Tutorial #6

Attempt the last question only in the end.

1. (2 points) Find the language accepted by the following grammar and also prove it.

$$S \to bS|Sa|aSb|\epsilon$$

2. (2 points) Give the grammar which generates the following language.

$$L = \{x \in \{a, b\}^* | \#_a(x) \le 2\#_b(x)\}$$

3. (2 points) Convert the following grammar into Chomsky's Normal Form

$$\begin{array}{rccc} S & \rightarrow & aSbb|T \\ T & \rightarrow & bTaa|S|\epsilon \end{array}$$

- 4. (2 points) Prove that the language $L = \{a^{n^2} | n \ge 0\}$ is not context free, using pumping lemma.
- 5. (2 points) Check which of the following languages are CFLs: (assume the result in the last question)
 - 1. $\{ww^R | w \in \{0, 1\}^*\}$
 - 2. $\{ww^R v^R v | w, v \in \{a, b\}^*\}$
 - 3. $\{ww|w \in \{0,1\}^*\}$
- 6. (2 points) If L is CFL and R is regular, show that L ∩ R is CFL. (Use the fact that all CFLs can be computed by PDAs and all languages computed by a PDA is a CFL). (HINT : Product construction. Use this idea in question 5.c.