Homework 3/Quiz

2.15) Consider the following context free grammar

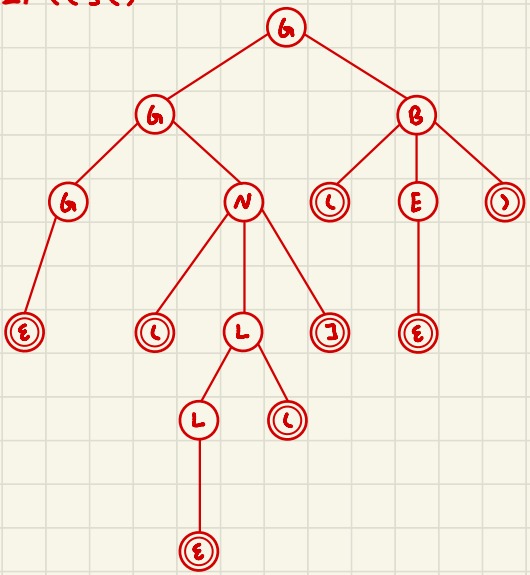
$$
\begin{aligned}
G &\longrightarrow G\ B \\
&\longrightarrow G\ N \\
&\longrightarrow \epsilon \\
B &\longrightarrow (\ E\ ) \\
E &\longrightarrow E\ (\ E\ ) \\
&\longrightarrow \epsilon \\
N &\longrightarrow (\ L\ ] \\
L &\longrightarrow L\ E \\
&\longrightarrow L\ (\\
&\longrightarrow \epsilon
\end{aligned}
$$

1. Describe, in English, the language generated by this grammar. (Hint: B stands for "balanced"; N stands for "nonbalanced".) (Your description should be a high-level characterization of the language—one that is independent of the particular grammar chosen.)
2. Give a parse tree for the string (( ]( ).
3. Give a canonical (right-most) derivation of this same string.
4. What is FIRST(E) in our grammar? What is FOLLOW(E)? (Recall that FIRST and FOLLOW sets are defined for symbols in an arbitrary CFG, regardless of parsing algorithm.)

1. All finite strings that are formed by concatenating zero or more blocks of
   - either a "balanced-parentheses block" (E), or
   - a "mismatched block" (L].

Inside each balanced block is a well-formed parentheses string. Inside each mismatched block is an arbitrary mixture of "(" and balanced chunks, followed by "\]".

2. (()()



3.

- G
- G —> G B
- G B —> G (E)
- G (E) —> G ( ) [since E —> ε]
- G ( ) —> G N ( )
- G N ( ) —> G (L] ( )
- G (L] ( ) —> G (L ( ] ( ) [expanding the rightmost L]
- G (L ( ] ( ) —> G (( ] ( ) [since L —> ε]
- G (( ] ( ) —> ε (( ] ( ) [finally G —> ε]

4.

- FIRST(E)={ (, ε }
- FOLLOW(E)={ (,),] }