

Problems A-C are intended to help you practice basic skills with CFGs. If you feel that you need more practice, then do more examples from the textbook.

A. Do 2.4c.

B. Do 2.6b.

C. Here is our CFG for fully parenthesized algebraic expressions, from class:

```
<expr> ::= <var> | <num> | (<expr><op><expr>)
<var>  ::= <char> | <char><var>
<char> ::= a | ... | z | A | ... | Z | _
<num>  ::= <dig> | <dig><num>
<dig>  ::= 0 | ... | 9
<op>   ::= + | * | ^ | - | /
```

Based on this CFG, draw the parse tree for the expression

$((3 * (4 / \text{temp})) - ((x + 50) * (\text{rate} ^ \text{pow})))$

Your parse tree will not look like the examples given in class on Friday. You should instead mimic the textbook's examples in Section 2.1, with variables labeling branch nodes and terminals labeling leaf nodes. For example, the root node of your parse tree will be labeled `<expr>`. Do not take shortcuts; draw the entire tree.

D. Prove that every regular language is context-free, by showing that any regular expression can be converted into a context-free grammar that describes the same language. Hint: Use structural induction, as we did in converting regular expressions to NFAs.