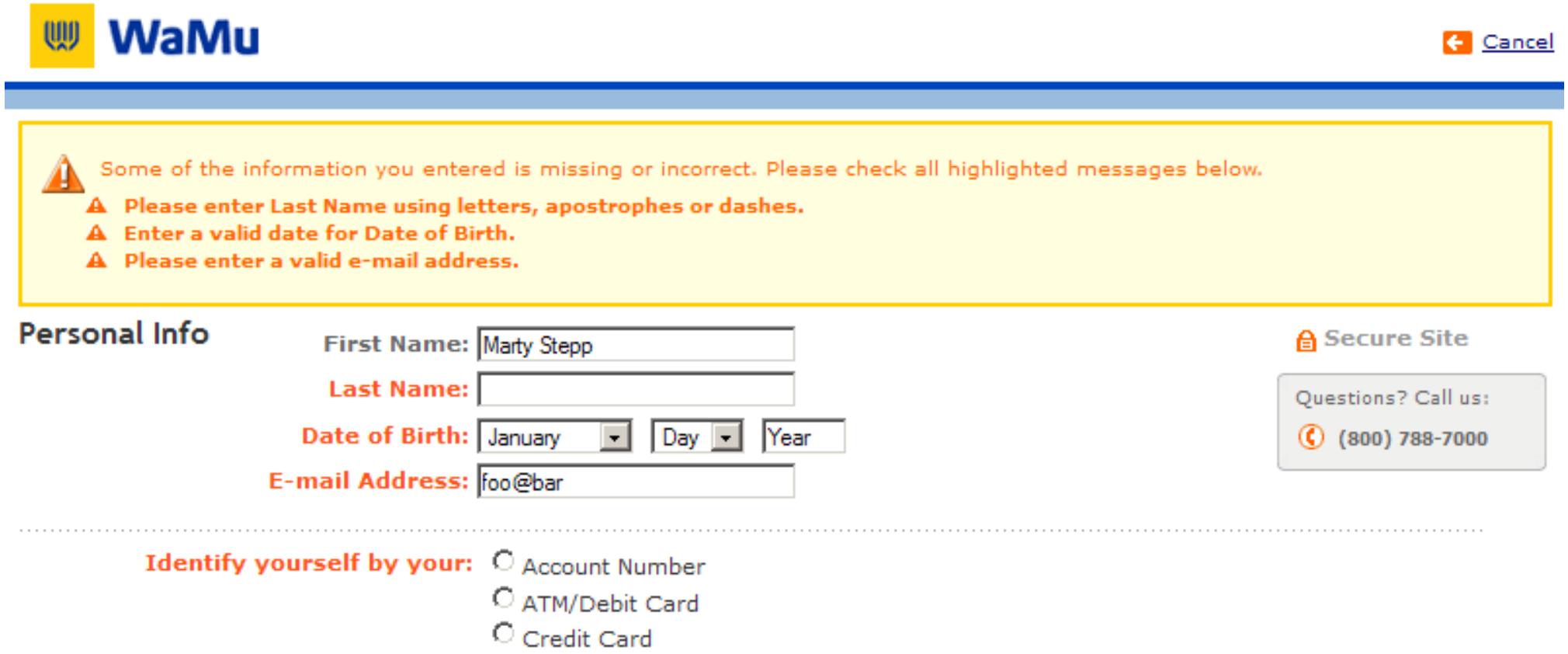
CSE 154

LECTURE 11: 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



Client vs. server-side validation

Validation can be performed:

- **client-side** (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

```
<form action="http://foo.com/foo.php" method="get">
  <div>
    City:  <input name="city" /> <br />
    State: <input name="state" size="2" maxlength="2" /> <br />
    ZIP:   <input name="zip" size="5" maxlength="5" /> <br />
    <input type="submit" />
  </div>
</form>
```

HTML

City:
State:
ZIP:
Submit Query

output

- Let's validate this form's data on the server...

Recall: Basic server-side validation

```php
$city  = $_POST["city"];
$state = $_POST["state"];
$zip   = $_POST["zip"];
if (!$city || strlen($state) != 2 || strlen($zip) != 5) {
  print "Error, invalid city/state/zip submitted.";
}
```

PHP

•*basic idea:* examine parameter values, and if they are bad, show an error message and abort. 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

```
/^[a-zA-Z_\-]+@(([a-zA-Z_\-])+\.)+[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 (CSE 143 sentence generator)
  - supported by PHP, JavaScript, and other languages
  - many text editors (TextPad) allow regexes in search/replace
  - The site Rubular is useful for testing a regex.

Regular expressions

This picture best describes regex.

Basic regular expressions

```
/abc/
```

- in PHP, regexes are strings that begin and end with /
- the simplest regexes simply match a particular substring
- the above regular expression matches any string containing "abc":
  - YES: "abc", "abcdef", "defabc", ".=.abc.=.", ...
  - NO: "fedcba", "ab c", "PHP", ...

Wildcards: .

- A dot . matches any character except a \n line break
  - /.oo.y/ matches "Doocy", "goofy", "LooNy", ...
- A trailing i at the end of a regex (after the closing /) signifies a case-insensitive match
  - /all/i matches “Allison Obourn", “small", “JANE GOODALL", ...

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"
- \ starts an escape sequence
  - many characters must be escaped to match them literally: / \ $. [ ] ( ) ^ * + ?
  - /<br \/>/ matches lines containing
 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
  - /Hi!+ there/ matches "Hi! there", "Hi!!! there", ...
  - /a(bc)+/ matches "abc", "abcbc", "abcbcbc", ...
- ? 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

Practice exercise

- When you search Google, it shows the number of pages of results as "o"s in the word "Google". What regex matches strings like "Google", "Gooogle", "Goooogle", ...? (try it) (data)

- Answer: /Goo+gle/ (or /Go{2,}gle/)

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
  - /^Alli.*Obourn$/ matches “AlliObourn", “Allie Obourn", “Allison E Obourn", ...
    but NOT “Allison Obourn stinks" or "I H8 Allison Obourn"
- (on the other slides, when we say, /PATTERN/ matches "text", we really mean that it matches any string that contains that text)

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

Practice Exercises

What regular expression matches letter grades such as A, B+, or D- ? (try it) (data)

What regular expression would match UW Student ID numbers? (try it) (data)

What regular expression would match a sequence of only consonants, assuming that the string consists only of lowercase letters? (try it) (data)

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 names in a "Last, First M." format with any number of spaces?
  - /\w+,\s+\w+\s+\w\./

Regular expressions in PHP (PDF)

- regex syntax: strings that begin and end with /, such as "/[AEIOU]+/"

function	description
preg_match(*regex*, *string*)	returns TRUE if *string* matches *regex*
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 given *regex* as delimiter (like explode but more powerful)

PHP form validation w/ regexes

```php
$state = $_POST["state"];
if (!preg_match("/^[A-Z]{2}$/", $state)) {
  print "Error, invalid state submitted.";
}
```

PHP

- preg_match and regexes help you to validate parameters
- sites often *don't* want to give a descriptive error message here (why?)

Regular expression PHP example

```php
# 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")
```

PHP

Practice exercise

Use regular expressions to add validation to the turnin form shown in previous lectures.

- The student name must not be blank and must contain a first and last name (two words).
- The student ID must be a seven-digit integer.
- The assignment must be a string such as "hw1" or "hw6".
- The section must be a two-letter uppercase string representing a valid section such as AF or BK.
- The email address must follow a valid general format such as user@example.com.
- The course must be one of "142", "143", or "154" exactly.

Handling invalid data

```php
function check_valid($regex, $param) {
  if (preg_match($regex, $_POST[$param])) {
    return $_POST[$param];
  } else {
    # code to run if the parameter is invalid
    die("Bad $param");
  }
}
...
$sid     = check_valid("/^[0-9]{7}$/", "studentid");
$section = check_valid("/^[AB][A-C]$/i", "section");
```

PHP

- Having a common helper function to check parameters is useful.
- If your page needs to show a particular HTML output on errors, the die function may not be appropriate.

Regular expressions in HTML forms

```
How old are you?
<input type="text" name="age" size="2" pattern="[0-9]+" title="an integer" />
<input type="submit" />
```

HTML

output

- HTML5 adds a new pattern attribute to input elements
- the browser will refuse to submit the form unless the value matches the regex