Homework #1

Name_____

Worked with (list all people you discussed this homework with):

URL's consulted:

Each question is worth 10 points.

#1. Given the alphabet $\Sigma = \{a,b\}$, and the languages over Σ: $L_1 = \{aaa\}^*$, $L_2 = \{a,b\}\{a,b\}\{a,b\}\{a,b\}$ and $L_3 = L_2^*$, describe the strings in

a) L_2
b) L_3
c) $L_1 \cap L_3$

#2. Give regular expressions for the following:

a) The set of strings over {a,b,c} where all the a's precede all the b's which precede all the c's (there may be no a's, b's or c's)

b) The set of strings over {0,1} which contain the substring *00* and the substring *11*.

c) The set of strings over {a,b} which do not contain the substring *ab.*

#3. a) Let G be the grammar:

$S \rightarrow 0 \mid 1 \mid 0\ S\ 0 \mid 1\ S\ 1 \mid \lambda \mid 0\ 0 \mid 1\ 1$

a) Show a leftmost derivation of *0 1 1 1 1 0*

b) Create a parse tree for *0 1 1 1 1 0*

c) Show that this grammar is ambiguous

d) Describe L(G) using set notation

b) Construct grammars to generate the languages of #2

#4. Explain briefly and clearly why (how) all finite alphabets can be replaced with a two symbol alphabet. Do this in general (for any length alphabet) and then show your method for the alphabet {a,b,c} and the string *b b c a*.

#5. For the CFG G defined by

S → 0 S | S 1 | 0 | 1
prove by induction on the size of the parse tree that no string in the language has *ba* as a substring