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|-----|---------|--|
| 16. | 15/3/24 | write GFG for given language.                      |
| 17  | 15/3/24 | write LRD & RRD and draw strings                   |
| 18  | 15/3/24 | Eliminate $\epsilon$ -Production (unit Production) |
| 19  | 15/3/24 | Convert the given grammar to CNF                   |
| 20  | 15/3/24 | Convert the given grammar to CNF                   |

16. write CFG for languages given below

i) set of all strings that start with a & end with b over  $\Sigma = \{a, b\}$

ii) set of all strings over  $\Sigma = \{a, b\}$  having 'aa' as a substring.

iii) set of all binary strings that start & end with different digits

Aim:- To write CFG for given language.

Procedure:-

i) start with a & end with b

$$\Sigma = \{a, b\} \quad (\subseteq \{aab, aab, abb, \dots\})$$

$$\text{CFG} : S \rightarrow aB$$

$$B \rightarrow aB \mid bC$$

ii) 'aa' as a substring

$$\Sigma = \{a, b\} \quad (\subseteq \{aaa, aaa, aab, baa, \dots\})$$

$$\text{CFG} : S \rightarrow xaaY \mid xyaa$$

$$X \rightarrow ax \mid bx \mid \epsilon$$

$$Y \rightarrow aY \mid bY \mid \epsilon$$

iii) starts & end with different digits

$$\Sigma = \{0, 1\} \quad (\subseteq \{01, 10, 001, 110, \dots\})$$

$$\text{CFG} : S \rightarrow 0A1 \mid 1B0$$

$$A \rightarrow 0A \mid 1A1C$$

$$B \rightarrow 0B \mid 1B \mid \epsilon$$

~~Ques. Define LR(0) grammar~~

Ques. Define LR(0) grammar for the language  $L = \{a^n b^n | n \geq 0\}$

Soln:

1.  $Q = \{S, A, B\}$

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

3.  $R = \{S \rightarrow aA, S \rightarrow bB, A \rightarrow aA, A \rightarrow bB, B \rightarrow aA, B \rightarrow bB\}$

4.  $L = \{S \Rightarrow^* w \mid w \in \Sigma^*\}$

5.  $L = \{a^n b^n \mid n \geq 0\}$

6.  $L = \{a^n b^n \mid n \geq 0\} \cap L(\text{LR}(0))$

7.  $L = \{a^n b^n \mid n \geq 0\} \cap L(\text{SLR}(0))$

8.  $L = \{a^n b^n \mid n \geq 0\} \cap L(\text{LL}(0))$

9.  $L = \{a^n b^n \mid n \geq 0\} \cap L(\text{LR}(1))$

10.  $L = \{a^n b^n \mid n \geq 0\} \cap L(\text{SLR}(1))$

11.  $L = \{a^n b^n \mid n \geq 0\} \cap L(\text{LL}(1))$

12.  $L = \{a^n b^n \mid n \geq 0\} \cap L(\text{LR}(k))$

13.  $L = \{a^n b^n \mid n \geq 0\} \cap L(\text{SLR}(k))$

14.  $L = \{a^n b^n \mid n \geq 0\} \cap L(\text{LL}(k))$

15.  $L = \{a^n b^n \mid n \geq 0\} \cap L(\text{LR}(0))$

16.  $L = \{a^n b^n \mid n \geq 0\} \cap L(\text{SLR}(0))$

17.  $L = \{a^n b^n \mid n \geq 0\} \cap L(\text{LL}(0))$

18.  $L = \{a^n b^n \mid n \geq 0\} \cap L(\text{LR}(1))$

19.  $L = \{a^n b^n \mid n \geq 0\} \cap L(\text{SLR}(1))$

20.  $L = \{a^n b^n \mid n \geq 0\} \cap L(\text{LL}(1))$

21.  $L = \{a^n b^n \mid n \geq 0\} \cap L(\text{LR}(k))$

22.  $L = \{a^n b^n \mid n \geq 0\} \cap L(\text{SLR}(k))$

23.  $L = \{a^n b^n \mid n \geq 0\} \cap L(\text{LL}(k))$

Result: Thus, CFG for given language  
written successfully

15/3/24

### Experiments - 17

- 17) write leftmost & right Most derivations  
 & draw parse tree for the string

id + id \* id from the CFS

$\leftarrow \rightarrow E + E / (E * E) / id$

Aim:- To write LRD & RMD & draw parse tree for the string given below

Procedure:-

$$E \xrightarrow{L} E * E$$

$$\Rightarrow E + E * E$$

$$\Rightarrow id + E * E$$

$$\Rightarrow id + id * E$$

$$\Rightarrow id + id * id$$

$$E \xrightarrow{R} E * E$$

$$\Rightarrow E * id$$

$$\Rightarrow E + E * id$$

$$\Rightarrow E + id * id$$

$$\Rightarrow id + id * id$$

Step 3: LRD & RMD, PNT

using matrices for private mode

Experiment - 18

18) Eliminate  $\epsilon$ -Productions & unit Productions & useless symbol from grammar

$$S \rightarrow ASB/A$$

$$A \rightarrow aAS/a$$

$$B \rightarrow SBS/A/bb$$

Aim :- To eliminate  $\epsilon$ -Productions & unit Productions & useless symbols from given grammar.

Procedure

Step 1 :- Eliminate  $\epsilon$ -Productions

S is nullable

$$S \rightarrow ASB/AB$$

$$A \rightarrow aAS/aa/a$$

$$B \rightarrow SBS/SB/b/A/bb$$

Step 2 :- Eliminate unit Productions

UnitPair	Productions
(S, S)	$S \rightarrow ASB/AB$
(A, A)	$A \rightarrow aAS/SB/b$
(B, B)	$B \rightarrow SBS/SB/b/bb$
(B, A)	$B \rightarrow aAS/aa/b$

Final grammar

$$S \rightarrow ASB/AB$$

$$A \rightarrow aAS/aa/a$$

$$B \rightarrow SBS/SB/b/bb/aas/aa$$

Step 3: Eliminate useless symbols. There are no useless symbols.

$\text{start} \leftarrow \epsilon$

$\text{P} \mid \text{AAP} \leftarrow A$

$\text{data} \mid \text{add} \leftarrow \alpha$

Attributed grammar 3. The units of  $\epsilon$ -rule

Remove one more & leaving useless  $\epsilon$ -rule

Attributed

Attributed-3. Starting w/  $\epsilon$ -rule

$\text{start} \leftarrow \epsilon$

$\text{data} \mid \text{add} \leftarrow \alpha$

$\text{P} \mid \text{AAP} \leftarrow A$

$\text{data} \mid \text{add} (\text{data} \mid \text{add}) \leftarrow \beta$

& now having 4 more  $\epsilon$ -rules  $\Rightarrow$  Step 4

(Redundant)  $\epsilon$ -production

$\text{data} \mid \text{add} \leftarrow \alpha$  (2nd)

$\text{data} \mid \text{add} \leftarrow \beta$  (3rd)

$\text{data} \mid \text{add} \leftarrow \gamma$  (4th)

$\text{data} \mid \text{add} \leftarrow \delta$  (5th)

Remove last

Result Thus, the  $\epsilon$ -productions, unit produced

by useless symbols eliminated successfully

A) Convert the given grammar to CNF.  
 $S \rightarrow ASA / BSB / a/b$

Aim: To convert given grammars if optimized  
Procedure

1. The given grammar is optimized

2. Introduction the Production

$$A \rightarrow a$$

$$B \rightarrow b$$

3 Rewrite the grammar

$$S \rightarrow ASA / BSB / a/b$$

$$a \rightarrow a$$

$$B \rightarrow b$$

4. Breaks Production

$$S \rightarrow AP_1 / BP_2 / a/b$$

$$P_1 \rightarrow SA$$

$$P_2 \rightarrow SB$$

$$A \rightarrow a$$

$$B \rightarrow b$$

2 f; removing movie gift first (411)  
 2018-03-15 2018-03-15

Result: Thus, the given grammar is LL(0) suggesting.

## Experiment - 2

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Convert the given grammar to CNF

$$S \rightarrow ABA / AB / BA / AA / A / B$$

$$A \rightarrow aA / c$$

$$B \rightarrow bB / c$$

Aim:- To convert given grammar to GNF

CNF :-  $A \rightarrow a_A$  or  $A \rightarrow a$

Procedure

1. Eliminate  $\epsilon$  Production

S, A, B are nullable

$$S \rightarrow ABA / AB / BA / AA / A / B$$

$$A \rightarrow aA / b$$

$$B \rightarrow bB / c$$

2. Eliminate unit Production

Unit Pair	Production
(S, S)	$S \rightarrow ABA / AB / BA / AA$
(S, A)	$S \rightarrow aA / a$
(S, B)	$S \rightarrow bB / b$
(A, A)	$A \rightarrow aA / b$
(B, B)	$B \rightarrow bB / b$

Final grammar is

$S \rightarrow ABA / BA / AB / AA / aA / aB / bB / b$

$A \rightarrow aA / a$

$B \rightarrow bB / b$

$\{(A \times B) \text{ are in GND}$

By Lemma 1,

Sub  $A \times B$  Production in  $S$ .

$S \rightarrow aABA / aBA / bBA / bA / aAB / aB /$   
 $aABA / aA / a / bB / b$

$A \rightarrow aA / b$  (the  $a$  in  $A_1, 2$ )

$B \rightarrow bB / b$  (the  $b$  in  $A_1, 2$ )

$\{ \} AP \leftarrow A$

$\{ \} d \leftarrow A$

(not in  $A_1, 2$ ) + in  $A_1, 2$  (not in  $A_1, 2$ )

(not in  $A_1, 2$ )

(not in  $A_1, 2$ )

$\{ \} AP \leftarrow A$

( $C, E$ )

$\{ \} AP \leftarrow A$

( $F, E$ )

$\{ \} d \leftarrow A$

( $G, E$ )

Result :- Thus, the given grammar is converted to CNF successively.