Assignment # 7.1 Sample

1. For each of the following languages, either provide a grammar to show it is a CFL or employ the Pumping Lemma to show it is not
   a.) $\mathbf{L = \{ a^i b^j \mid j > 2*I \}}$

   b.) $\mathbf{L = \{ a^n b^{n!} \mid n>0 \}}$

Assignment # 7.2 Sample

2. Consider the context-free grammar **G = ({ S } , { a , b } , S , P),** where **P** is:

   $\mathbf{S \rightarrow S\,a\,S\,b\,S \mid S\,b\,S\,a\,S \mid S\,a\,S\,a\,S \mid a \mid} \lambda$

   Provide the first part of the proof that

   L (G) = L = { w | w has at least as many **a's** as **b's }**

   That is, show that **L (G)** $\subseteq$ **L**

   To attack this problem we can first introduce the notation that, for a syntactic form α, α_a = the number of **a's** in α, and α_b = the number of **b's** in α. Using this, we show that if $\mathbf{S} \Rightarrow^* \alpha$, then $\alpha_b \leq \alpha_a$ and hence that **L (G)** $\subseteq$ **L:**

   A straightforward approach is to show, inductively on the number of steps, **i**, in a derivation, that, if $\mathbf{S} \Rightarrow^{i} \alpha$, then $\alpha_b \leq \alpha_a$.