1. Let $L$ be the language corresponding to the RE $b(ab)^*$. For the following CFG for $L$, determine the number of derivation trees for the string $bababab$.

$$S \rightarrow SaS \mid b$$

2. Consider the following CFG with start state $S$:

$$S \rightarrow 0AS \mid 1BS \mid \varepsilon$$

$$A \rightarrow 0AA \mid 1$$

$$B \rightarrow 1BB \mid 0$$

Determine the language generated by $S$. Justify your answer.

3. Consider the language of strings where (at least) the first half is all the same symbol. To be specific, consider the set of all strings $a^n x$ where $|x| \leq n$ and $x \in \{a, b\}^*$. Give both a grammar and a PDA for this language.

4. Produce a PDA that accepts all strings of the form $0^a1^b2^c$ such that $a, b, c > 0$ and at least one of the following is true: $a < b$ or $b < c$.

5. Explain how, given a PDA for $L_1$ and a PDA for $L_2$, one can produce a PDA for the concatenation $L_1L_2$.

**Due: Wednesday October 11**