

Sample Grammar

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⟨SENTENCE⟩ → ⟨NOUN-PHRASE⟩⟨VERB-PHRASE⟩
⟨NOUN-PHRASE⟩ → ⟨CMPLX-NOUN⟩ | ⟨CMPLX-NOUN⟩⟨PREP-PHRASE⟩
⟨VERB-PHRASE⟩ → ⟨CMPLX-VERB⟩ | ⟨CMPLX-VERB⟩⟨PREP-PHRASE⟩
⟨PREP-PHRASE⟩ → ⟨PREP⟩⟨CMPLX-NOUN⟩
⟨CMPLX-NOUN⟩ → ⟨ARTICLE⟩⟨NOUN⟩
⟨CMPLX-VERB⟩ → ⟨VERB⟩ | ⟨VERB⟩⟨NOUN-PHRASE⟩
  ⟨ARTICLE⟩ → a | the
    ⟨NOUN⟩ → boy | girl | flower
      ⟨VERB⟩ → touches | likes | sees
        ⟨PREP⟩ → with
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Grammar has 10 variables, 27 terminals (regular alphabet plus space characters) and 18 rules.

Exercise 2.3, page 155

^A2.3 Answer each part for the following context-free grammar G .

$$\begin{aligned}R &\rightarrow XRX \mid S \\S &\rightarrow aTb \mid bTa \\T &\rightarrow XTX \mid X \mid \epsilon \\X &\rightarrow a \mid b\end{aligned}$$

- a. What are the variables of G ?
- b. What are the terminals of G ?
- c. Which is the start variable of G ?
- d. Give three strings in $L(G)$.
- e. Give three strings *not* in $L(G)$.
- f. True or False: $T \Rightarrow aba$.
- g. True or False: $T \xRightarrow{*} aba$.
- h. True or False: $T \Rightarrow T$.
- i. True or False: $T \xRightarrow{*} T$.
- j. True or False: $XXX \xRightarrow{*} aba$.
- k. True or False: $X \xRightarrow{*} aba$.
- l. True or False: $T \xRightarrow{*} XX$.
- m. True or False: $T \xRightarrow{*} XXX$.
- n. True or False: $S \xRightarrow{*} \epsilon$.
- o. Give a description in English of $L(G)$.

Exercise 2.3, page 155

A2.3 Answer each part for the following context-free grammar G .

$$\begin{aligned}R &\rightarrow XRX \mid S \\S &\rightarrow aTb \mid bTa \\T &\rightarrow XTX \mid X \mid \epsilon \\X &\rightarrow a \mid b\end{aligned}$$

- a. What are the variables of G ? $\{R, S, T, X\}$
- b. What are the terminals of G ? $\{a, b\}$
- c. Which is the start variable of G ? R
- d. Give three strings in $L(G)$. ab, ba, ϵ
- e. Give three strings *not* in $L(G)$. aba, bab, aab
- f. True or False: $T \Rightarrow aba$. F
- g. True or False: $T \stackrel{*}{\Rightarrow} aba$. T
- h. True or False: $T \Rightarrow T$. F
- i. True or False: $T \stackrel{*}{\Rightarrow} T$. F
- j. True or False: $XXX \stackrel{*}{\Rightarrow} aba$. T
- k. True or False: $X \stackrel{*}{\Rightarrow} aba$. F
- l. True or False: $T \stackrel{*}{\Rightarrow} XX$. T
- m. True or False: $T \stackrel{*}{\Rightarrow} XXX$. T
- n. True or False: $S \stackrel{*}{\Rightarrow} \epsilon$. F
- o. Give a description in English of $L(G)$. *Strings over $a + b$ that aren't palindromes*