obtain a grammar to generate all non-palindromes over $\{a, b\}$. (7)

$S \to aSa \mid bSb \mid A$ | Generate palindromes on right & left

$A \to aBb \mid bBa$ | Generate a non-palindrome

$B \to aB \mid bB \mid \epsilon$ | Generates any combination of a's and b's.

$V = \{S, A, B\}$ | A generates strings of non-palindromes

$V = \{S, A, B\}$

$T = \{a, b\}$

$P = \{ S \to aSA \mid bSb$

$S \to A$

$A \to aBb \mid bBa$

$B \to aB \mid bB \mid \epsilon$

$\}$

S is the start symbol

$S \to aSa$

$\to abSba$

$\to abAba$

$\to abaBbba$

$\to abaaBbba$

$\to abaabba$ $\longrightarrow$ non-palindrome

Obtain the grammar to generate

$L = \{0^m 1^m 2^n \mid m \geq 1 \text{ and } n \geq 0\}$

Sol

$L = 0^m 1^m 2^n$ if $n = 0$, $m = 1$

$= 01$

$\therefore A \rightarrow 01 \mid 0A1$

If $n \geq 0$

$S \rightarrow A \mid S2 \Leftarrow$

$n = 1 \quad m = 2$

$L = 00112$

$A \rightarrow 01 \mid 0A1$

$L = L_1 L_2$ (concate)

$L_1 \Leftarrow$ contains m 0's followed by m 1's

$L_2 \Leftarrow$ zero or more 2's

L_1 $\quad A \rightarrow 01 \mid 0A1$

L_2 $\quad B \rightarrow 2B \mid \epsilon$

$L = L_1 L_2$

$\Rightarrow S \Rightarrow AB$

$G = \{V, T, P, S\}$

$T = \{0, 1, 2\}$

$P = \{ S \rightarrow AB$
$A \rightarrow 01 \mid 0A1$
$B \rightarrow 2B \mid \epsilon$

Q

find a string using the productions

$S \rightarrow$ } start symbol.

$L = \{0^n 1^{n+1} \mid n \geq 0\}$ (9)

sol.

Recursive definition of to generate string $0^n 1^n$ is

$A \to 0A1 \mid \epsilon$

If $A \to 0A1$ is applied n times.

$L = 1 \quad n = 0$

$L = 011 \quad n = 1$

$L = 00111 \quad n = 2$

$= (0011)1$

$n = 3$

$L = 0001111$

$= (000111)1$

$A \Rightarrow 0A1 \Rightarrow 00A11 = \cdots 0^n A 1^n$

$A \to \epsilon$

n times

$A \to 0A1 \to 00A11 \to 000A111 \Rightarrow 0^n 1^n$

But $L = 0^n 1^{n+1} = 0^n 1^n 1$

$S \to A1$

$V = \{S, A\}$

$T = \{0, 1\}$

$P \to \{$

$S \to A1$

$A \to 0A1 \mid \epsilon$

$\}$

$S \to$ is the start symbol

$S \to 0S1 \mid 1$

~~Obtain the grammar to generate the~~ (10)
language $L = \{ w \mid n_a(w) = n_b(w) \}$

\# of a's = \# of b's,

For equal \# of a's and b's

(1) an empty string ϵ has equal \# of a's and b's (zero).

(2) symbol a can be followed by b

(3) symbol b can be followed by a.

$\Downarrow$

$S \to \epsilon$

$S \to aSb$

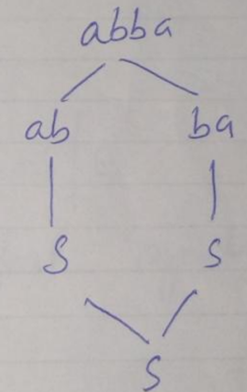
$S \to bSa$

$S \to SS$

$S \to aSb$

$S \to abSab$

$S \to abab$



$G = (V, T, P, S)$

$V = \{S\}$

$T = \{a, b\}$

$P = \{ S \to \epsilon$
$S \to aSb$
$S \to bSa$
$S \to SS \}$

S is the start symbol.

Obtain a grammar to generate the Language $L = \{ w = |w| \bmod 3 = 0 \}$ (11)

$\Sigma = \{a, b\}$

Sol The language generated by the grammar can be written as

$L = \{ \epsilon, aaa, aaaaaa, aaaaaaaaa, \ldots \}$

i.e, string generated should have a lengths of multiples of 3,

$S \to aaaS \mid \epsilon$

$\therefore V = \{S\}$

$T = \{a\}$

$P = \{$
$S \to aaaS \mid \epsilon$
$\}$

S is the start symbol.