Derivations

A *derivation* of a string is the steps in generating the string. A *leftmost* derivation is where the leftmost variable replaced each time. A *derivation tree* has each variable with its replacement string as its children. A grammar is *unambiguous* if every string has unique leftmost derivation or derivation tree.

Example:

$$S \to 1S \mid 0A0S \mid \varepsilon$$

$$A \to 1A \mid \varepsilon$$

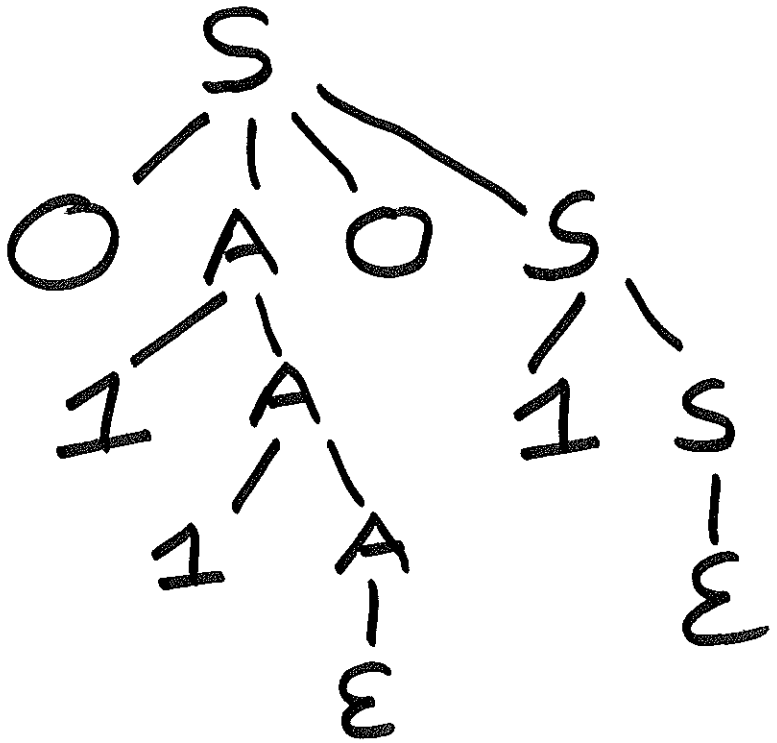
$S \to 0A0S \to 01A0S$

$\to 011A0S$

$\to 0110S$

$\to 01101S$

$\to 01101$



This generates all binary strings with an even number of Os
It is unambiguous.

Example:

$$S \to 0S1S \mid 1S0S \mid \varepsilon$$

Everything generated has equal Os and 1s. But can all such strings be generated?

Yes. Idea: if starts with 0, must be some 1 that brings equality. 0 [equal] 1 [equal]

ambiguous