

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:
 $S \rightarrow \text{if b then } S \text{ else } S \mid \text{if b then } S \mid a$
 $\Sigma = \{a, b, \text{if, then, else}\}$ 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 $S \rightarrow AB$
 $A \rightarrow a$
 $B \rightarrow AB \mid b$
 Run the CKY algorithm on the string aab.
4. Using the grammar $S \rightarrow RT$
 $R \rightarrow TR \mid a$
 $T \rightarrow TR \mid b$
 Run the CKY algorithm on the string baba.
5. Give a context-free grammar for the PDA below

