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CT-200 Autômatas e Linguagens Formais

Segunda Lista de Exercícios

Exercício 5 (Sudkamp Pág. 114). *Let G be the grammar: $S \to aS \,|\, Sb \,|\, ab \,|\, SS$.*

a) Give a regular expression for $L(G)$.

b) Give 2 leftmost derivations for 'aabb'.

c) Build the derivation trees for (b).

d) Construct an unambiguous grammar equivalent to G.

Exercício 6 (Sudkamp). *Let G be the grammar:*

$$
\begin{aligned}
S &\to ASB|ab|SS \\
A &\to aA|\epsilon \\
B &\to bA|\epsilon
\end{aligned}
$$

a) Give a leftmost derivation for 'aaabb'.

b) Give a rightmost derivation for 'aaabb'.

c) Show that G is ambiguous.

d) Construct an unambiguous grammar equivalent to G.

Exercício 8 (Sudkamp). *Show that $S \to aaS|aaaaaS|\epsilon$ is ambiguous. Give an unambiguous grammar that generates $L(G)$.*

Exercício 25 (Sudkamp). *Let G be:*

$$
\begin{aligned}
S &\to aS|AB \\
A &\to bAa|a \\
B &\to bB|b
\end{aligned}
$$

a) Descreva a evolução do conteúdo da fila para um parsing top-down depth-first de 'baab'.

b) Give the tree built by the bread-first bottom-up parse at 'baab'.

c) Descreva a evolução do conteúdo da fila para um parsing bottom-up depth-first de 'baab'.

Exercício 26 (Sudkamp). *Let G be:*

$$S \to A|AB$$
$$A \to abA|b$$
$$B \to baB|a$$

a) Give a regular expression for $L(G)$.

b) Descreva a evolução do conteúdo da fila para um parsing top-down depth-first de 'abbbaa'.

c) Give the tree built by the bread-first bottom-up parse at 'abbbaa'.

d) Descreva a evolução do conteúdo da fila para um parsing bottom-up depth-first de 'abbbaa'.

Exercício 2.4 (Sipser Pág. 120). *Give the CFG's that generate the following languages. Consider* $\Sigma = \{0, 1\}$.

a) $\{w | w \textit{ contains at least three } 1\text{'s}\}$.

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

c) $\{w | \textit{length(w) is odd}\}$.

d) $\{w | \textit{length(w) is odd and it's middle symbol is } 0\}$.

e) $\{w | w \textit{ contain more } 1\text{'s than } 0\text{'s}\}$.

f) $\{w | w = w^R\}$.

g) The empty set.

Exercício 2.5 (Sipser). *Give the informal descriptions and state diagrams of pushdown automata for the languages in Exercise 2.4.*

Exercício 2.18 (Sipser 121). *Use the Pumping Lemma to show that the following languages are regular.*

a) -.

b) $\{0^n \# 0^{2n} \# 0^{3n} | n \geq 0\}$.

c) $\{w \# x | w \textit{ is a substring of } x \textit{ where } w, x \in \{a, b\}^*\}$.

d) $\{x_1 \# x_2 \# \ldots \# x_k | k \geq 2\, x_i \in \{a, b\}^* \wedge \exists i \neq j | x_i = x_j\}$.

Exercício 2.26 (Sipser). *Let* $C = \{x \# y | x, y \in \{0, 1\}^* \wedge x \neq y\}$. *Show that C is context free.*

Exercício 2.27 (Sipser). *Let* $D = \{xy | x, y \in \{0, 1\}^* \wedge |x| = |y| \textit{ but } x \neq y\}$. *Show that D is context free.*

Exercício 7.1 (Hopcroft Pág. 74). *Design a Turing Machine to recognize the following languages:*

a) $\{0^n 1^n 0^n | n \geq 1\}$.

b) $\{ww^R | w \in \{0,1\}^*\}$.

c) The set of strings of equal number of 0's and 1's.

Exercício 7.2 (Hopcroft). *Design a Turing Machine to compute the following functions:*

a) $\lceil \log_2 n \rceil$.

b) $n!$.

c) n^2.