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Question-3:

Given Context free grammar is

- $S \rightarrow XaX$
  $X \rightarrow aX \mid bX \mid \wedge$

a) Given Context Free Grammar (CFG) is unambiguous because it has only one parse tree for given grammar

For example:

(i) "aa"

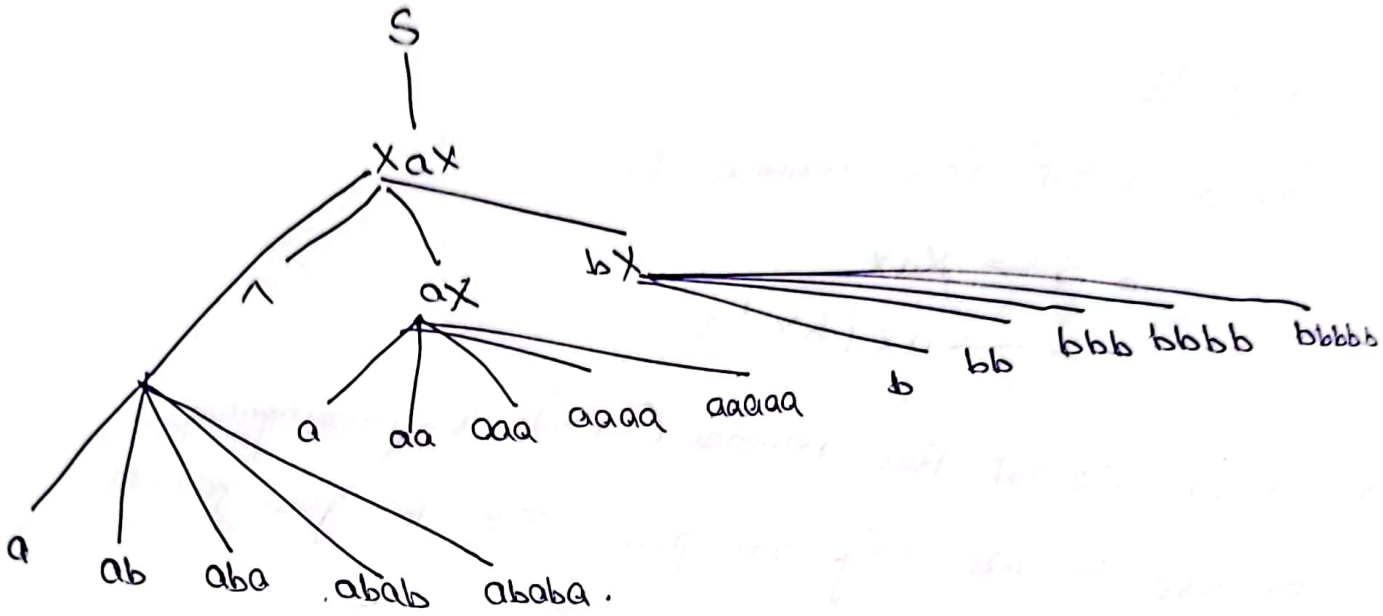
$S \rightarrow XaX \quad (S \rightarrow XaX)$
$\rightarrow aXaX \quad (X \rightarrow aX)$
$\rightarrow aaX \quad (X \rightarrow \wedge)$
$\rightarrow aa \quad (X \rightarrow \wedge)$

(ii) "aabba"

$S \rightarrow XaX \quad (S \rightarrow XaX)$
$\rightarrow aXaX \quad (X \rightarrow aX)$
$\rightarrow aaXaX \quad (X \rightarrow aX)$
$\rightarrow aabXaX \quad (X \rightarrow bX)$
$\rightarrow aabbXaX \quad (X \rightarrow bX)$
$\rightarrow aabbaX \quad (X \rightarrow \wedge)$
$\rightarrow aabba \quad (X \rightarrow \wedge)$

There is only one way to derive them using given grammar so it is not ambiguous.

c) Total Language Tree is



The given grammar is unambiguous.