2.4) Given context-free grammars that generate the following languages. In all parts, the alphabet Σ is $\{0,1\}$.

a.) $\{w \mid w$ contains at least three 1's$\}$

$S \rightarrow R1R1R1R$

$R \rightarrow 0R \mid 1R \mid \varepsilon$

b.) $\{w \mid w$ starts and ends with the same symbol$\}$

$S \rightarrow 0P0 \mid 1P1 \mid 0 \mid 1$

$P \rightarrow 0P \mid 1P \mid \varepsilon$

c.) $\{w \mid$ the length of w is odd$\}$

$S \rightarrow 0 \mid 1 \mid 00S \mid 01S \mid 10S \mid 11S$

$S \rightarrow 0 \mid 1 \mid 0S0 \mid 0S1 \mid 1S0 \mid 1S1$ (or)

d.) $\{w \mid$ The length of w is odd and its middle symbol is a 0$\}$

$S \rightarrow 0 \mid 0S0 \mid 0S1 \mid 1S0 \mid 1S1$

e.) $\{w \mid w = w^R$, that is, w is a Palindrome$\}$

$S \rightarrow 0 \mid 1 \mid 0S0 \mid 1S1 \mid \varepsilon$

f.) The empty set ($\{\}$)

$S \rightarrow S$