CMSC 22610 **Winter 2007**	**Implementation** **of** **Computer Languages**	**Homework 3** **Due February 8**

1. Translate the following regular expression into a context free grammar:

$$(\mathbf{b} \mid \mathbf{c})^* \cdot \mathbf{a} \cdot ((\mathbf{b} \mid \mathbf{c})^* \cdot \mathbf{a} \cdot (\mathbf{b} \mid \mathbf{c})^* \cdot \mathbf{a})^* \cdot (\mathbf{b} \mid \mathbf{c})^*$$

2. Consider the following grammar:

$$\begin{array}{rcl} E & \rightarrow & T \\ & \rightarrow & T\texttt{+}E \\ & \rightarrow & T\texttt{-}E \\ T & \rightarrow & A \\ & \rightarrow & \texttt{-}T \\ A & \rightarrow & \texttt{[}E\texttt{]} \\ & \rightarrow & \mathbf{id} \end{array}$$

   (a) What is the associativity of `+` and `-` in this grammar?

   (b) Draw the *derivation tree* for `1-2+-3`.

3. Give an LL(1) grammer for this language that preserves the associativity and precedence of the operators.