**Assignment 3**

1. (*5 pts*) Give a context-free grammar (CFG) for each of the following languages over the alphabet

Σ = *{a, b}*:

* 1. All nonempty strings that start and end with the same symbol.

1. (10 pts) Answer each part for the following context-free grammar.
2. → XRX | S
3. → aTb | bTa
4. → XTX | X | ε X → a | b
5. What are the variables and terminals of G? Which is the start symbol?
6. Give three examples of strings in L(G).
7. Give three examples of strings not in L(G).
8. True or False: T ⇒ aba.
9. True or False: T ⇒∗ aba.
10. (*5 pts*) Determine whether the grammar implicitly defined by the following rules is ambiguous. Prove your answer.

S → AB  
A → aA  
A → abA  
A → ε  
B → bB  
B → abB  
B → ε

1. (*5 pts*) Give pushdown automata that recognize the following languages.
   1. A = {w ∈ {0, 1}\* | w contains at least two 1s }

Notes:

* Submit your answers to Blackboard. No hard copies.
* Handwritten answers are accepted but should be legible.