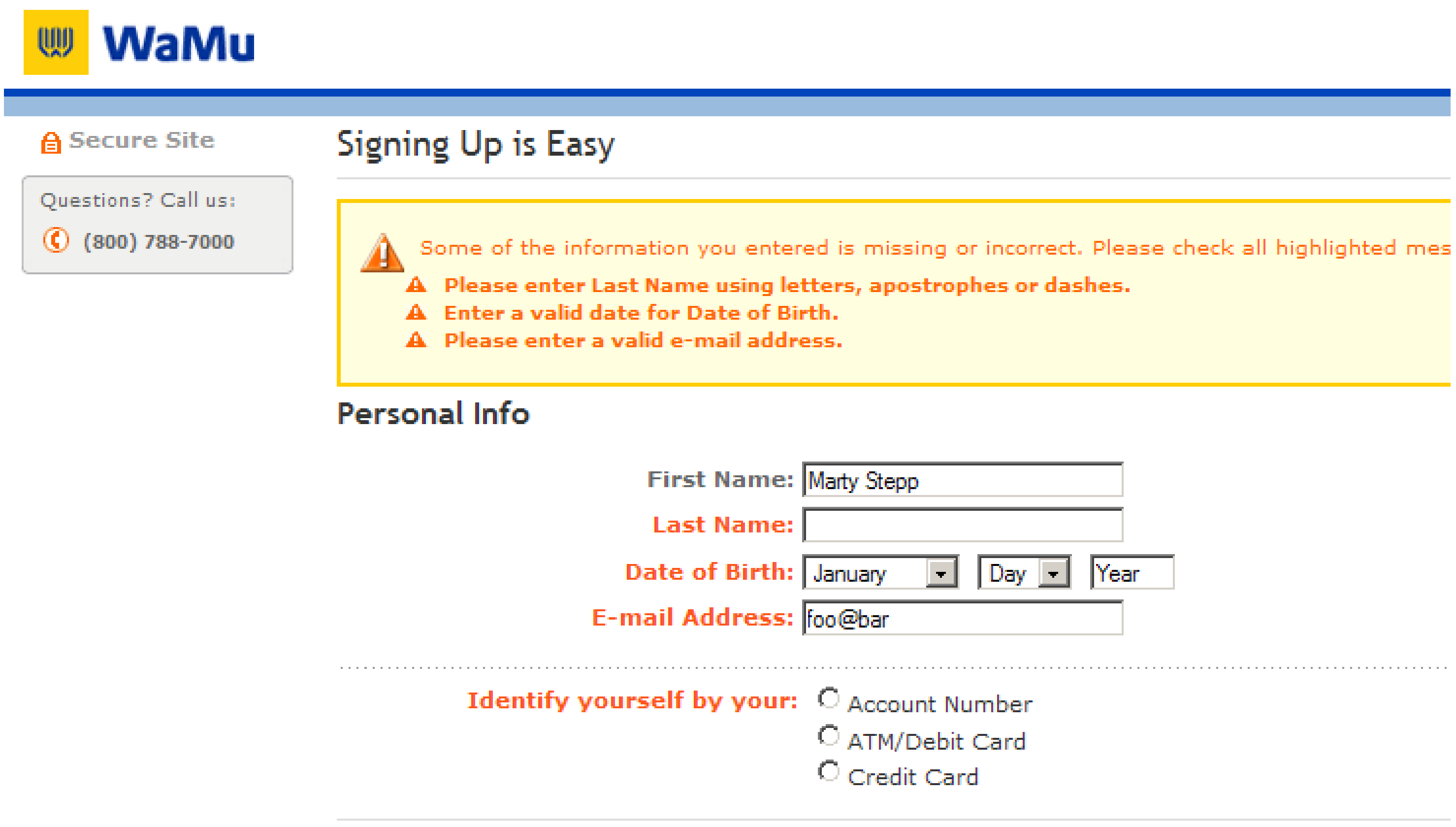
Form Validation with Regular Expressions

What is form validation?

- **validation**: ensuring that form's values are correct
- some types of validation:
  - preventing blank values (email address)
  - ensuring the type of values
    - integer, real number, currency, phone number, Social Security number, postal address, email address, date, credit card number, ...
  - ensuring the format and range of values (ZIP code must be a 5-digit integer)
  - ensuring that values fit together (user types email twice, and the two must match)

A real form that uses validation



Signing Up is Easy

Some of the information you entered is missing or incorrect. Please check all highlighted mes

- Please enter Last Name using letters, apostrophes or dashes.
- Enter a valid date for Date of Birth.
- Please enter a valid e-mail address.

Personal Info

First Name:	Marty Stepp
Last Name:	
Date of Birth:	January, Day, Year
E-mail Address:	foo@bar

Identify yourself by your: ○ Account Number ○ ATM/Debit Card ○ Credit Card

Client vs. server-side validation

Validation can be performed:

- **client-side** (in JavaScript code, before the form is submitted)
  - can lead to a better user experience, but not secure (why not?)
- **server-side** (in PHP code, after the form is submitted)
  - needed for truly secure validation, but slower
- both
  - best mix of convenience and security, but requires most effort to program

An example form to be validated

```html
<form id="exampleform" action="http://foo.com/foo.php" method="GET">
  <fieldset>
    City:  <input id="city" type="text" name="city" /> <br />
    State: <input id="state" type="text" name="state" size="2" /> <br />
    <input type="submit" />
  </fieldset>
</form>
```

HTML

- Let's validate this form's data, first on the server and then on the client.

Server-side validation code

```php
$city = $_REQUEST["city"];
$state = $_REQUEST["state"];
if ($city == "" || strlen($state) != 2) {
?>

      <h2>Error, invalid city/state submitted.</h2>

<?php
}
```

PHP

- basic idea: test request parameters' values in various ways, and if they are invalid, show an error message (and don't save the data, etc.)

Client-side validation code

```html
<form id="exampleform" action="http://foo.com/foo.php" method="GET">
```

HTML

```javascript
window.onload = function() {
  $("exampleform").onsubmit = checkData;
};

function checkData(event) {
  if ($("city").value == "" || $("state").value.length != 2) {
    Event.stop(event);
    alert("Error, invalid city/state.");  // show error message
  }
}
```

JS

- forms expose `onsubmit` and `onreset` events
- to abort a form submission, call Prototype's `Event.stop` on the event

Validation can be a pain!

- client-side validation can't be trusted. The user could:
  - disable JavaScript in their browser
  - use Firebug to change the page or JS code
  - download the page and edit manually, then use it to submit data
- validation code can take a lot of time / lines to write
  - testing for simple constraints (empty string, length 2) can be easy, but...
  - How do you test for integers vs. real numbers vs. strings?
  - How do you test for a valid credit card number?
  - How do you test that a person's name has a middle initial?
  - (How do you test whether a given string matches a particular complex format?)

Regular expressions

Using regular expressions to validate forms

What is a regular expression?

```
/^[\w\.%\-]+@[\w.\-]+\.[a-zA-Z]{2,4}$/
```

- **regular expression** ("regex"): a description of a pattern of text
  - can test whether a string matches the expression's pattern
  - can use a regex to search/replace characters in a string
- regular expressions are extremely powerful but tough to read
  (the above regular expression matches email addresses)
- regular expressions occur in many places:
  - Java: `Scanner`, `String`'s `split` method
  - supported by JavaScript, PHP, and other languages
  - many text editors (TextPad) allow regexes in search/replace

Basic regular expressions

```
/abc/
```

- regular expressions generally begin and end with `/`
- the simplest regular expressions simply match a particular substring
- the above regular expression matches any string containing `"abc"`:
  - YES: `"abc"`, `"abcdef"`, `"defabc"`, `".=.abc.=."`, ...
  - NO: `"fedcba"`, `"ab c"`, `"JavaScript"`, ...

Wildcards: `.`

- A dot `.` matches any character except a `\n` line break
  - `/.oo.y/` matches `"Doocy"`, `"goofy"`, `"PooPy"`, ...
- A trailing `i` at the end of a regex (after the closing `/`) signifies a case-insensitive match
  - `/mart/i` matches `"Marty Stepp"`, `"smart fellow"`, `"WALMART"`, ...

Special characters: `|`, `()`, `^`, `\`

- `|` means *OR*
  - `/abc|def|g/` matches `"abc"`, `"def"`, or `"g"`
  - There's no *AND* symbol. Why not?
- `()` are for grouping
  - `/(Homer|Marge) Simpson/` matches `"Homer Simpson"` or `"Marge Simpson"`
- `^` matches the beginning of a line; `$` the end
  - `/^<!--$/` matches a line that consists entirely of `"<!--"`
- `\` starts an **escape sequence**
  - 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!?_a"`, ...
- `+` 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

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" (`[a-zA-Z_0-9]`); `\W` any non-word char
  - `\s` matches any whitespace character (, `\t`, `\n`, etc.); `\S` any non-whitespace
- email regex revisited:
  - `/^[\w\.%\-]+@[\w.\-]+\.[a-zA-Z]{2,4}$/`
- What regular expression matches dollar amounts of at least $100.00 ?
  - `/\$\d{3,}\.\d{2}/`

Programming with regular expressions

How various web languages support regexes

Regular expressions in PHP (PDF)

- syntax: strings that begin and end with `/`, such as `"/[AEIOU]+/"`
- `preg_match(`*regex*`,` *string*`)`
  returns `TRUE` if *string* matches *regex*
  - for a case-insensitive match, place an `i` at end of regular expression (after closing `/`)
- `preg_replace(`*regex*`,` *replacement*`,` *string*`)`
  returns a new string with all substrings that match *regex* replaced by *replacement*
- `preg_split(`*regex*`,` *string*`)`
  returns an array of strings from given *string* broken apart using the given *regex* as the delimiter (similar to `explode` but more powerful)

Regular expression example

```
# replace vowels with stars
$str = "the quick    brown        fox";
$str = preg_replace("/[aeiou]/", "*", $str);
                         # "th* q**ck    br*wn        f*x"

# break apart into words
$words = preg_split("/[ ]+/", $str);
                         # ("th*", "q**ck", "br*wn", "f*x")

# capitalize words that had 2+ consecutive vowels
for ($i = 0; $i < count($words); $i++) {
  if (preg_match("/\\*{2,}/", $words[$i])) {
    $words[$i] = strtoupper($words[$i]);
  }
}                        # ("th*", "Q**CK", "br*wn", "f*x")
```

- notice how `\` must be escaped to `\\`

PHP form validation w/ regexes

```php
$state = $_REQUEST["state"];
if (!preg_match("/[A-Z]{2}/", $state)) {
?>

      <h2>Error, invalid state submitted.</h2>

<?php
}
```

PHP

- using `preg_match` and well-chosen regexes allows you to quickly validate query parameters against complex patterns