1. Consider the following grammar.

\[
\langle s \rangle \rightarrow \text{a } \langle s \rangle \mid \text{b } \langle s \rangle \mid \text{a } \mid \text{b}
\]

(a) describe in plain English what types of strings it produces and (b) give a left-most derivation of the string \text{abba}.

2. Define a grammar for simple Boolean formulas. Assume variables consist of a single lower-case letter (except \text{v} which denotes disjunction), \& represents conjunction, \text{v} represents disjunction, \! represents negation, and parentheses ()'s denote (optional) evaluation order. Your grammar should ONLY allow well-formed Boolean formulas. The following are examples of well-formed formulas (one formula per line).

\[
\begin{align*}
\text{p} \\
\text{p v q} \\
\text{q v (p & !q)} \\
\text{(p & !(q v r) & (q & !s))}
\end{align*}
\]

3. Using the MyPL grammar provided in HW 3, give left-most derivations of 3 different statements: (a) an assignment statement involving at least two arithmetic operators; (b) an if-then statement with at least one Boolean operator in the condition; and (c) a while statement with at least one Boolean operator in the condition.