CSC 311—Theory of Computation
Context-free grammars, ambiguity, CNF, CKY, PDA.

Tutorial 4 Second Semester 2017

1. Show that the following CFL is ambiguous by giving two leftmost derivations and two different parse trees for:
   `if b then if b then a else a`
   given the rules:
   $S \to$ `if b then` S `else` $S \mid$ `if b then` $S \mid$ `a`
   $\Sigma = \{$`a, b, if, then, else`$\}$ and $V = S$ is the only variable.

2. Give a grammar in Chomsky normal form for $\{a^n b^k a^n \mid n, k \geq 0\}$.

3. Using the grammar $S \to AB$
   $A \to a$
   $B \to AB \mid b$
   Run the CKY algorithm on the string `aab`.

4. Using the grammar $S \to RT$
   $R \to TR \mid$ `a`
   $T \to TR \mid b$
   Run the CKY algorithm onthe string `baba`.

5. Give a context-free grammar for the PDA below