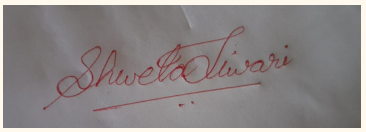
CD: COMPILER DESIGN
CD: UNIT-2 09/2022

SEPTEMBER 2022 / IT-3rd year, Vth semester
FALL SEMESTER, YEAR (Vth, 3rd)
FALL SESSION (2022-23)
(CD)
MS. SHWETA TIWARI
Published: SEPTEMBER, 2022

PREPARED FOR
Engineering Students
All Engineering College



INSTRUCTOR: Ms. SHWETA TIWARI
shwetatiwari08@recabn.ac.in
shwetatiwari08aug@gmail.com

CD: COMPILER DESIGN

TOPIC On : Grammar Ambiguity

Check Ambiguous Grammar

—

By SHWETA TIWARI

Under On: Unit-2

TOPIC On : Grammar Ambiguity
Check Ambiguous Grammar

Grammar Ambiguity-

- There exists no algorithm to check whether any given grammar is ambiguous or not.
- This general decision problem is undecidable-

"Whether the grammar is ambiguous or not?"

- This is because it can be shown that this problem is equivalent to the Post Correspondence Problem.

General Approach To Check Grammar Ambiguity-

To check whether a given grammar is ambiguous or not, we follow the following steps-

Step-01:

We try finding a string from the **Language of Grammar** such that for the string there exists more than one-

- parse tree
- or derivation tree
- or syntax tree
- or leftmost derivation
- or rightmost derivation

Step-02:

If there exists at least one such string, then the grammar is ambiguous otherwise unambiguous.

PROBLEMS BASED ON CHECKING WHETHER GRAMMAR IS AMBIGUOUS-

Problem-01:

Check whether the given grammar is ambiguous or not-

$S \rightarrow SS$

$S \rightarrow a$

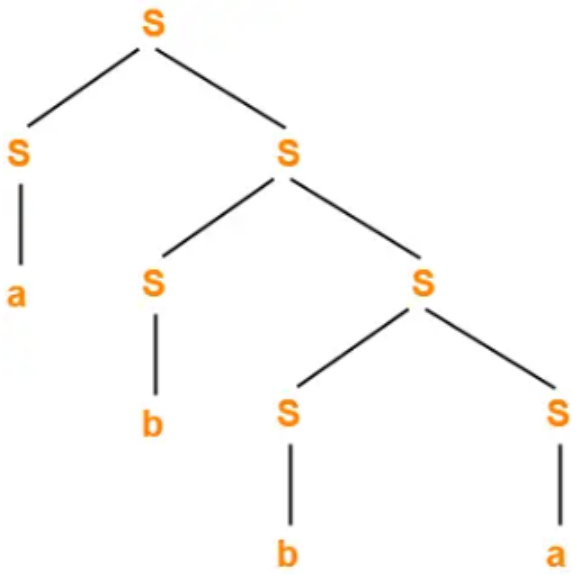
$S \rightarrow b$

Solution-

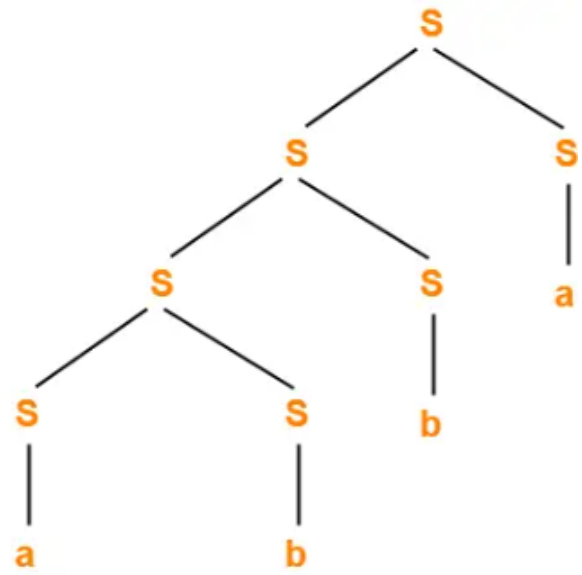
Let us consider a string w generated by the given grammar-

$w = abba$

Now, let us draw parse trees for this string w.



Parse tree-01



Parse tree-02

Since two different parse trees exist for string w, therefore the given grammar is ambiguous.

Problem-02:

Check whether the given grammar is ambiguous or not-

$S \rightarrow A / B$

$A \rightarrow aAb / ab$

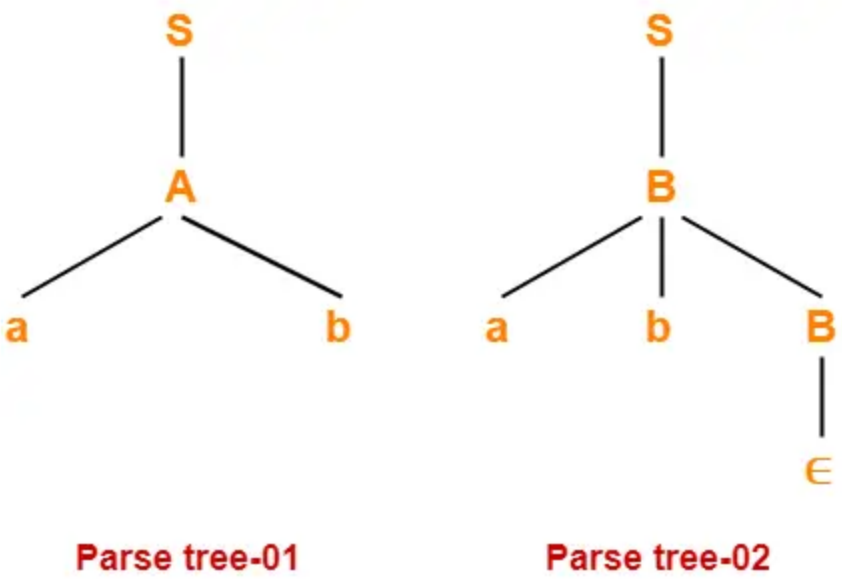
$B \rightarrow abB / \in$

Solution-

Let us consider a string w generated by the given grammar-

$w = ab$

Now, let us draw parse trees for this string w.



Parse tree-01 Parse tree-02

Since two different parse trees exist for string w, therefore the given grammar is ambiguous.

Problem-03:

Check whether the given grammar is ambiguous or not-

S → AB / C

A → aAb / ab

B → cBd / cd

C → aCd / aDd

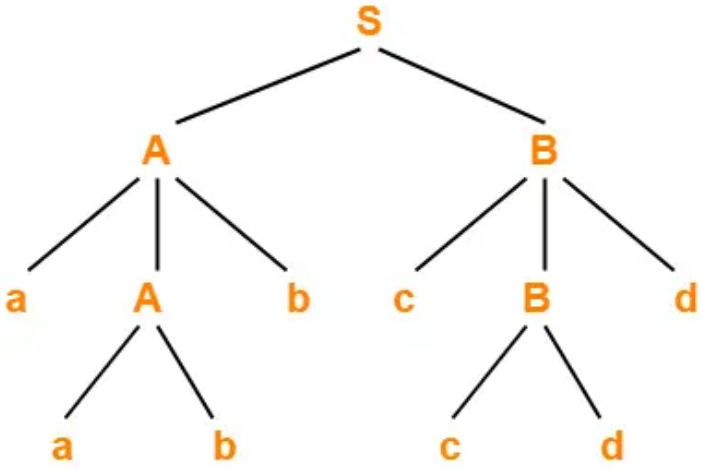
D → bDc / bc

Solution-

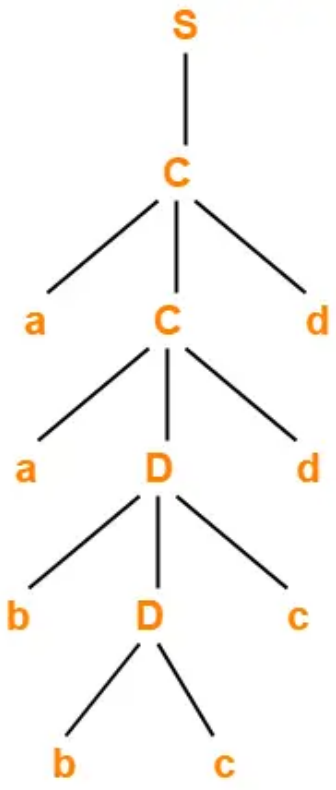
Let us consider a string w generated by the given grammar-

w = aabbccdd

Now, let us draw parse trees for this string w.



Parse tree-01



Parse tree-02

Since two different parse trees exist for string w, therefore the given grammar is ambiguous.

Problem-04:

Check whether the given grammar is ambiguous or not-

S → AB / aaB

A → a / Aa

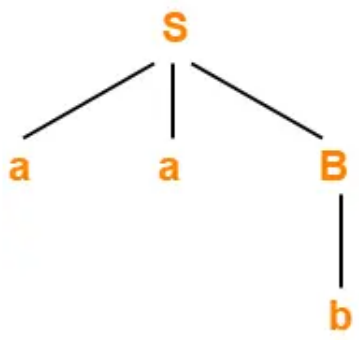
B → b

Solution-

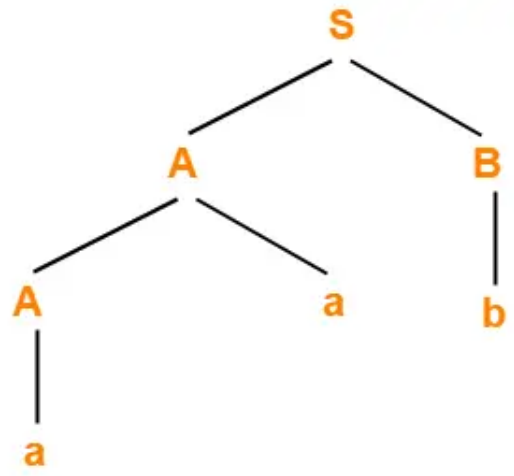
Let us consider a string w generated by the given grammar-

w = aab

Now, let us draw parse trees for this string w.



Parse tree-01



Parse tree-02

Since two different parse trees exist for string w, therefore the given grammar is ambiguous.

Problem-05:

Check whether the given grammar is ambiguous or not-

S → a / abSb / aAb

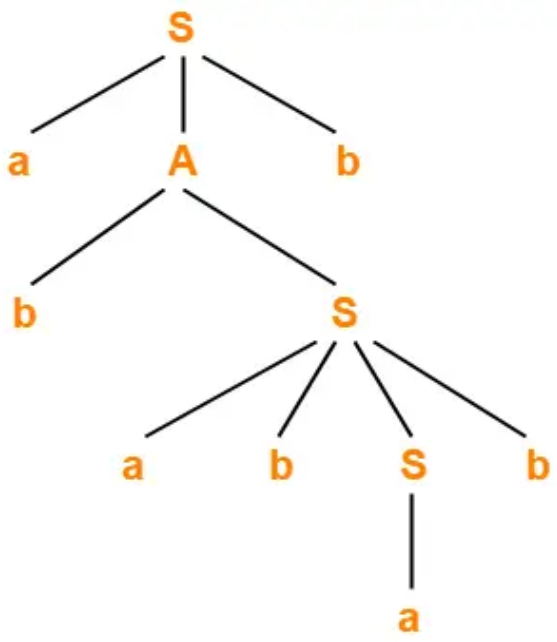
A → bS / aAAb

Solution-

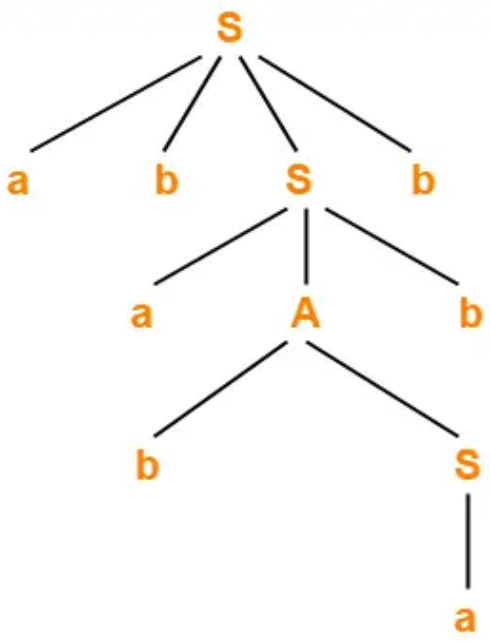
Let us consider a string w generated by the given grammar-

w = abababb

Now, let us draw parse trees for this string w.



Parse tree-01



Parse tree-02

Since two different parse trees exist for string w, therefore the given grammar is ambiguous.

Problem-06:

Check whether the given grammar is ambiguous or not-

$$E \rightarrow E + T / T$$

$$T \rightarrow T \text{ x } F / F$$

$$F \rightarrow id$$

Solution-

- There exists no string belonging to the language of grammar which has more than one parse tree.
- Since a unique parse tree exists for all the strings, therefore the given grammar is unambiguous.

Problem-07:

Check whether the given grammar is ambiguous or not-

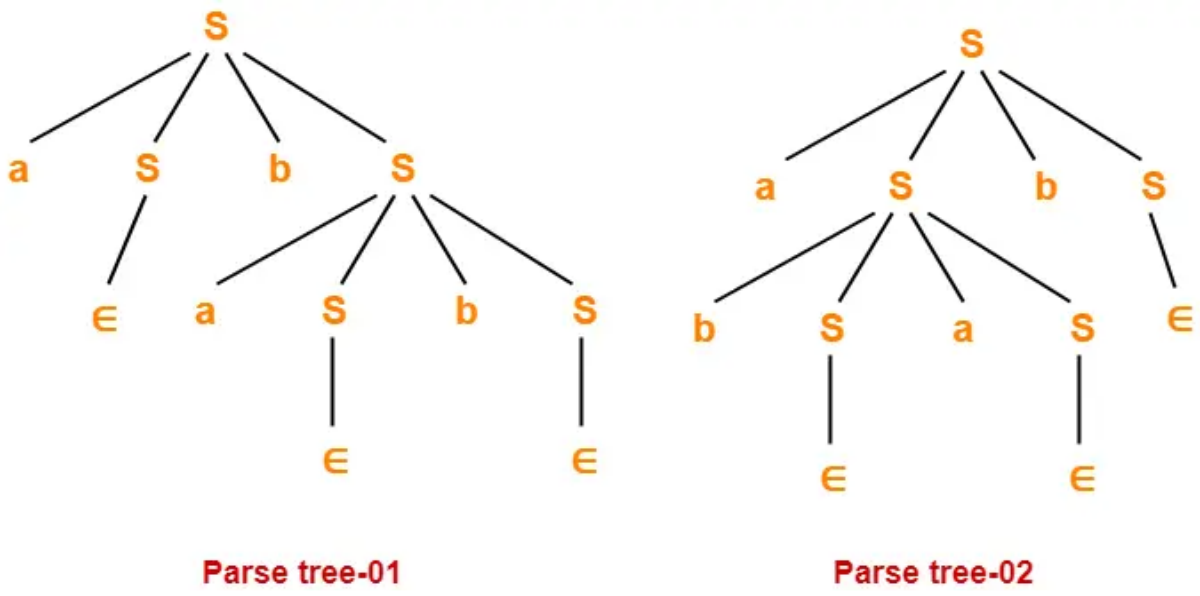
$$S \rightarrow aSbS / bSaS / \in$$

Solution-

Let us consider a string w generated by the given grammar-

$$w = abab$$

Now, let us draw parse trees for this string w.



Parse tree-01 Parse tree-02

Since two different parse trees exist for string w, therefore the given grammar is ambiguous.

Problem-08:

Check whether the given grammar is ambiguous or not-

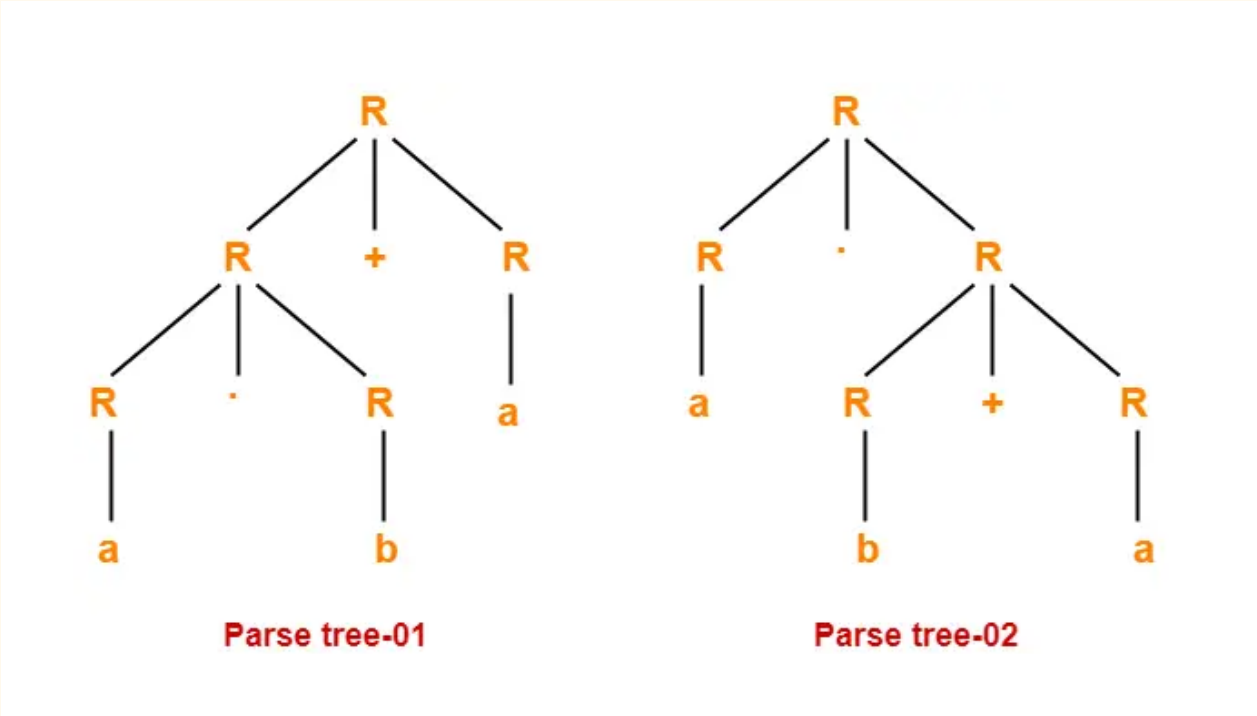
$R \rightarrow R + R \mid R \,.\, R \mid R^* \mid a \mid b$

Solution-

Let us consider a string w generated by the given grammar-

$w = ab + a$

Now, let us draw parse trees for this string w.



Since two different parse trees exist for string w, therefore the given grammar is ambiguous.