

1 Interpreting Regular Expressions

1. Interpreting a Regular Expression

Find the shortest string $\omega \in \{a, b\}^*$ that is not in the language represented by the regular expression $a^*(ab)^*b^*$. Give reasons for your answer.

2. Interpreting a Regular Expression Consider the regular expression $(a(cd)^*b)^*$.

- Find a string of length 2 over $\{a, b, c, d\}$ which matches the expression.
- Find a string of length 1 over $\{a, b, c, d\}$ which does not match the expression.

Finden Sie für den oben angegebenen regulären Ausdruck

- einen String der Länge 2 mit den Symbolen $\{a, b, c, d\}$, welcher als gültig erkannt wird
- einen String der Länge 1 mit den Symbolen $\{a, b, c, d\}$, welcher als ungültig erkannt wird

3. Interpreting a Regular Expression

Describe in an English sentence (as simple as possible) the language corresponding to the regular expression:

$(b + ab)^*(a + ab)^*$.

Beschreiben Sie in einem möglichst einfachen deutschen Satz die Sprache des oben gegebenen regulären Ausdrucks.

2 C, C#, Java Comments

- Comments** In C, C#, or Java comments can be given in the form `/* This is the comment */`. This means that comments start with the string `/*` and end with the string `*/`. The comment itself can be an arbitrary string with the exception that the string `*/` must not occur.

More precisely we could say that the language of a comment is now the string starting with `/*` followed by a `*` followed by an arbitrary long sequence of characters except the sequence `*/` and ending with the sequence `*/`. You may write $\alpha - \{“x”\}$ to denote a set of characters excluding one specific character `“x”`.

- Give a state diagram of a DFA which can parse this language.
- Give a regular grammar which describes the language of C comments.
- Describe this language by a regular set.
- Is it possible to describe nested comments, e.g., `/* This is a /* nested */ comment */`, by a regular expression? Give arguments for your decision.

In C, C# oder Java gibt es die Blockkommentare, welche in `/*` und `*/` eingeschlossen sind. Der Kommentar selbst kann eine beliebige Zeichenkette sein, welche nur dadurch eingeschränkt ist, dass sie die Sequenz `*/` nicht beinhalten darf.

- Geben Sie das Zustandsdiagramm eines DFA an, der diese Sprache erkennt.
- Geben Sie die dazugehörige reguläre Grammatik an.
- Geben Sie den dazugehörigen regulären Ausdruck an.
- Ist es möglich, geschachtelte Kommentare in Form eines regulären Ausdrucks zu beschreiben? Begründen Sie Ihre Antwort.

3 *as and bs sometimes cs*

5. **aabs and bbs**

Given a language L defined over the alphabet $\{a, b\}$ defined recursively as follows:

1. $\varepsilon \in L$.
2. If $x \in L$ then $aabx \in L$ and $xbb \in L$.
3. Nothing else is in L .

Please answer the following questions concerning L :

- (a) Draw the state diagram of the DFA parsing strings of this language.
 - (b) Give the regular grammar for L .
 - (c) Give the regular expression which describes L .
6. $4i + 1b$'s Given the following regular language:

$$L(G(S)) = \{\omega \in (a \mid b \mid c)^* \mid \omega \text{ has } 4i + 1b \text{'s } (i \geq 0)\}$$

- (a) Give the state diagram of a DFA which parses this language.
- (b) Give a regular grammar $G(S)$ which describes this language.
- (c) Give a regular expression which describes this language.

7. **No bbb** Given the following regular language:

$$L(G(S)) = \{\omega \in (a \mid b)^* \mid \omega \text{ does not contain the substring } bbb\}$$

- (a) Give the state diagram of a DFA which parses this language.
- (b) Give a regular grammar $G(S)$ which describes this language.

Gegeben sei oben genannte reguläre Sprache.

- (a) Zeichnen Sie das Zustandsdiagramm eines DFA, der diese Sprache erkennt.
- (b) Geben Sie die reguläre Grammatik $G(S)$ für diese Sprache an.

4 **With 0s and 1s**

8. **Starts with two 0s**

Given the following regular language:

$$L(G(S)) = \{\omega \in (0 \mid 1)^* \mid \omega \text{ starts with two 0s}\}$$

- (a) Give the state diagram of a DFA which parses this language.
- (b) Give a regular grammar $G(S)$ which describes this language.
- (c) Give a regular expression which describes this language.

9. **Ends with 00 or 01**

Given the following regular language: $L(G(S)) = \{\omega \in (0 \mid 1)^* \mid \omega \text{ ends with 00 or 01}\}$

- (a) Give the state diagram of a DFA which parses this language.
- (b) Give a regular grammar $G(S)$ which describes this language.
- (c) Give a regular expression which describes this language.

Geben sei obige reguläre Sprache $L(G(S))$.

- (a) Zeichnen Sie das Zustandsdiagramm eines DFA, der diese Sprache erkennt.
- (b) Geben Sie die reguläre Grammatik $G(S)$ für diese Sprache an.
- (c) Geben Sie den regulären Ausdruck für diese Sprache an.