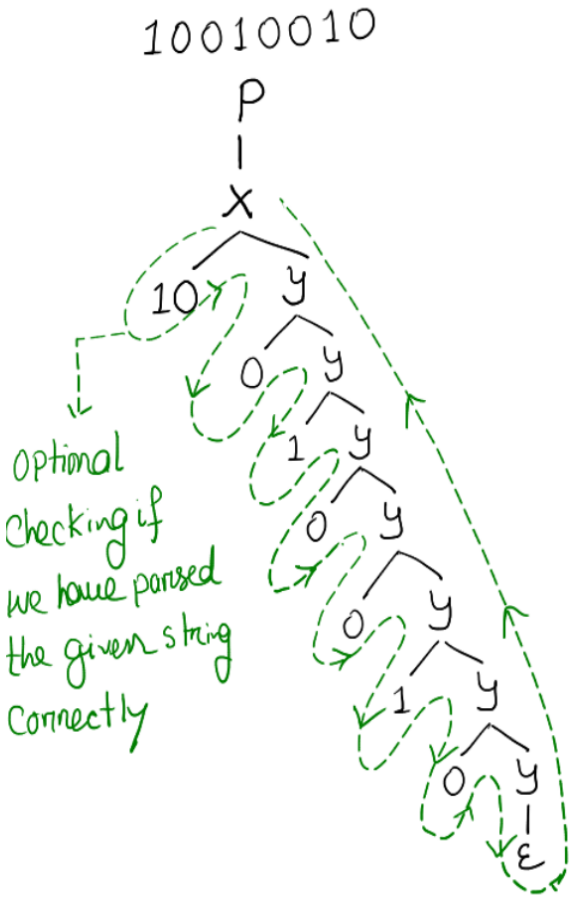
CSE331: Automata and Computability
Quiz on: Derivation, Parse Tree, and Ambiguity

Take a look at the following grammar and solve the following problems:

$$P \rightarrow 00P \mid 01P \mid 10P \mid 11P \mid X$$
$$X \rightarrow 00Y \mid 10Y$$
$$Y \rightarrow 0Y \mid 1Y \mid \varepsilon$$

a) Show three different parse trees for the string "10010010"
b) Show the leftmost derivation for the parse trees

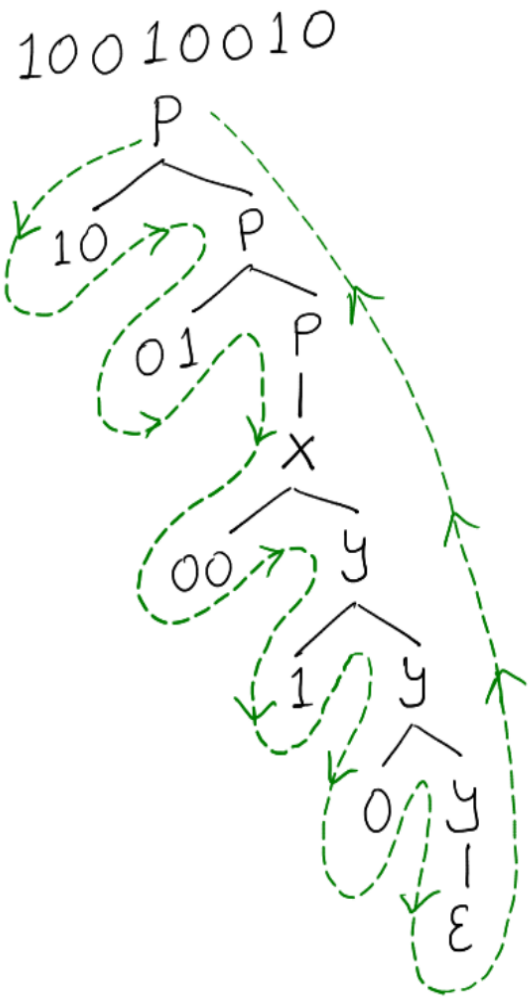
a) First Parse Tree



b) Leftmost Derivation for the parse tree shown at (a)

$$\begin{aligned} P &\rightarrow \underline{X} \\ &\rightarrow 10\underline{Y} \\ &\rightarrow 100\underline{Y} \\ &\rightarrow 1001\underline{Y} \\ &\rightarrow 10010\underline{Y} \\ &\rightarrow 100100\underline{Y} \\ &\rightarrow 1001001\underline{Y} \\ &\rightarrow 10010010\underline{Y} \\ &\rightarrow 10010010\varepsilon \end{aligned}$$

c) Second Parse Tree



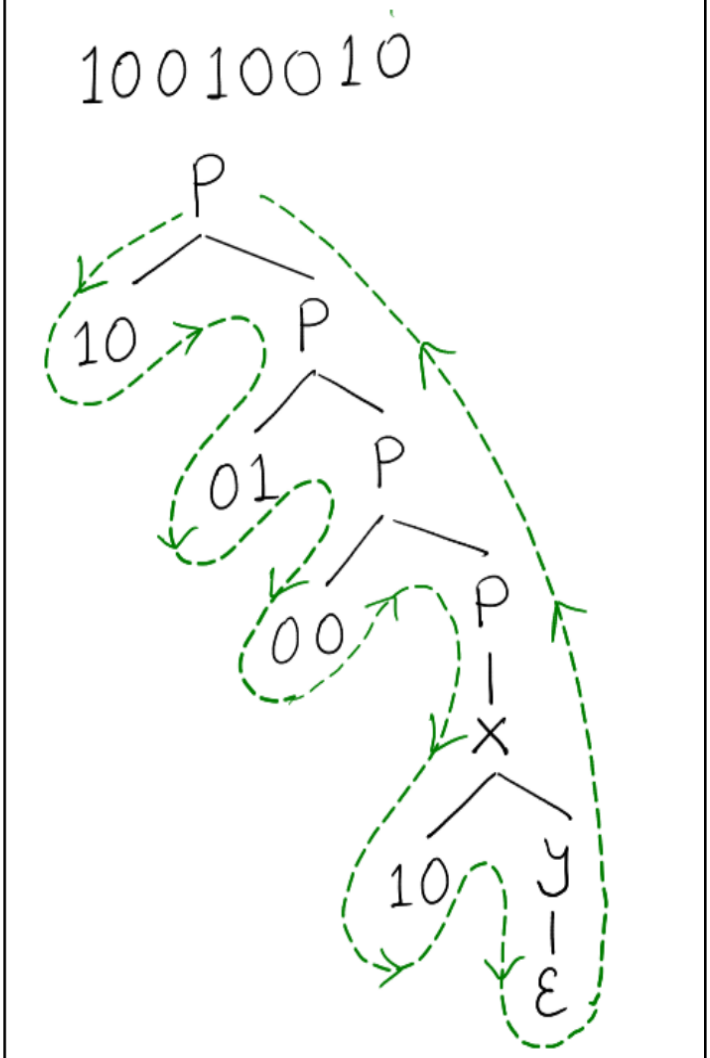
d) Leftmost Derivation for the parse tree shown at (c)

$$
\begin{aligned}
P &\rightarrow 10\underline{P} \\
&\rightarrow 1001\underline{P} \\
&\rightarrow 1001\underline{X} \\
&\rightarrow 100100\underline{Y} \\
&\rightarrow 1001001\underline{Y} \\
&\rightarrow 10010010\underline{Y} \\
&\rightarrow 10010010\varepsilon
\end{aligned}
$$

e) Third Parse Tree

f) Leftmost Derivation for the parse tree shown at (e)

$$
\begin{aligned}
P &\rightarrow 10\underline{P} \\
&\rightarrow 1001\underline{P} \\
&\rightarrow 100100\underline{P} \\
&\rightarrow 100100\underline{X} \\
&\rightarrow 10010010\underline{Y} \\
&\rightarrow 10010010\varepsilon
\end{aligned}
$$


10010010
P
10
P
01
P
00
P
X
10
y
ε