

TEST PRACTICE QUESTIONS

1. Show that the class of context-free languages are closed under union

2. Show that $L = \{a^n b^m a^n b^m \mid n, m \geq 1\}$ is not a cfl.

3. Let $L = \{w \in \{a, b\}^+ \mid \#_a(w) = \#_b(w)\}$

- (a) Give a cfg for L
- (b) Give a CNF grammar for L
- (c) Give a GNF grammar for L
- (d) Give a pda accepting L

4. Put the following grammar into CNF

$$\begin{array}{ll} S \rightarrow A|B & C \rightarrow S|a|e \\ A \rightarrow C|D & D \rightarrow S|b \\ B \rightarrow D|E & E \rightarrow S|c|e \end{array}$$

5. Give a pda accepting \bar{L} where $L = \{ww^* \mid w \in \{a, b\}^*\}$

6. Let $L = \{a^n b^n c^n \mid n \geq 1\}$. Prove or disprove:
 \bar{L} is a cfl.

7. Let $f(m)$ be a positive, monotonically increasing function s.t. for all n there is an m s.t. $f(m+1) \geq f(m) + n$. Show that $\{a^{f(m)} \mid m \geq 1\}$ is not ~~regular~~ context-free.