Formal Languages and Compilers

Dominika Regéciová

Faculty of Information Technology, Brno University of Technology
Božetěchova 1/2. 612 66 Brno
iregeciova@fit.vutbr.cz

5.10.2021

- Review of material from the previous lecture
- Alphabet, strings, and languages (all slides)
- Introduction to compilers (all slides)
- Exercises
- Extra exercise for home - 0.5 point when completed and send to me today

- **What is a symbol?**

- **What is a symbol?**
  - The symbols can be characters, words, punctuation, hieroglyphs, dots and dashes (Morse code), etc.

- What is a symbol?
  - The symbols can be characters, words, punctuation, hieroglyphs, dots and dashes (Morse code), etc.
- **What is a sentence?**

- What is a symbol?
  - The symbols can be characters, words, punctuation, hieroglyphs, dots and dashes (Morse code), etc.
- **What is a sentence?**
  - A sentence is a sequence of symbols.

- What is a symbol?
  - The symbols can be characters, words, punctuation, hieroglyphs, dots and dashes (Morse code), etc.
- What is a sentence?
  - A sentence is a sequence of symbols.
- **What is a language?**

- What is a symbol?
  - The symbols can be characters, words, punctuation, hieroglyphs, dots and dashes (Morse code), etc.
- What is a sentence?
  - A sentence is a sequence of symbols.
- **What is a language?**
  - A language is a set of "legal" sentences.

- What is a symbol?
  - The symbols can be characters, words, punctuation, hieroglyphs, dots and dashes (Morse code), etc.
- What is a sentence?
  - A sentence is a sequence of symbols.
- What is a language?
  - A language is a set of "legal" sentences.
- **What is a formal language?**

- What is a symbol?
  - The symbols can be characters, words, punctuation, hieroglyphs, dots and dashes (Morse code), etc.
- What is a sentence?
  - A sentence is a sequence of symbols.
- What is a language?
  - A language is a set of "legal" sentences.
- **What is a formal language?**
  - A formal language is a language defined by a finite set of unambiguous rules delimiting the legal sentences from the illegal ones.

1. Write down first 5 strings over alphabet $\Sigma = \{a\}$ in length order:
a) $L = \{a^{2^n} : n \geq 0\}$
b) $L = \{a^n$: n is a prime number$\}$
Note: 1 is not a prime number

1. Write down first 5 strings over alphabet $\Sigma = \{a\}$ in length order:
a) $L = \{a^{2^n} : n \geq 0\}$
b) $L = \{a^n$: n is a prime number$\}$
Note: 1 is not a prime number

Solution:
a) a, aa, aaaa, aaaaaaaa, aaaaaaaaaaaaaaaa
b) aa, aaa, aaaaa, aaaaaaa, aaaaaaaaaaa

2. Concatenate following languages:

a) $\{aa, bb\}.\{aa, bb\}$

b) $\{aa, bb\}.\{\varepsilon\}$

c) $\{aa, bb\}.\varnothing$

2. Concatenate following languages:

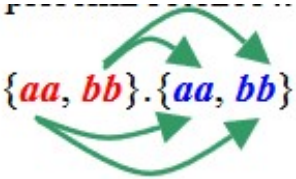
a) $\{aa, bb\}.\{aa, bb\}$

b) $\{aa, bb\}.\{\varepsilon\}$

c) $\{aa, bb\}.\varnothing$

Solution:

a) $\{aa, bb\}.\{aa, bb\} = \{aaaa, aabb, bbaa, bbbb\}$



b) $\{aa, bb\}.\{\varepsilon\} = \{aa\varepsilon, bb\varepsilon\} = \{aa, bb\}$

c) $\{aa, bb\}.\varnothing = \varnothing$

3. Define intersection of $L_1 = \{a^{2n} : n \geq 1\}$ and $L_2 = \{a^{3n} : n \geq 1\}$

3. Define intersection of $L_1 = \{a^{2n} : n \geq 1\}$ and $L_2 = \{a^{3n} : n \geq 1\}$

Solution:

$L_1 \cap L_2 = \{a^{6n} : n \geq 1\}$

Extra exercise

- Solve till today's midnight
- Send your solution to iregeciova@fit.vutbr.cz
- You can get 0.5 points for correct and nice solution (short answer does not count!)
- Extra points does not count into credit and course minimum
- **Exercise**: **Define if complement of language** $L = \{a^n : n \geq 2\}$ **is finite if:**
  a) L is defined over alphabet $\Sigma = \{a\}$
  b) L is defined over alphabet $\Sigma = \{a, b\}$

Thank you for your attention