1. Give the shortest string generated by the following CFG (with start variable $S$ and alphabet $\{0, 1\}$), and give a derivation tree for that string:

\[ S \rightarrow ABA | SS \\
A \rightarrow S0 | T1T \\
B \rightarrow S1 | 0 \\
T \rightarrow 0 \]

2. Construct a CFG for the language of binary strings that have an unequal number of 0’s and 1’s.

3. Give a regular grammar for the language of all nonempty binary strings that do not contain 000.

4. Construct a PDA for the language of strings of the form $0^n1^{2n}$.

5. Walk through the following silly PDA with the strings abba, babab and baaa. What language does it accept?

Due: Thursday February 24