Experiment # 10 Student ID 30642
Date 11/9/24 Student Name Nithale

Pre-Tutorial (To be completed by student before attending tutorial session)

1. Remove *null* productions from the following CFG

$$S \rightarrow ASA \mid aB \mid \epsilon, \quad A \rightarrow B \mid S \mid \epsilon, \quad B \rightarrow b \mid \epsilon$$

Solution:

$S \rightarrow ASA \mid aB \mid \epsilon$

$A \rightarrow B \mid S \mid \epsilon$

$B \rightarrow b \mid \epsilon$

Nullable:

$S \rightarrow \epsilon$

$A \rightarrow \epsilon$ } Eliminate.

$B \rightarrow \epsilon$

$S \rightarrow ASA$ (i) $S \rightarrow SA$

$S \rightarrow AA$

$S \rightarrow AS$

$S \rightarrow A$

$S \rightarrow S$

$S \rightarrow aB$

⇓

$S \rightarrow a$

∴ P = { $S \rightarrow ASA \mid aB \mid SA \mid AA \mid AS \mid A \mid S \mid a$

$A \rightarrow B \mid S$

$B \rightarrow b$ }

2. Remove *unit* productions from the following.

$S \to A, \quad A \to B, \quad B \to C \mid a, \quad C \to b \mid c$

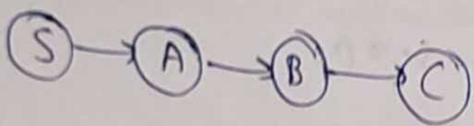
Solution:

S → A
A → B
B → C | a
C → b | c

unit productions:

S → A
A → B
B → C

Dependency graph:



S → B
A → C

(i) S → A
→ B
→ a
S → a

(ii) A → B
A → a
A → C
A → b
A → c

(iii) B → C
B → b
B → c

(iv) S → B
S → a
→ C
S → b
S → c

(v) A → C
A → b
A → c

∴ P = { S → a | b | c
A → a | b | c
B → a | b | c
C → b | c }

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Nishita.

3.Simplify the following grammar:

$$S \rightarrow Aa \mid B, \quad B \rightarrow a \mid bC, \quad C \rightarrow a \mid \varepsilon$$

Mention the number of productions in your simplified grammar.

Solution:

(i) ϵ-productions :

$C \rightarrow \epsilon$ (eliminate)

$B \rightarrow bC$

$B \rightarrow b$

$S \rightarrow Aa \mid B$

$B \rightarrow a \mid bC \mid b$

$C \rightarrow a$

(ii) unit productions :

$S \rightarrow B$ (eliminate)

$S \rightarrow a$

$S \rightarrow B$

$\rightarrow bC$

$S \rightarrow b$

$S \rightarrow ba$

$S \rightarrow Aa \mid B \mid a \mid b \mid ba$

$B \rightarrow a \mid bC \mid b$

$C \rightarrow a$

(iii) Useless symbols:

$S \rightarrow Aa$

useless : {A}

$S \rightarrow B$

$S \rightarrow$ "a"

{$S \rightarrow B \mid a \mid b \mid ba$

$B \rightarrow a \mid bC \mid b$

$C \rightarrow a$}

∴ No. of productions : 8.

Date 18/9/24 Student Name 30641 Nikhil Ca

IN-TUTORIAL (To be carried out in presence of faculty in classroom)

1.Simplify the following CFG.

$S \rightarrow AB \mid AC, \quad A \rightarrow aB \mid BC \mid \epsilon, \quad B \rightarrow b, \quad C \rightarrow c$

Solution:

(i) ϵ-productions

$A \rightarrow \epsilon$ (eliminate)

$S \rightarrow AB \mid AC \mid B \mid C$

$A \rightarrow aB \mid BC \mid B$

$B \rightarrow b$

$C \rightarrow c$

$S \rightarrow AB$ $\quad$ $S \rightarrow AC$

$\boxed{S \rightarrow B}$ $\quad$ $\boxed{S \rightarrow C}$

(ii) Unit productions : NIL

(iii) Useless symbols

1) $S \rightarrow AB$ $\quad$ $S \rightarrow AC$ $\quad$ $A \rightarrow aB$ $\quad$ $A \rightarrow BC$

$\rightarrow aBB$ $\quad$ $\rightarrow aBc$ $\quad$ $\rightarrow$ "ab" $\quad$ $\rightarrow$ "bc"

$\rightarrow$ "abb" $\quad$ $\rightarrow$ "abc"

2) $S \rightarrow AB$, $\quad S \rightarrow AC$

$aBb \quad \rightarrow aBc$

"abb" $\quad \rightarrow$ "abc"

NO useless symbols.

$\therefore \{ S \rightarrow AB \mid AC \mid B \mid C$

$A \rightarrow aB \mid BC$

$B \rightarrow b$

$C \rightarrow c \}$

Experiment # 10 | Student ID 30642
Date 18/4/24 | Student Name Krishika

Simplify the following CFG.

$S \rightarrow AB \mid \epsilon, \quad A \rightarrow aB \mid \epsilon, \quad B \rightarrow bA \mid b, \quad C \rightarrow bC$

Solution:

(i) ϵ - productions

$S \rightarrow \epsilon$ & (eliminate)
$A \rightarrow \epsilon$

$S \rightarrow AB \quad B \rightarrow bA$

$\boxed{S \rightarrow B} \quad \boxed{B \rightarrow b}$

$S \rightarrow AB \mid B$
$A \rightarrow aB$
$B \rightarrow bA \mid b$
$C \rightarrow bC$

(ii) unit productions : NIL

(iii) useless symbols:

$C \rightarrow bC$
$\rightarrow$ (x)

useless : {C}

CFG:

$P = \{ S \rightarrow AB \mid B$
$A \rightarrow aB$
$B \rightarrow bA \mid b \}$

Experiment # 10 Student ID 30642
Date 11/9/24 Student Name Nikhil

3. Simplify the following CFG.

$S \to ABCD \mid AC, \quad A \to aA \mid \epsilon, \quad B \to bB \mid bC \mid b, \quad C \to cC \mid D,$ D

Solution:

(i) ∈ productions

A → ∈ (eliminate)

S → ABCD S → AC A → aA

S → BCD S → C A → a

(ii) unit productions:

C → D

C → d

(iii) useless symbols:

1) S → ABCD S → AC A → aA B → bB

aABCD S → (x) (x) → bb'

useless: {A}

B → bC

B → bDc

→ bd'

2) S → ABCD S → AC

(x) (x)

CFG: G = ({S, A, B, C, D}, {a, b, c}, P, S)

P = { S → BCD | C C → d | D | cC

A → a D → d }

D → bB | bC | b

Exp. No. 10 Student ID 30642
Date 18/9/24 Student Name Rishik

Post-Tutorial (To be carried out by student after attending tutorial session)

1. Simplify the following CFG : $S \rightarrow AB,\ A \rightarrow aA \mid \epsilon,\ B \rightarrow bB \mid b$

Solution:

(i) ϵ-productions

$A \rightarrow \epsilon$ (elim)

$S \rightarrow AB$ $\quad$ $A \rightarrow aA$

$S \rightarrow B$ $\quad$ $A \rightarrow a$

(ii) Unit productions : NIL

(iii) Useless symbols:

1) $S \rightarrow AB$ $\quad$ $A \rightarrow aA$ $\quad$ $B \rightarrow bB$

$\rightarrow aAB$ $\quad$ (x) $\quad$ $\rightarrow$ "bb"

$\rightarrow aAb$

(x)

useless: {A}

2) $S \rightarrow AB$

(x)

$G = (\{S, A, B\}, \{a, b\}, P, S)$

$P : \{ S \rightarrow B$

$A \rightarrow a$

$B \rightarrow bB \mid b \}$

Experiment # 1P Student Name Nishitha

Date 15/9/24

2. Remove useless symbols from the following CFG

$$T \rightarrow xxY \mid xbX \mid xxT, \quad X \rightarrow xX, \quad Y \rightarrow xy \mid y, \quad Z \rightarrow xz$$

Solution:

1) $T \rightarrow xxY$ $T \rightarrow xbX$ $T \rightarrow xxT$

$\rightarrow$ "xxy" $\rightarrow$ xbX $\rightarrow$ xxxxY

$\rightarrow$ xbxX $\rightarrow$ "xxxxy"

(x)

useless: {X}

$X \rightarrow xX$ $Y \rightarrow$ "xy" $Z \rightarrow$ "xz"

(x) $Y \rightarrow$ "y"

2) $T \rightarrow xxY$ $T \rightarrow xbX$ $T \rightarrow xxT$

"xxy" (x) "xxxxy"

useless: {X}

$\therefore \{T \rightarrow xxY \mid xxT$

$Y \rightarrow xy \mid y$

$Z \rightarrow xz\}$

...ment #	10 IMalu	Student ID	30642
		Student Name	Nishitha

emove null production from the following

$$S \rightarrow ABA, \quad A \rightarrow 0A \mid \varepsilon, \quad B \rightarrow 1B \mid \varepsilon$$

...tion:

$A \rightarrow \epsilon$
$B \rightarrow \epsilon$ } eliminate

$S \rightarrow ABA$ (i) $S \rightarrow BA$

$S \rightarrow AA$

$S \rightarrow AB$

$S \rightarrow A$

$S \rightarrow B$

$A \rightarrow 0A$ $B \rightarrow 1B$

$A \rightarrow 0$ $B \rightarrow 1$

$\therefore S \rightarrow ABA \mid BA \mid AA \mid AB \mid A \mid B$

$A \rightarrow 0A \mid 0$

$B \rightarrow 1B \mid 1$

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Student ID 30642
Student Name Nisha

Viva Questions

1. Why is it important to simplify context-free grammars?

Answer:

To construct chomsky normal form and Greay Normal form, we need to simplify the CFG to convert easily with ε, unit and useless productions.

3. Does simplifying a context-free grammar change the language it generates? Why or why not?

Answer:

By simplifying CFG the language doesnot changes. Because by simplifying CFG, even we eliminate the ε-productions, unit productions and useless symbols, the language can't change only the productions will be change.

(For Evaluator's use only)

	Comment of the Evaluator (if Any)	Evaluator's Observation
		Marks Secured: out of 50 Full Name of the Evaluator: Signature of the Evaluator Date of Evaluation: