Workshop Week 3

Christian Nassif-Haynes

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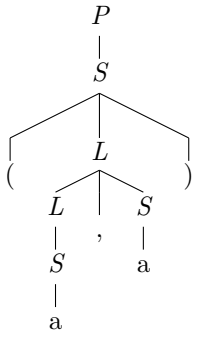
3 Grammar Derivations And Parse Trees

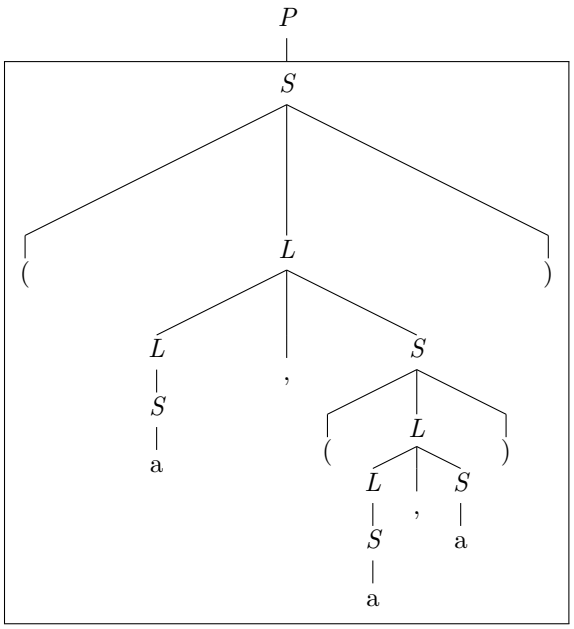
Derivation and parse tree for `(a,b)`:

$$
\begin{aligned}
P &\to S \\
&\to (\ L\ ) && (2)\\
&\to (\ L\ ,\ S\ ) && (3)\\
&\to (\ S\ ,\ S\ ) && (3)\\
&\to (\ \mathrm{a}\ ,\ S\ ) && (2)\\
&\to (\ \mathrm{a}\ ,\ \mathrm{a}\ ) && (2)
\end{aligned}
$$



Derivation and parse tree for `(a,(a,a))`:

$$
\begin{aligned}
P &\to S \\
&\to (\ L\ ) && (2)\\
&\to (\ L\ ,\ S\ ) && (3)\\
&\to (\ S\ ,\ S\ ) && (3)\\
&\to (\ \mathrm{a}\ ,\ S\ ) && (2)\\
&\to (\ \mathrm{a}\ ,\ (\ L\ )\ ) && (2)\\
&\to (\ \mathrm{a}\ ,\ (\ L\ ,\ S\ )\ ) && (3)\\
&\to (\ \mathrm{a}\ ,\ (\ S\ ,\ S\ )\ ) && (3)\\
&\to (\ \mathrm{a}\ ,\ (\ \mathrm{a}\ ,\ S\ )\ ) && (2)\\
&\to (\ \mathrm{a}\ ,\ (\ \mathrm{a}\ ,\ \mathrm{a}\ )\ ) && (2)
\end{aligned}
$$



Derivation and parse tree for `((a,(a,a)),a)` is show below. The triangle represents the framed section of the parse tree from the previous answer:

$P \to S$

$\to$ (L) (2)

$\to$ (L , S) (3)

$\to$ (S , S) (3)

$\to$ ((L) , S) (2)

$\to$ ((L , S) , S) (3)

$\to$ ((S , S) , S) (3)

$\to$ ((a , S) , S) (2)

$\to$ ((a , (L)) , S) (2)

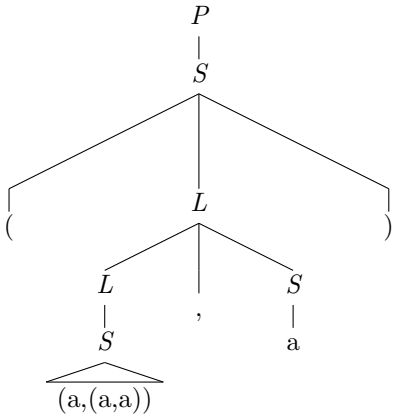
$\to$ ((a , (L , S)) , S) (3)

$\to$ ((a , (S , S)) , S) (3)

$\to$ ((a , (a , S)) , S) (2)

$\to$ ((a , (a , a)) , S) (2)

$\to$ ((a , (a , a)) , a) (2)



4 Ambiguous Grammars

The string `abab` has precisely two parses under the given grammar:

- [P [S a [S ϵ] b [S a [S ϵ] b [S ϵ]]]]
- [P [S a [S b [S ϵ] a [S ϵ]] b [S ϵ]]]