

Ciências / Ciência da computação / Introduction to the Theory of Computation (3rd Edition)

Exercício 4

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Introduction to the Theory of Computation

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Part a.

Set $\{w \mid w \text{ contains at least three 1s}\}$ is a regular language, and regular expression describing it is $\Sigma^*1\Sigma^*1\Sigma^*1\Sigma^*$. This gives us inspiration to write context-free grammar for this language:

$$S \rightarrow T1T1T1T$$

$$T \rightarrow TT \mid 0 \mid 1.$$

Part b.

Again, set $\{w \mid w \text{ starts and ends with the same symbol}\}$ is a regular language, and regular expression describing it is $0\Sigma^*0 \cup 1\Sigma^*1$. This gives us inspiration to write context-free grammar for this language:

$$S \rightarrow 0T0 \mid 1T1$$

$$T \rightarrow TT \mid 0 \mid 1.$$

Part c.

Again, set $\{w \mid \text{the length of } w \text{ is odd}\}$ is a regular language, and regular expression describing it is $(\Sigma^2)^*\Sigma$. This gives us inspiration to write context-free grammar for this language:

$$S \rightarrow TS \mid 0 \mid 1$$

$$T \rightarrow 00 \mid 01 \mid 10 \mid 11.$$

Passo 2

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Part d.

Finally, set $\{w \mid \text{the length of } w \text{ is odd and its middle symbol is a } 0\}$ is not regular, which can be easily verified using pumping lemma. So we have to come up with another strategy.

We find inspiration from grammar of language $\{a^n b^n \mid n \geq 0\}$. Grammar for our language is:

$$S \rightarrow 0S0 \mid 0S1 \mid 1S0 \mid 1S1 \mid 0.$$

Part e.

Grammar is similar to the one from previous part:

$$S \rightarrow 0S0 \mid 1S1 \mid 00 \mid 11.$$

Part f.

This is funny:

$$S \rightarrow S.$$

Resultado

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First three languages are regular, so we use regular expressions to write grammars. Other ones are similar to language $\{a^n b^n \mid n \geq 0\}$.

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