

Programming Languages Review Read Chapter 1 and esp. Chapter 2 sections 2.1 and 2.2 (and their subsections), section 2.3 (although we didn't cover it in depth) may also be of some help.

1. Describe what is meant by a language, give examples.
2. Construct a FSM that accepts the string a^2b^2 .
3. Describe (in words) the language represented by the regular expression

$$(0|1)^* 1$$

4. Draw a finite state machine that will accept the language given by the regular expression in the previous problem. Is this FSM *deterministic* or *non-deterministic*, Explain.
5. Draw a FSM that accepts any integer (note: integers do not begin with 0).
6. Give a grammar that generates valid strings of integers.
7. Given the grammar:

$$\begin{aligned} id_list &\rightarrow id\ id_list_tail \\ id_list_tail &\rightarrow ,id\ id_list_tail \\ id_list_tail &\rightarrow \end{aligned}$$

- (a) Construct a Top-down (LL) parse tree for the string "A, B, C, D;".
 - (b) Construct a Bottom-up (LR) parse tree for the same string.
8. Given the grammar $G = (\{a, b\}, \{S, A, B\}, P, S)$ (here $\Sigma = \{a, b\}$, $\{S, A, B\}$ is the set of non-Terminals, P is the set of Production Rules, and S is the start symbol. The production rules are given by:
 $S \rightarrow A$
 $S \rightarrow B$
 $S \rightarrow AB$
 $A \rightarrow aA$
 $B \rightarrow bB$
 $A \rightarrow \epsilon$
 $B \rightarrow \epsilon$
 - (a) Verify that the language generated by this grammar accepts the string "aaa" by showing a derivation for this string.
 - (b) Draw a left-most parse tree for this string.
 - (c) Is this grammar ambiguous? Why or why not?
 - (d) Describe the language generated by this grammar.