CS472 WAP

Regular Expressions

JavaScript Functional Programming

Main Point Preview

- Regular Expressions are an industry standard way of performing pattern matching. Basically every language has support for them (including HTML5, which isn't even a programming language). Pattern matching is often used for input validation.
- *A pattern can describe many different permutations on the same theme. It's an abstraction that lets you check if something is correct; helping you keep input clean. Purification leads to Progress. One of the practical benefit of TM is the removal of stress.*

JavaScript Regular Expressions

- You can create a regular expression in two ways
  - Either using the RegExp constructor
  - Or with the a regular expression literal (which starts and ends with a /)
    - IDEs often have additional syntax highlighting support for this

```
let emailMatch1 = new RegExp("^[a-zA-Z_\-]+@(([a-zA-Z_\-])+\.)+[a-zA-Z]{2,}$");
let emailMatch2 = /^[a-zA-Z_-]+@(([a-zA-Z_-])+\.)+[a-zA-Z]{2,}$/;
```

- The most common thing to do is to see if a string matches the pattern
  - Either by using the .match() method on the string
  - Or the .test() on the regex

```
"mzijlstra@miu.edu".match(emailMatch2) // boolean value
emailMatch1.test("mzijlstra@miu.edu")  // same boolean value
```

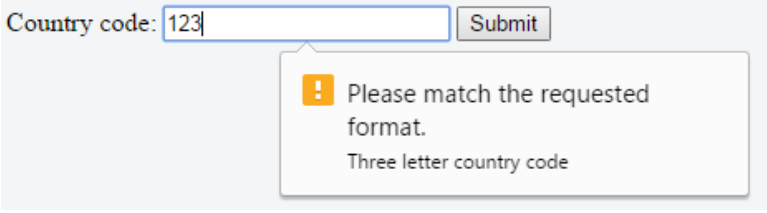
<input> pattern attribute

The **pattern** attribute specifies a regular expression that the **<input>** element's value is checked against. The **pattern** uses the ECMAScript (i.e. JavaScript) flavor of regex.

Note: The **pattern** attribute works with the following input types: **text**, **date**, **search**, **url**, **tel**, **email**, and **password**.

Tip: Use the global **title** attribute to describe the pattern to help the user.

```
<form action="demo_form.jsp">
 Country code:
 <input type="text" name="country_code" pattern="[A-Za-z]{3}" title="
Three letter country code ">
 <input type="submit">
</form>
```



Regular expressions

```
^[a-zA-Z_\-]+@(([a-zA-Z_\-])+\.)+[a-zA-Z]{2,4}$
```

- Test whether a string matches the expression's pattern
- powerful but tough to read
  - (the above regular expression matches email addresses)
- used in all languages:
  - Java, PHP ,JavaScript, HTML, C#, and other languages
- Many IDEs allow regexes in search/replace

Basic regular expressions

The simplest regexes simply matches any string that contains that text.

```
abc
```

above regular expressio**n** matches any string containing "abc“:

- YES: "abc", "abcdef", "defabc", ".=.abc.=.", ...
- NO: " ABC" , " fedcba", "ab c", "PHP", ...

- Note that html5 <input pattern=‘abc’ .. >has implicit anchors ^ and $, so abc is really ^abc$
- Regular expressions are case-sensitive by default.

Wildcards

A dot `.` matches exactly **one-character** except a `\n` line break

`.oo.y` matches "Doocy", "goofy", "LooNy", ...

Special characters: |, (), \

| means OR

`abc|def|g` matches "abc", "def", or "g"

() are for grouping

`(Homer|Marge) Simpson`

matches "Homer Simpson" or "Marge Simpson"

**** escapes a special character

many characters must be escaped to match them literally: / \ $. [ ] ( ) ^ * + ?

`<br\/>` matches lines containing <br /> tags

Quantifiers: *, +, ?

`*` means 0 or more occurrences

- **`abc*`** matches "ab", "abc", "abcc", "abccc", ...
- **`a(bc)*`** matches "a", "abc", "abcbc", "abcbcbc", ...
- **`a.*a`** matches "aa", "aba", "a8qa", "a!?xyz__9a", ...

`+` means 1 or more occurrences

- **`a(bc)+`** matches "abc", "abcbc", "abcbcbc", ...
- **`Goo+gle`** matches "Google", "Gooogle", "Goooogle", ...

`?` means 0 or 1 occurrences

- **`a(bc)?`** matches "a" or "abc"

More quantifiers: {min,max}

`{min,max}` means between min and max occurrences (inclusive)

- `a(bc){2,4}` matches "abcbc", "abcbcbc", or "abcbcbcbc"

`min` or `max` may be omitted to specify any number

- `{2,}` means 2 or more
- `{,6}` means up to 6
- `{3}` means exactly 3

Anchors: ^ and $

`^` represents the beginning of the string or line;

`$` represents the end

`Jess` matches all strings that contain Jess;

`^Jess` matches all strings that start with Jess;

`Jess$` matches all strings that end with Jess;

`^Jess$` matches the exact string "Jess" only

`^Mart.*Stepp$` matches "MartStepp", "Marty Stepp", "Martin D Stepp", ... but NOT "Marty Stepp stinks" or "I H8 Martin Stepp"

The html5 spec states that ^ and $ are implicit

Character sets: []

`[]` group characters into a character set, will match any **single character** from the set

`[bcd]art` matches strings containing "bart", "cart", and "dart"

equivalent to `(b|c|d)art` but shorter

inside [], many of the modifier keys act as normal characters

`what[!*?]*` matches "what", "what!", "what?**!", "what??!", ...

What regular expression matches DNA (strings of A, C, G, or T)?

`[ACGT]+`

Character ranges: [start-end]

inside a character set, specify a range of characters with -

- `[a-z]` matches any lowercase letter
- `[a-zA-Z0-9]` matches any lower- or uppercase letter or digit

an initial `^` inside a character set negates it

- `[^abcd]` matches any character other than a, b, c, or d

inside a character set, - must be escaped to be matched

- `[+\-]?[0-9]+` matches an optional + or -, followed by at least one digit

What regular expression matches letter grades such as A, B+, or D- ?

`[ABCDF][+\-]?`

Escape sequences

Special escape sequence character sets:

\d matches any digit (same as [0-9])

\D any non-digit ([^0-9])

\w matches any word character (same as [a-zA-Z_0-9])

\W any non-word char

\s matches any whitespace character (, \t, \n, etc.)

\S any non-whitespace

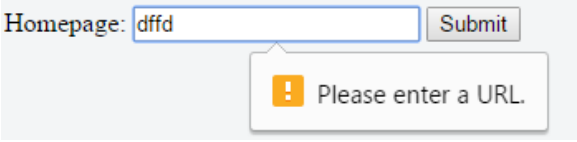
What regular expression matches dollar amounts of at least $100.00 ?

\$[1-9]\d{2,}\.\d{2}

Example - URL

- An <input> element with type="url" that must start with http:// or https:// followed by at least one character:

```
<form action="demo_form.jsp">
 Homepage:
 <input type="url" name="website" pattern="https?://.+"
title="“Please enter a URL">
 <input type="submit">
</form>
```



Main Point

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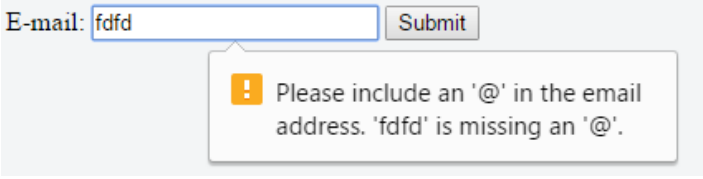
Example - email

- An <input> element with type="email" that must be in the following order: characters@characters.domain

  (characters followed by an @ sign, followed by more characters, and then a "." and then 2 or 3 letters)

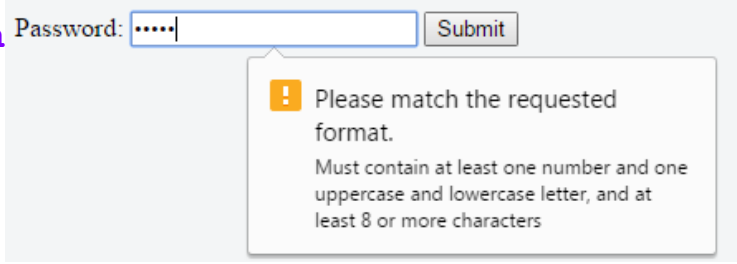
```
<form action="demo_form.jsp">
 E-mail:
 <input type="email" name="email" pattern="[a-z0-9._+\-]+@[a-z0-9.\-]+\.[a-z]{2,3}">
 <input type="submit">
</form>
```



Examples - password

- An <input> element with type="password" that must contain 8 or more characters that are of at least one number, and one uppercase and lowercase letter:

```
<form action="demo_form.jsp">
 Password:
 <input type="password" name="pw" pattern="(?=\d+)(?=[a-z]*)(?=[A-Z]*).{8,}" title="Must contain at least one number and one uppercase and lowercase letter, and at least 8 or more ch
 <input type="submit">
</form>
```



Advanced: Lookaround

Positive lookahead `(?=A)B`

Once a group starts with `?=` it means positive lookahead. Find expression A first, if found then expression B follows.

Negative lookahead `(?!A)B`

Once a group starts with `?!` it means negative lookahead.

First check if expression A is not found, then check if expression B follows.

Example - Search

- An <input> element with type="search" that CANNOT contain the following characters: ' or “

```
<form action="demo_form.jsp">
 Search: <!-- x27 is a single quote and \x22 is a double quote -->
 <input type="search" name="search" pattern="[^\x27\x22]+" title="cannot contain quote characters">
 <input type="submit">
</form>
```