

## Homework 6

1. (i) Give the regular expressions for lexing a language consisting of whitespaces, identifiers (some letters followed by digits), numbers, operations =, < and >, and the keywords if, then and else. (ii) Decide whether the following strings can be lexed in this language?

- (a) "if y4 = 3 then 1 else 3"  
(b) "if33 ifif then then23 else else 32"  
(c) "if x4x < 33 then 1 else 3"

In case they can, give the corresponding token sequences. (Hint: Observe the maximal munch rule and priorities of your regular expressions that make the process of lexing unambiguous.)

2. Suppose the grammar

$$\begin{aligned} E &\rightarrow F \mid F \cdot * \cdot F \mid F \cdot \setminus \cdot F \\ F &\rightarrow T \mid T \cdot + \cdot T \mid T \cdot - \cdot T \\ T &\rightarrow \text{num} \mid ( \cdot E \cdot ) \end{aligned}$$

where  $E$ ,  $F$  and  $T$  are non-terminals,  $E$  is the starting symbol of the grammar, and  $\text{num}$  stands for a number token. Give a parse tree for the string  $(3+3)+(2*3)$ .

3. Define what it means for a grammar to be ambiguous. Give an example of an ambiguous grammar.
4. Suppose boolean expressions are built up from

- 1.) tokens for true and false,
- 2.) the infix operations  $\wedge$  and  $\vee$ ,
- 3.) the prefix operation  $\neg$ , and
- 4.) can be enclosed in parentheses.

- (i) Give a grammar that can recognise such boolean expressions and (ii) give a sample string involving all rules given in 1.-4. that can be parsed by this grammar.