PES UNIVERSITY ONLINE

Automata Formal Languages & Logic

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Unit 3

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Example 1:

Find out whether the given grammar is ambiguous or not?

1. S⟶ aS|Sa|λ
2. S⟶ aSbS|bSaS|λ
3. R⟶ R+R|RR|R*|a|b|c
4. S⟶ 1S|11S|λ
5. S⟶ AB|aaB
   A⟶ a|Aa
   B⟶ b

Solution :

1. aa
2. abab
3. a+bc
4. 111
5. aab

Example 2:
Show that union of $\{a^n b^n c^m | n>=0, m>=1\}$ $\{a^n b^m c^m | n>=1, m>=0\}$ is inherently ambiguous.

Solution :

$L=\{a^n b^n c^m\} \cup \{a^n b^m c^m\}$

$S1 \rightarrow Ac$ $\quad$ $S2 \rightarrow aB$

$A \rightarrow aAb|\lambda$ $\quad$ $B \rightarrow bBc|\lambda$

$S \rightarrow S1|S2$

- Strings that belong to both the languages are $L1 \cap L2=\{a^n b^n c^n\}$
- For every string in $a^n b^n c^n$ there exists two parse trees(either using LMD or RMD).
- No other grammar can generate L.Hence ,the language L is ambiguous or we can say that the given language L is inherently ambiguous.

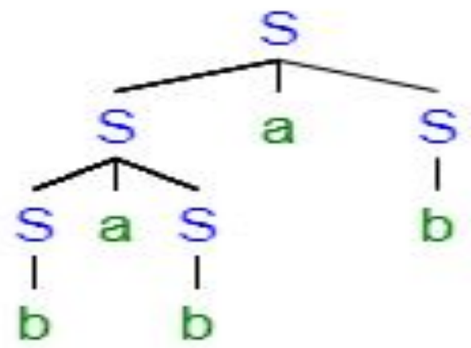
Example 3:

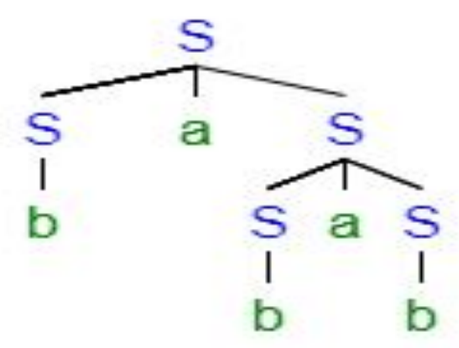
Find out whether the given grammar is inherently ambiguous or not. S→ SaS|b

Solution :

➔ **First we prove the grammar is ambiguous by showing that a string has more than one parse tree**

Consider the string ”babab”,to prove the grammar is ambiguous.





Two parse trees for the string “babab” indicates the grammar is ambiguous.

Try constructing another grammar which is unambiguous.
The language is regular ,we can write the regular expression b(ab)+
S⟶ bA
A⟶ abA|ab
Now,the grammar is unambiguous.

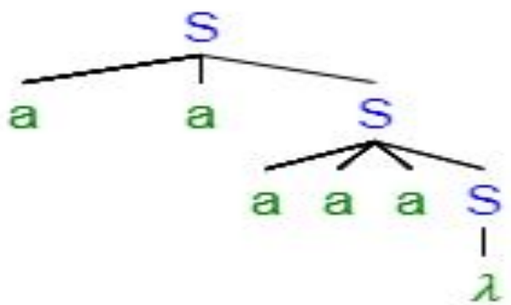
Example 4:

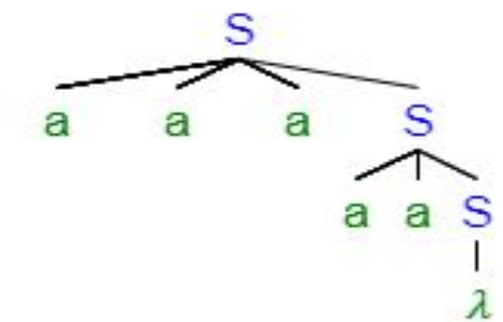
Find out whether the given grammar is inherently ambiguous or not. S⟶ aaS|aaaS|λ

Solution :

➔ **First we prove the grammar is ambiguous by showing that a string has more than one parse tree. .**

Parse tree for the string "aaaaa".





Two parse trees for the string "aaaaa" indicates the grammar is ambiguous.

➔ Try constructing another grammar which is unambiguous.

L=(aa+aaa)*
S⟶ aaA|λ
A⟶ aA|λ

This grammar is unambiguous.

Example 5:

Find out whether the given grammar is inherently ambiguous or not.

$S \rightarrow AB \mid aaB$

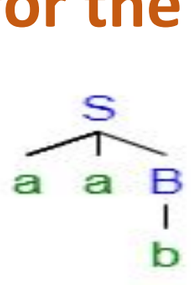
$A \rightarrow a \mid Aa$

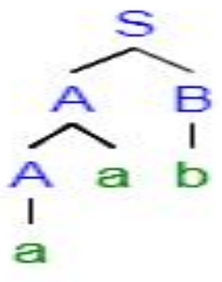
$B \rightarrow b$

Solution :

First we prove the grammar is ambiguous by showing that a string has more than one parse tree.

Parse tree for the string "aab"





Two parse trees for the string "aab" indicates the grammar is ambiguous.

➔ Try constructing another grammar which is unambiguous

L={ab,aab,aaaaaaaab,.....}

L=aa*b

S⟶ aAb

A⟶ aA|λ

This grammar is unambiguous.

Example 6:
Eliminate ambiguity in following grammar:
B⟶ B or B | B and B| not B | True |False

Solution :

Unambiguous grammar ,

B⟶ B or F | F

F⟶ F and G | G

G⟶ not G|True | False

Example 7:
Eliminate ambiguity in following grammar:
R⟶ R+R|RR|R*|a|b|c

Solution :

Unambiguous grammar,

R⟶ R+S|S

S⟶ S.T|U

U⟶ U*|a|b|c

THANK YOU

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