Av-22

Regular expression to CFG

~~R = (0+1)* 0(0+1)*~~

$(0+1)^* 0 1^*$

$L = \{0, 00, 010, 0010, 00101, \ldots\}$

Try to generate CFG for this.

$S \longrightarrow A0B$

$A \longrightarrow 0A/1A/\varepsilon$

$B \longrightarrow 1B/\varepsilon$

Check the above CFG correct or not.

Generate 0101

$S \rightarrow A0B$

$\Rightarrow 0A0B \quad A \rightarrow 0A$

$\Rightarrow 01A0B \quad A \rightarrow 1A$

$\Rightarrow 01\varepsilon 0B \quad A \rightarrow \varepsilon$

$\Rightarrow 0101B \quad B \rightarrow 1B$

$\Rightarrow 0101\varepsilon \quad B \rightarrow \varepsilon$

$\Rightarrow 0101$

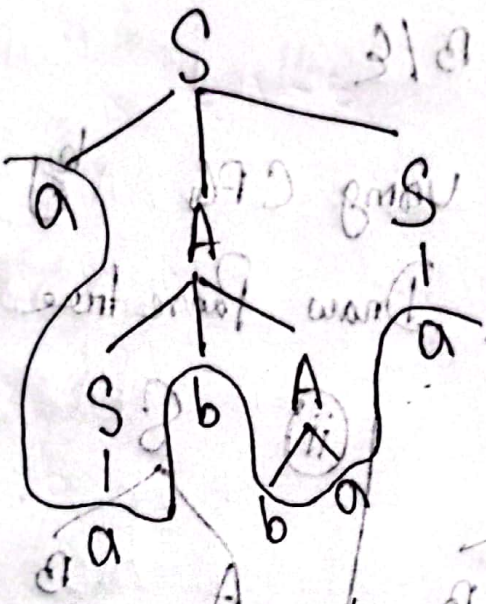
Constructing CFG to Parse tree, rightmost / Leftmost.

Given,

$S \longrightarrow aAS \mid a$

$A \longrightarrow SbA \mid SS \mid ba$

Show that $S \longrightarrow aabbaa$ by constructing derivation tree, by rightmost derivation.



$\rightarrow aabbaa$ (Ans)

$S \rightarrow aAS$

$\rightarrow aAA$

$\rightarrow aAaA$

$\rightarrow aAaSba$

$\rightarrow aAaaba$

$\rightarrow aaaaba$

Ambiguous grammer

if there exist two or more derivation tree for the string w.

$S \longrightarrow AB$

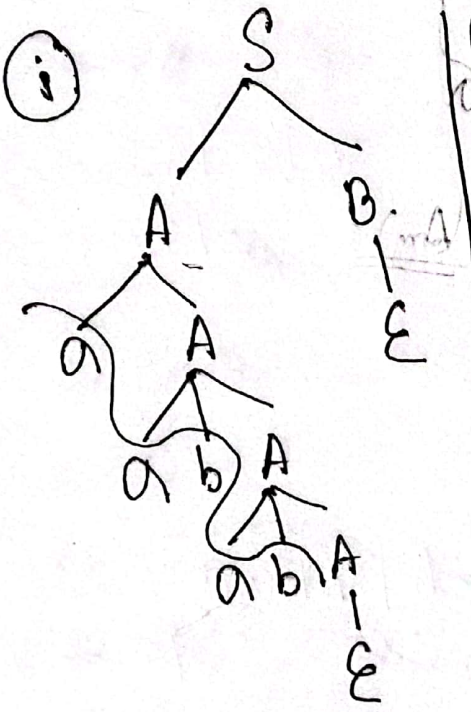
$A \longrightarrow aA / abA / \varepsilon$

$B \longrightarrow bB / abB / \varepsilon$

⇒ how to derive aabab using CFG

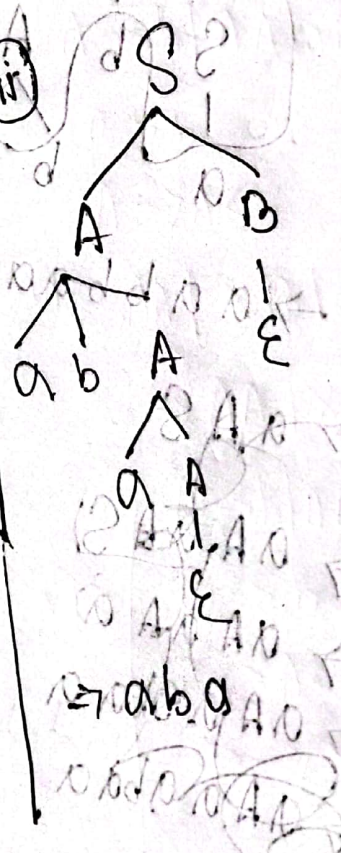
I.H.M derivation. Draw Parse tree.

(i)



⇒ aabab

(ii)

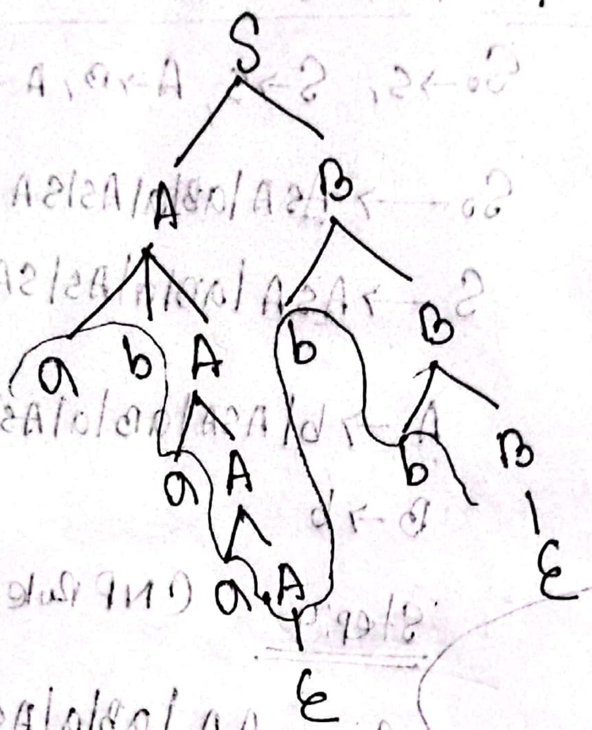


⇒ abaab

we get two Parse tree

So given grammer

On derive abaabb Using CFG R.M.D.



abaabb by R.M.d

For L.M.d → aababb

S → AB
→ aAB A → aA
→ aabAB A → abA
aab abAB A → abA
→ aab ab εε A → ε, B → ε
→ aabab

For R.M.d abaabb

S → AB
→ AbB B → bB
→ AbbB B → bB
→ Abbε B → ε
⇒ abAbb A → abA
⇒ abaAbb A → aA
⇒ abaaAbb A → aA
⇒ abaabb A → ε

CFG to CNF

Given $S \to ASA \mid aB$

$A \to B \mid S$

$B \to b \mid \varepsilon$

Step: 1:

$S_0 \to S$

$S \to ASA \mid aB$

$A \to B \mid S$

$B \to b \mid \varepsilon$

Step: 2 Remove Null Product.

$B \to \varepsilon$, $A \to \varepsilon$

Remove $B \to \varepsilon$,

$S_0 \to S$

$S \to ASA \mid aB \mid a$

$A \to B \mid S \mid \varepsilon$

$B \to b$

Remove $A \to \varepsilon$

$S_0 \to S$

$S \to ASA \mid aB \mid a \mid AS \mid SA \mid S$

$A \to B \mid S$

$B \to b$

Step: 3 Remove unit Production

$S_0 \to S$, $S \to S$, $A \to B$, $A \to S$

$S_0 \to ASA \mid aB \mid a \mid AS \mid SA$

$S \to ASA \mid aB \mid a \mid AS \mid SA$

$A \to b \mid ASA \mid aB \mid a \mid AS \mid SA$

$B \to b$

Step: 4 CNF Rules

$A \to a$

$A \to AB$

$S_0 \to AA \mid aB \mid a \mid AS \mid SA$

$S \to AA \mid aB \mid a \mid AS \mid SA$

$A \to b \mid AA \mid aB \mid a \mid AS \mid SA$

$B \to b$

$A \to AS$

Again $S_0 \to AA \mid XB \mid a \mid AS \mid SA$

$S \to AA \mid XB \mid a \mid AS \mid SA$

$A \to b \mid AA \mid XB \mid a \mid AS \mid SA$

$B \to b$

$A \to AS$

$a \to X$.

Remove Unit Production

Simplification of CFG

B A → AB

A → a

B → C | b

C → D

D → E

E → a

Step 1 Remove Unit Production.

⇒ B → C , C → D, D → E

⇒ B → C → D → E

A ⟶ AB

A ⟶ a

B ⟶ a | b

C ⟶ a

D ⟶ a

E ⟶ a

Step 2 Remove unreachable State.

A ⟶ AB

A ⟶ a

B ⟶ a | b

Remove NULL Production

$S \longrightarrow ABAC$

$A \longrightarrow aA \mid \varepsilon$

$B \longrightarrow bB \mid \varepsilon$

$C \longrightarrow C$

Step 1: Remove Null $A \to \varepsilon$, $B \to \varepsilon$

Remove $A \to \varepsilon$,

$S \longrightarrow ABAC \mid BAC \mid ABC \mid BC$

$A \longrightarrow aA$

$B \to bB \mid \varepsilon$

$C \to C$

B Remove $B \to \varepsilon$

$S \longrightarrow ABAC \mid BAC \mid ABC \mid BC \mid AAC \mid AC \mid C$

$A \longrightarrow aA$

$B \longrightarrow bB \mid b$

$C \longrightarrow C$

Ex: 1 Find out whether $L = \{x^n y^n z^n \mid n \geq 1\}$ is Content free or not.

⇒ Let L is Content free

⇒ now we Can take a string such that

$$S = x^n y^n z^n$$

⇒ we divide S into 5 Parts $uvxyz$

Case 1 $n = 4$, so $x^4 y^4 z^4$

v & y Each Contain only one type of Symbol

xxxx yyyy zzzz → divide into 5 Parts

u v x y z

⇒ $uv^n xy^n z$ [Let $n = 2$]

⇒ $uv^2 xy^2 z$ $u = xx$

$y = y$

$v = xx$

$x \rightarrow yyy$

$z = zzzz$

⇒ xxxxxxyyyyyyzzzz

⇒ $x^6 y^5 z^4 \notin L$

not Satisfy the Cond^n

not Content free.

$\{a^i b^j c^k \mid 0 <= i <= j <= k\}$

Let L be a Content free.

Now we can have string such that

$S = a^p b^p c^p$

divide S into 5 Parts u v x y z

Let P = 4

(i) v and y each Contain one type of Symbol

$S = a^4 b^4 c^4$

$\Rightarrow$ aaaa bbbb cccc

u v x y z

Condition is $uv^i xy^i z$ $i=2$

aaaaaa bbbb ccccc

$a^6 b^4 c^5 \notin L$

(ii) v or y each Contain more than one type of Symbol

aaaa bbbb cccc

u v x y z

$uv^i xy^i z$ $i=2$

aaaabbaabbbb cccc

$\notin L$ not following scenario