CS 3530: Assignment 2a

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Exercise 2.1abcd (10 points)

Problem

Recall the CFG G_4 that we gave in example 2.4. For convenience, let's rename its variables with single letters as follows.

$$E \rightarrow E + T|T$$
$$T \rightarrow T \times F|F$$
$$F \rightarrow (E)|a$$

Give derivations for each string.

   a. a

   b. $a + a$

   c. $a + a + a$

   d. $((a))$

Solution

a:

E=>T, E=>F, E=>a

b: E=> E+T

E=> T+T

E=> F+T

E=>a+T

E=>a+F

E=>a+a

c: E=> E+T

E=> E+T+T

E=> T+T+T

E=> F+T+T

E=> a+T+T

E=> a+F+T

E=> a+a+T

E=> a+a+F

E=> a+a+a

d: E=> T

E=> F

E=> (E)

E=> (T)

E=> (F)

E=> ((E))

E=> ((T))

E=> ((F))

E=> ((a))

Exercise 2.4bc (10 points)

Problem

Give context-free grammars that generate the following languages. In all parts, the alphabet Σ is $\{0, 1\}$.

  b. $\{w|w$ starts and ends with the same symbol $\}$

  c. $\{w|$ the length of w is odd $\}$

Solution

b.

S => 0P0|1P1|0|1

P => 0P|1P|ε

c.

S => 0|1|0S0|0S1|1S0|1S1