Exaer ment a   9/
Date   10/9/24

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

1. Is G:{S → SS | aSb | bSa | ε } ambiguous? Explain your answer.
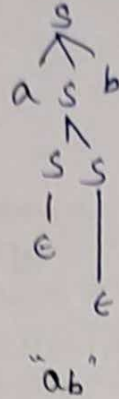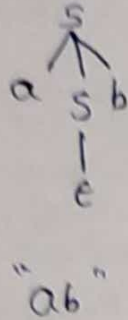
Solution:

∴ It is ambiguous

2. Is G: {S → aSbS | bSaS| ε } ambiguous? Explain your answer.
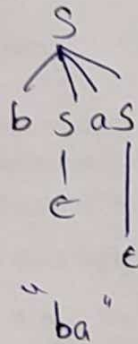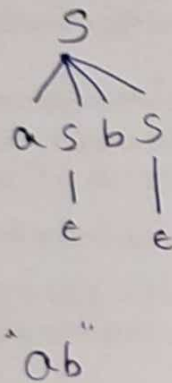
Solution:

∴ It is not ambiguous

Consider the following grammar

$S \to aS \mid \epsilon$

The language generated by this grammar is $L = \{a^n : n \geq 0\}$ or a^*

a. Find the Leftmost Derivation and Rightmost Derivation.

b. Prove All the strings generated the above grammar have their leftmost derivation and rightmost derivation exactly same. Draw the Parse tree for the same.

Solution:

a. leftmost :

$S \to aS$ $S \to aS$

$\to a\epsilon$ $\to aaS$

$\to "a"$ $\to aa"$

Rightmost :

$S \to aS$ $S \to aS$

$\to a\epsilon$ $\to aaS$

$\to "a"$ $\to aa"$
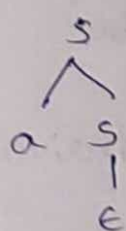
b.   leftmost   Rightmost
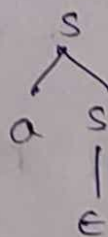
     "a" $\Rightarrow$ "a" $\Rightarrow$

$\therefore$ Leftmost derivation = Rightmost derivation.

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

1. Construct a CFG for a language $L = \{wcwR \mid w \in (a, b)^*\}$.

Solution:

$P = \{ S \rightarrow asa \mid bsb \mid c \mid \epsilon \mid asb \mid bsa \}$

$wcw^R \rightarrow$ "w" may a or b

If "a", aca^R

If "b", bcb^R

$S \rightarrow c \mid asa \mid bsb$

$S \rightarrow \epsilon$ (if no a's or b's).

2. Derive the string "aabbabba" for left most derivation and right most derivation using above CFG.

Solution:

$S \rightarrow asa \qquad\qquad S \rightarrow asa$

$\rightarrow aasba \qquad\qquad \rightarrow aasba$

$\rightarrow aabsaba \qquad\quad \rightarrow aabsbba$

$\rightarrow aabbsbba \qquad\quad \rightarrow aabbsabba$

$\rightarrow a \qquad\qquad\qquad \rightarrow$ "aabbabba"

Both leftmost and Rightmost derivations

are equal.

3. Consider the following grammar

$$S \rightarrow ASB \mid c$$

$$A \rightarrow \epsilon \mid aA$$

$$B \rightarrow \epsilon \mid bB$$

Derive the string acb using leftmost and rightmost derivation. Show the parse trees for your derivation.

Solution:

leftmat:

$$S \longrightarrow ASB$$
$$\rightarrow aASB$$
$$\rightarrow a\epsilon SB$$
$$\rightarrow aSB$$
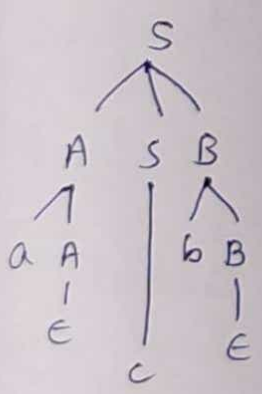$$\rightarrow acB$$
$$\rightarrow acbB$$
$$\rightarrow acb$$

Rightmost:

$$S \rightarrow ASB$$
$$\rightarrow AsbB$$
$$\rightarrow Asb$$
$$\rightarrow Acb$$
$$\rightarrow aAcb$$
$$\rightarrow acb$$

"acb"

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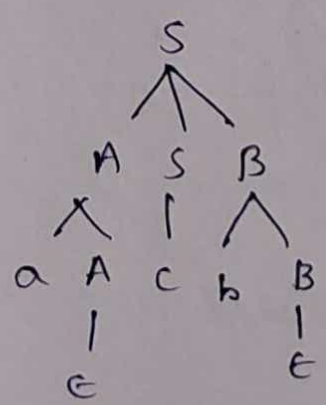
Post-Tutorial (To be carried out by student after attending tutorial session)

1. Generate CFG for the language $L = \{0^i 1^j 0^k : j > i + k\}$

Solution:

for $i = 0, j = 2, k = 0$ (11")

$S \rightarrow A 1^i B$

$A \rightarrow \epsilon$

$B \rightarrow \epsilon$

for $i = 1, j = 3, k = 1$ ("01110")

$S \rightarrow A 1^{is} B$

$A \rightarrow 0$

$B \rightarrow 0$

for $i = 2, j = 4, k = 2$ ("00111100")

$S \rightarrow A 1^i B$

$A \rightarrow 00$

$B \rightarrow 00$

CFG:

$S \rightarrow A1B$

$A \rightarrow 0A1 | 01 | \epsilon$

$B \rightarrow 0B1 | 01 | \epsilon$

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2. Consider the following grammar-

$$S \rightarrow SaS \mid b$$

Is it an ambiguous grammar? Generate the string *babab* from this grammar to prove your point.

Solution:

$S \rightarrow SaS$

$\rightarrow SaSas$

$\rightarrow basas$

$\rightarrow babas$

$\rightarrow$ "babab"

$S \rightarrow SaS$

$\rightarrow SaSas$
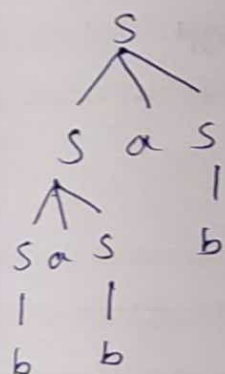
$\rightarrow saSab$

$\rightarrow Sabab$

$\rightarrow$ "babab"
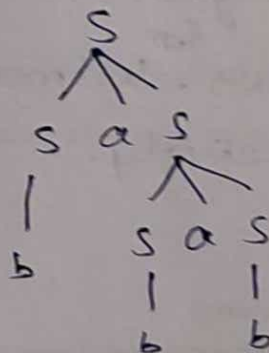
leftmost :

```
        S
       /|\
      S a S
     /|\   |
    S a S  b
    |   |
    b   b
```

"babab"

Rightmost :

```
      S
     /|\
    S a S
    |  /|\
    b S a S
      |   |
      b   b
```

"babab"

∴ It is ambiguous.

Experiment #   9

Date   12/9/24

Student ID   80642

Student Name   Nishala

Viva Questions

1. What is a context-free grammar (CFG), and how is it defined?

Answer:

It is 4-tuple representation $G = (V, T, P, S)$

$P : \alpha \rightarrow \beta$

$\alpha \in V$

$\beta \in (V \cup T)^*$

2. How do you construct a parse tree for a given string using a context-free grammar?

Answer:

By substituting the terminals to generate a string.

In that process we form leftmost and Rightmost derivations by substituting from terminals. leftmost and from rightmost respectively.

(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:

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