaa$

$abbaaa$

$abbaaba$

8) Construct a grammar for $a^n b^{n+1}$

Valid

abb

$aabbb$

$aaabbbb$

$aaaa bbbbb$

$aaaaa bbbbbb$

Invalid

ab

$aabb$

$bbbaa$

$abbb$

$aabbbb$

Assignment

- 1) Construct a grammar to represent set of all strings over $\{0,1\}$ ending with 01.

$$P = \{ S \rightarrow 0B / 1S \\ B \rightarrow 0S / 1 \}$$

$$N = \{ S, B \} \quad \Sigma = \{ 0, 1 \} \quad S \rightarrow s$$

$$L = \{ 1101, 1001, 0101, 11101, 1111, 1000, 100, 100001111, 111 \}$$

Valid

1)	2)	3)	4)	5)
1101	11	0101	11101	11101
11	101	011	11	11
111	1001	0101	111	111
1101	1001	0101	11101	11101
1101				

Invalid

1)	2)	3)	4)	5)
1111	1000	110	11011	1010
11	11	11		
111	101	111		
1111	1001	1101		
11101	1001	110		

d) Construct a grammar to represent set of all decimal integers with the derivation tree.

$$P = \{ N \rightarrow -A / +A / dA / e$$

$$A \rightarrow e \}$$

$$T = \{ +, -, d, e \}$$

$$\Sigma = N$$

$$N = \{ N, A \}$$

valid

$$1) +54321$$

$$N \rightarrow +A$$

$$+dA$$

$$+ddA$$

$$+dddA$$

$$+ddddA$$

$$+dddddA$$

$$2) -45$$

$$= -A$$

$$-dA$$

$$-ddA$$

$$3) +85$$

$$= +A$$

$$+dA$$

$$+ddA$$

$$+dddA$$

Invalid:

$$1) + - 542$$

$$2) - + 123$$

$$3) + | - 32$$

$$4) + 54 - 21$$

$$5) 0x + 13$$

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