Introduction to Regular Expressions

Matthias Braun

Today's Plan

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- Why are they so useful?

Regular Languages

A reminder

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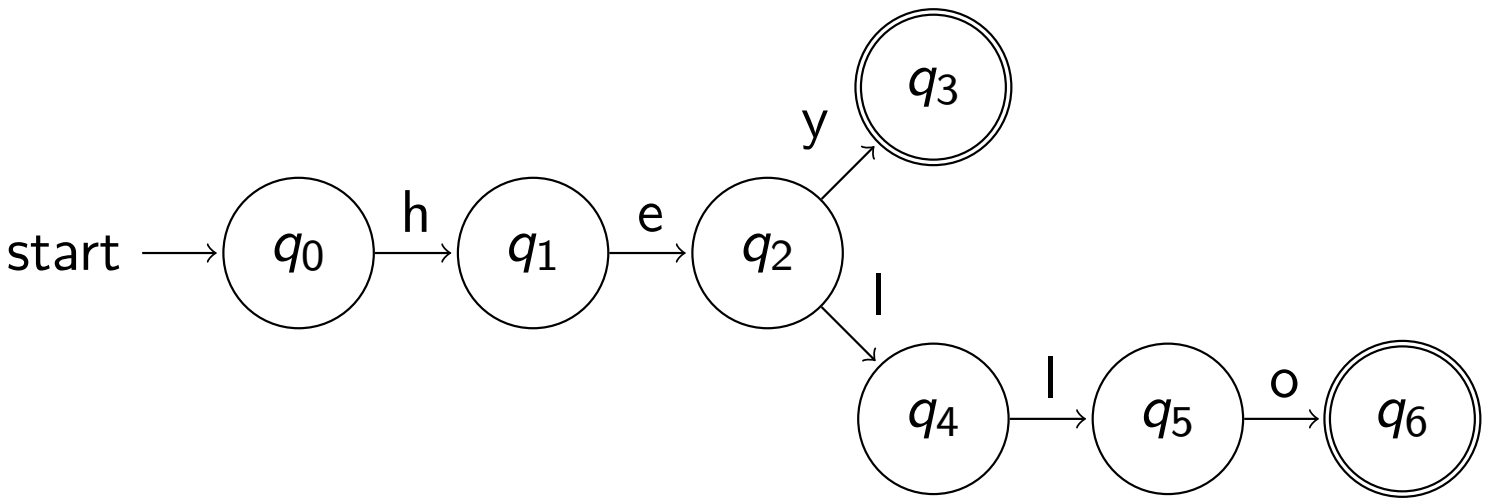
- For example, the language $\{hey, hello\}$ is regular since the following automaton accepts all of its two sentences:



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- Regexes are a pattern language for text

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regex	matched string
`a|b`	“a”
`a|b`	“b”
`ab`	“ab”
`a*`	“”
`a*`	“a”
`a*`	“aa”
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- The rules of operator precedence from lowest to highest:
  - Choice: `a|b`
  - Concatenation: `ab`
  - Repetition: `a*`
- We can group subexpressions in regexes with parentheses to override the precedence rules, for example:

regex	matched string
`ab*`	"abbbb"
`(ab)*`	"abababab"
`0123*`	"012"
`0123*`	"01233333"
`0(123)*`	"0123123123"
`0(123)*`	"0"

Your Turn!

Part 1: Does it match?

1. Which of these strings does the regex `ab*` match?
    1. "a"
    2. "abab"
    3. "ab"
    4. "abb"
    5. "b"
2. Which of these strings does the regex `XY|(ab)*` match?
    1. ""
    2. "XY"
    3. "XYXY"
    4. "aba"
    5. "abab"

Your Turn!

Part 2: Gotta match 'em all

Given these strings, create *one* regex that matches them all:

1. YRPGX
2. YX
3. YRPGRPGRPGX
4. YRPGRPGX

Regular Expressions in Practice

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- One of these extensions are backreferences to previous matches: `(the |a |an )\1` matches
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  - "the the "
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- regex101.com lets us test and inspect our regexes

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- Let's print the line with the American spelling of "color":

```
grep -E "color" grep_test.txt
```

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- Adding the `-n` option to `grep` adds line numbers to the results:

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- Matches two digits followed by a vowel: `[0-9][0-9][aeiou]`

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- `reg(ular)? ?ex(pression)?` matches both "regular expression" and "regex"

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- `Z{9,}` matches when there are at least nine Zs
- `\d{6,}` matches a number equal to or greater than a million

Your Turn!

Finding integers

- Create a regex that matches integers of arbitrary length:
  - "1"
  - "-50"
  - "+961"
  - "2983292032"
- Your regex should *not* match any of these strings:
  - ""
  - "-"
  - "+"
- Use character classes with quantifiers to make the regex as short as you can
- Use regex101.com to test and inspect your regex

Your Turn!

Hex colors

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  2. Then, make the "#" optional to also match strings like "FF00FA"

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  3. Finally, make your regex case insensitive to also match strings like "#fF00bC" and "a0eec2"

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  1. Create a regex to match these strings
  2. Then, make the "#" optional to also match strings like "FF00FA"
  3. Finally, make your regex case insensitive to also match strings like "#fF00bC" and "a0eec2"
- Your regex should *not* match a string like "#G9F1X2" since "G9" and "X2" are not hexadecimal numbers

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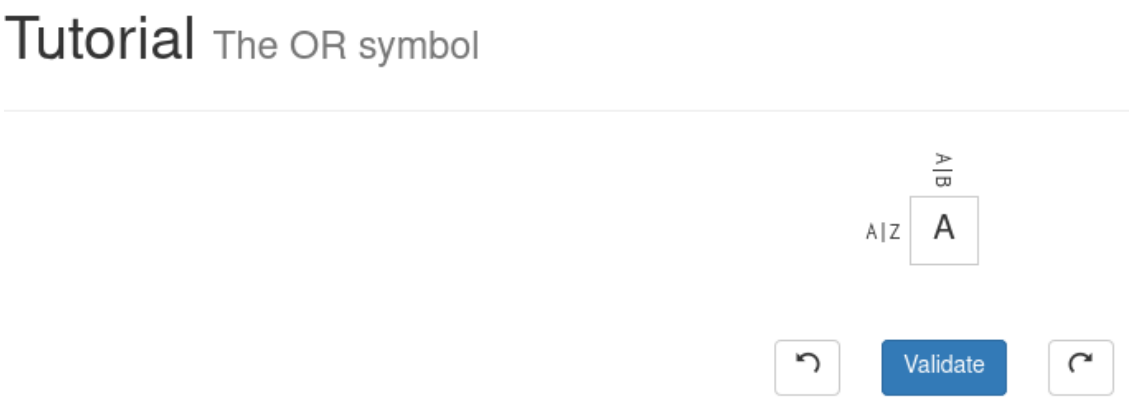
Regex Crossword

- Do the tutorial at regexcrossword.com:



- How far can you get with your current regex skills? To intermediate level? For extra credit, send me a screenshot of the hardest puzzle you could solve