

Context-free Grammars

example: $S \rightarrow 0S11$
 $S \rightarrow \epsilon$

start with S

repeatedly use rule to replace.

E.g. $S \rightarrow 0S11$
 $\rightarrow 0\underline{0S11}11$
 $\rightarrow 001111$

E.g. $S \rightarrow \epsilon$

Generates: $0^n 1^{2^n}$

Terminology:

variable (can be replaced)

terminal (cannot...)

rule or production

language of grammar is
set of all strings of
~~non~~ terminals that can
be generated from
start variable.

Example

$S \rightarrow OT \mid 1S \mid \epsilon$

$T \rightarrow 1T \mid OS$

with start variable S .

0110 ✓

01010x

ϵ ✓

All binary strings with
even number of 0's

Example: ① Binary palindromes

② binary strings with exactly two blocks of 0's, and these are equal!

① $P \rightarrow OPO / 1P1 /$
 $O / 1 / \epsilon$

② $B \rightarrow YAY$
 $Y \rightarrow 1Y / \epsilon$
 $A \rightarrow OAO$
 $A \rightarrow 1Y$