

COT 4420: Homework 4

CFGs, derivations, derivations trees

Unless stated otherwise, the base alphabet in this problem set is $\Sigma = \{0,1\}$.

1. Write a context-free grammar for the language $\{0^m 1^{m+n} 0^n \mid m, n > 0\}$

2. Tricky: Construct a CFG for $\{0^l 1^m 2^n \mid l = m \text{ or } m = n\}$. *Hint: Consider both cases ($l = m$ and $m = n$) separately and then bring them together into one grammar.*

3. A *Palindrome* is a string that reads the same forwards and backwards. Some palindromes are of even length (001100, 101101), some of odd length (0001000, 0110110, 0111110).

a) Write a CFG for *odd length palindromes*. [1/2]

b) Draw derivation trees for the three odd example strings given. [1/2]

4. Now the vocabulary is $\Sigma = \{0, 1, (,), \cup, *, \emptyset, \varepsilon\}$. Construct a CFG that generates exactly the Regular Expressions, such as $(0 \cup (10)^* 1)^*$

Write down the derivation of the RE $(0 \cup (10)^* 1)^*$.

Hint: Look at the recursive definition of REs in the handout. It works with one non-terminal symbol.

5. Is the language $L = \{(01)^n (00)^n \mid n > 0\}$ regular or not? *Note: Parentheses are not part of the language, I put them in to show what is under the exponent.*

No, that's not the same language as in Homework 3!