

This homework assignment is a written assignment that should be turned in at the beginning of class on Tuesday February 10.

1. (a) Consider the grammar  $G = \langle \mathcal{N}, \mathcal{T}, S, \mathcal{P} \rangle$ , with nonterminal symbols  $\mathcal{N} = \{S, B, D, E, F\}$ , terminal symbols  $\mathcal{T} = \{\mathbf{x}, \mathbf{y}, \mathbf{w}, \mathbf{u}, \mathbf{v}, \mathbf{z}\}$ , and  $\mathcal{P}$  consisting of the following productions:

$$S \rightarrow \mathbf{u} B D \mathbf{z}$$

$$B \rightarrow B \mathbf{v}$$

$$B \rightarrow \mathbf{w}$$

$$D \rightarrow E F$$

$$E \rightarrow \mathbf{y}$$

$$E \rightarrow \varepsilon$$

$$F \rightarrow \mathbf{x}$$

$$F \rightarrow \varepsilon$$

Calculate First and Follow for  $G$ .

- (b) Construct the LL(1) parsing table for the above grammar.  
(c) Is the grammar LL(1)?
2. Translate the following regular expressions into a context free grammar:
- (a)  $(\mathbf{ab}^*\mathbf{a}) \mid (\mathbf{ba}^*\mathbf{b})$   
(b)  $(\mathbf{0} \mid \mathbf{1})^+(\cdot(\mathbf{0} \mid \mathbf{1})^+)^?$  (here “.” is a terminal symbol).
3. Consider the following grammar:

$$E \rightarrow U$$

$$\rightarrow U + E$$

$$\rightarrow U - E$$

$$U \rightarrow A$$

$$\rightarrow -U$$

$$A \rightarrow (E)$$

$$\rightarrow \mathbf{num}$$

- (a) What are the associativities of  $+$  and  $-$  in this grammar?

- (b) Draw the *derivation tree* for **1+2--3**.
4. Give an LL(1) grammar for this language that preserves the associativity and precedence of the operators.