Chapter 15

How to use regular expressions, handle exceptions, and validate data

Objectives

Applied

1. Create and use regular expressions.
2. Create and throw exceptions.
3. Catch and handle exceptions.

Knowledge

1. Describe the creation of a regular expression, and the processing that's done by the preg_match function.
2. Describe the use of case-insensitive, multiline, and global regular expressions.
3. Describe the use of the preg_replace and preg_split functions that work with regular expressions.
4. Describe how regular expressions can be used for data validation such as validating a social security number.
5. Describe the way exceptions are created, thrown, and handled.

Terms

regular expression:

- a coded pattern that is used to search for matching patterns in text strings
- commonly used for data validation

pattern:

- a string contained within single quotes and forward slashes
- example:

  $pattern = '/NC/';

A function for matching a regular expression

```
preg_match($pattern, $string);
//returns 1 if the pattern is found, 0 if not, FALSE
//if there is an error in the pattern
```

Create a regular expression:

```
$pattern = '/Harris/';
```

Two strings to test:

```
$author = 'Ray Harris';
$editor = 'Joel Murach';
```

How to search for the pattern

```
$author_match = preg_match($pattern, $author);
// $author_match is 1

$editor_match = preg_match($pattern, $editor);
// $author_match is 0
```

How to test for errors in a regular expression

```
if ($author_match === false) {
    echo 'Error testing author name.';
} else if ($author_match === 0) {
    echo 'Author name does not contain Harris.';
} else {
    echo 'Author name contains Harris.';
}
```

By default a search is case-sensitive

To perform a case-insensitive search, include a lowercase i after the closing /:

```
$pattern = '/murach/i';

$editor = 'Joel Murach';

$editor_match = preg_match($pattern, $editor);
// $editor_match is 1
```

Patterns for special characters

Pattern	Matches
`\\`	Backslash character
`\/`	Forward slash
`\t`	Tab
`\n`	New line
`\r`	Carriage return
`\f`	Form feed
`\xhh`	The Latin-1 character whose value is the two hexadecimal digits

Matching special characters

```
$string =
"© 2010 Mike's Music. \ All rights reserved (5/2010).";

preg_match('/\xA9/', $string)
// Matches © and returns 1

preg_match('///', $string)
// Returns FALSE and issues a warning\

preg_match('/\//', $string)
// Matches / and returns 1

preg_match('/\\\\/', $string)
// Matches \ and returns 1
```

Patterns for character types

Pattern	Matches
`.`	Any single character except a new line character (use \. to match a period)
`\w`	Any letter, number, or the underscore
`\W`	Any character that's not a letter, number or the underscore
`\d`	Any digit
`\D`	Any character that's not a digit
`\s`	Any whitespace character (space, tab, new line, carriage return, form feed, or vertical tab)
`\S`	Any character that's not whitespace

Matching character types

```
$string = 'The product code is MBT-3461.';

preg_match('/MB./', $string)
// Matches MBT and returns 1 because MB is followed by a
//character

preg_match('/MB\d/', $string)
// Matches nothing and returns 0 because MB is not
//followed by any digit

preg_match('/MBT-\d/', $string)
// Matches MBT-3 and returns 1
```

Using the character class: a list of characters to match against a single character

```
$string = 'The product code is MBT-3461.';

preg_match('/MB[TF]/', $string)
// Matches MBT and returns 1

preg_match('/[.]/', $string)
// Matches . and returns 1
// Equivalent to preg_match('/\./', $string)

preg_match('/[13579]/', $string)
// Matches 3 and returns 1
```

Metacharacters

- characters which have special meanings in patterns such as / \ . [ ] $ ^ ( ) –
- most metacharacters lose their special meanings inside a character class
- the exceptions:
  - ^ (caret) negation: match any character except)
  - - (dash): represents a range of characters between the ones on either side

```
Usage: $string = 'The product code is MBT-3461.';

preg_match('/MB[^TF]/', $string)
// Matches nothing and returns 0

preg_match('/MBT[^^]/', $string)
// Matches MBT- and returns 1

preg_match('/MBT-[1-5]/', $string)
// Matches MBT-3 and returns 1

preg_match('/MBT[_*-]/', $string)
// Matches MBT- and returns 1
```

Using bracket expressions (complete list on pp. 467)

```
preg_match('/MBT[[:punct:]]/', $string)
// Matches MBT- and returns 1

preg_match('/MBT[[:digit:]]/', $string)
// Matches nothing and returns 0

preg_match('/MB[[:upper:]]/', $string)
// Matches MBT and returns 1
```

Patterns for string positions

Pattern	Matches
`^`	The beginning of the string (use \^ to match a caret)
`$`	The end of the string (use \$ to match a dollar sign)
`\b`	The beginning or end of a word (must not be inside brackets)
`\B`	A position other than the beginning or end of a word

Matching string positions

```
$author = 'Ray Harris';

preg_match('/^Ray/', $author)
// Returns 1: 'Ray' is the beginning of the string

preg_match('/Harris$/', $author)
// Returns 1:'Harris' is the end of the string

preg_match('/^Harris/', $author)
// Returns 0

$editor = 'Anne Boehm';
preg_match('/Ann/', $editor)
// Returns 1

preg_match('/Ann\b/', $editor)
// Returns 0
```

Matching subpatterns

```
$name = 'Rob Robertson';

preg_match('/^(Rob)|(Bob)\b/', $name)
// Returns 1

preg_match('/^(\w\w\w) \1/', $name)
// Returns 1
```

Matching repeating patterns

```
$phone = '559-555-6627';
preg_match('/^\d{3}-\d{3}-\d{4}$/', $phone)
// Returns 1

$fax = '(559) 555-6635';
preg_match('/^\(\d{3}\) ?\d{3}-\d{4}$/', $fax)
// Returns 1

$phone_pattern  =
    '/^(\d{3}-)|(\(\d{3}\) ?)\d{3}-\d{4}$/';
preg_match($phone_pattern, $phone)
// Returns 1

preg_match($phone_pattern, $fax)
// Returns 1
```

Look-ahead assertion: a condition on the characters that follow

```
(?=*pattern*)
```

Look-ahead assertions

```
(?=[[:digit:]])
// The next character in the pattern must be a digit

(?=.*[[:digit:]])
// The pattern must contain at least one digit (0 or more
characters (.*) must be followed by a digit)
```

A look-ahead assertion

```
$pattern = '/^(?=.*[[:digit:]])[[:alnum:]]{6}$/';

preg_match($pattern, 'Harris')
// Assertion fails and returns 0

preg_match($pattern, 'Harri5')
// Matches and returns 1
```

A pattern to enforce password complexity

```
$pw_pattern =
  '/^(?=.*[[:digit:]])(?=.*[[:punct:]])[[:print:]]{6,}$/';
```

The parts of the pattern

```
^                    // start of the string
(?=.*[[:digit:]])    // at least one digit
(?=.*[[:punct:]])    // at least one punctuation character
[[:print:]]{6,}      // six or more printable characters
$                    // nothing else
```

Using the pattern

```
$password1 = 'sup3rsecret';
$password2 = 'sup3rse(ret';

preg_match($pw_pattern, $password1)
// Assertion fails and returns 0

preg_match($pw_pattern, $password2)
// Matches and returns 1
```

A global regular expression finds all matches

```
preg_match_all($pattern, $string, $matches);
returns the number of matches in the string and stores
all matching substrings in an array (3rd parameter)
```

How to work with a global regular expression

```
$string  = 'MBT-6745 MBT-5712';
$pattern = '/MBT-[[:digit:]]{4}/';

$count = preg_match_all($pattern, $string, $matches);
// Count is 2

foreach ($matches[0] as $match) {
    echo '<div>' . $match . '</div>';
    // Displays MBT-6745 and MBT-5712
}
```

How to use the preg_replace function to replace a pattern with a string

```
$items = 'MBT-6745 MBS-5729';
$items = preg_replace('/MB[ST]/', 'ITEM', $items);

echo $items;       // Displays ITEM-6745 ITEM-5729
```

Note: This is similar to str_replace, but preg_replace allows you to replace any text that can be specified with a regular expression.

The preg_split function returns an array of strings that is created by splitting the string on the pattern. (This is similar to the explode function.)

How to use the preg_split function to split a string on a pattern

```
$items =
    'MBT-6745 MBS-5729, MBT-6824, and MBS-5214';
$pattern = '/[, ]+(and[ ]*)?/';
$items = preg_split($pattern, $items);

// $items contains:
// 'MBT-6745', 'MBS-5729', 'MBT-6824', 'MBS-5214'

foreach ($items as $item) {
    echo '<li>' . $item . '</li>';
}
```

Regular expressions for testing validity

Phone numbers as: 999-999-9999

```
/^[[:digit:]]{3}-[[:digit:]]{3}-[[:digit:]]{4}$/
```

Credit card numbers as: 9999-9999-9999-9999

```
/^[[:digit:]]{4}(-[[:digit:]]{4}){3}$/
```

Zip codes as either: 99999 or 99999-9999

```
/^[[:digit:]]{5}(-[[:digit:]]{4})?$/
```

Dates as: mm/dd/yyyy

```
/^(0?[1-9]|1[0-2])\/(0?[1-9]|[12][[:digit:]]|3[01])\/
[[:digit:]]{4}$/     // on one line with no spaces
```

Note: that this may still match some invalid dates such as 02/30/2012. Additional validation is necessary.

Testing a phone number for validity

```
$phone = '559-555-6624';

$phone_pattern =
  '/^[[:digit:]]{3}-[[:digit:]]{3}-[[:digit:]]{4}$/';

$match = preg_match($phone_pattern, $phone);

// Returns 1
```

Testing a date for a valid format, but not for a valid month, day, and year

```
$date = '8/10/209';           // invalid date

$date_pattern = '/^(0?[1-9]|1[0-2])\/'
     . '(0?[1-9]|[12][[:digit:]]|3[01])\/'
     . '[[:digit:]]{4}$/';

$match = preg_match($date_pattern, $date);

// Returns 0
```

Complete email address validation

```
function valid_email ($email) {
    $parts = explode("@", $email); //split into 2 parts
    if (count($parts) != 2 ) return false;
    if (strlen($parts[0]) > 64) return false;
    if (strlen($parts[1]) > 255) return false;

    $atom = '[[:alnum:]_!#$%&\'*+\/=?^`{|}~-]+';
    $dotatom = '(\.' . $atom . ')*';
    $address = '(^' . $atom . $dotatom . '$)';
    $char = '([^\\\\"])';
    $esc  = '(\\\\[\\\\"])';
    $text = '(' . $char . '|' . $esc . ')+';
    $quoted = '(^"' . $text . '"$)';
    $local_part = '/' . $address . '|' . $quoted . '/';
    $local_match = preg_match($local_part, $parts[0]);
    if ($local_match === false
        || $local_match != 1) return false;
```

continued...

Complete email address validation (continued)

```
    $hostname =
        '([[:alnum:]]([-[:alnum:]]{0,62}[[:alnum:]])?)';
    $hostnames = '(' . $hostname .
                 '(\.' . $hostname . ')*)';
    $top = '\.[[:alnum:]]{2,6}';
    $domain_part = '/^' . $hostnames . $top . '$/';
    $domain_match = preg_match($domain_part, $parts[1]);
    if ($domain_match === false
        || $domain_match != 1) return false;

    return true;
}
```

Exceptions: runtime errors due to unexpected conditions

You can also *throw* exceptions and write code to handle them

The syntax for creating new Exception objects

```
new Exception($message [, $code])
```

The syntax for the throw statement

```
throw $exception;
```

Methods of Exception objects

```
getMessage()
getCode()
getFile()
getLine()
getTrace()
getTraceAsString()
```

A function that may throw an Exception

```
function calculate_future_value(
       $investment, $interest_rate, $years) {
    if  ($investment <= 0 ||
         $interest_rate <= 0 ||
         $years <= 0 ) {
      throw new Exception("Please check all entries.");
    } //function ends and control is passed back

    $future_value = $investment;
    for ($i = 1; $i <= $years; $i++) {
        $future_value =
            ($future_value +
                ($future_value * $interest_rate * .01));
    }
    return round($futureValue, 2);
}
```

A statement that causes an exception

```
$futureValue =
    calculate_future_value(10000, 0.06, 0);
```

When an Exception object is thrown, the application needs to *catch* it and handle it. This is called *exception handling*.

A *try-catch* statement catches any thrown exceptions using a *try block* and at least one *catch block*.

The syntax for a try-catch statement

```
try { statements }
catch (ExceptionClass $exceptionName) { statements }
[ catch (ExceptionClass $exceptionName) { statements } ]
```

A statement that catches an Exception object

```
try {
    $fv =  calculate_future_value(10000, 0.06, 0);
    echo 'Future value was calculated successfully.';
} catch (Exception $e) {
    echo 'Error: ' . $e->getMessage();
}
```

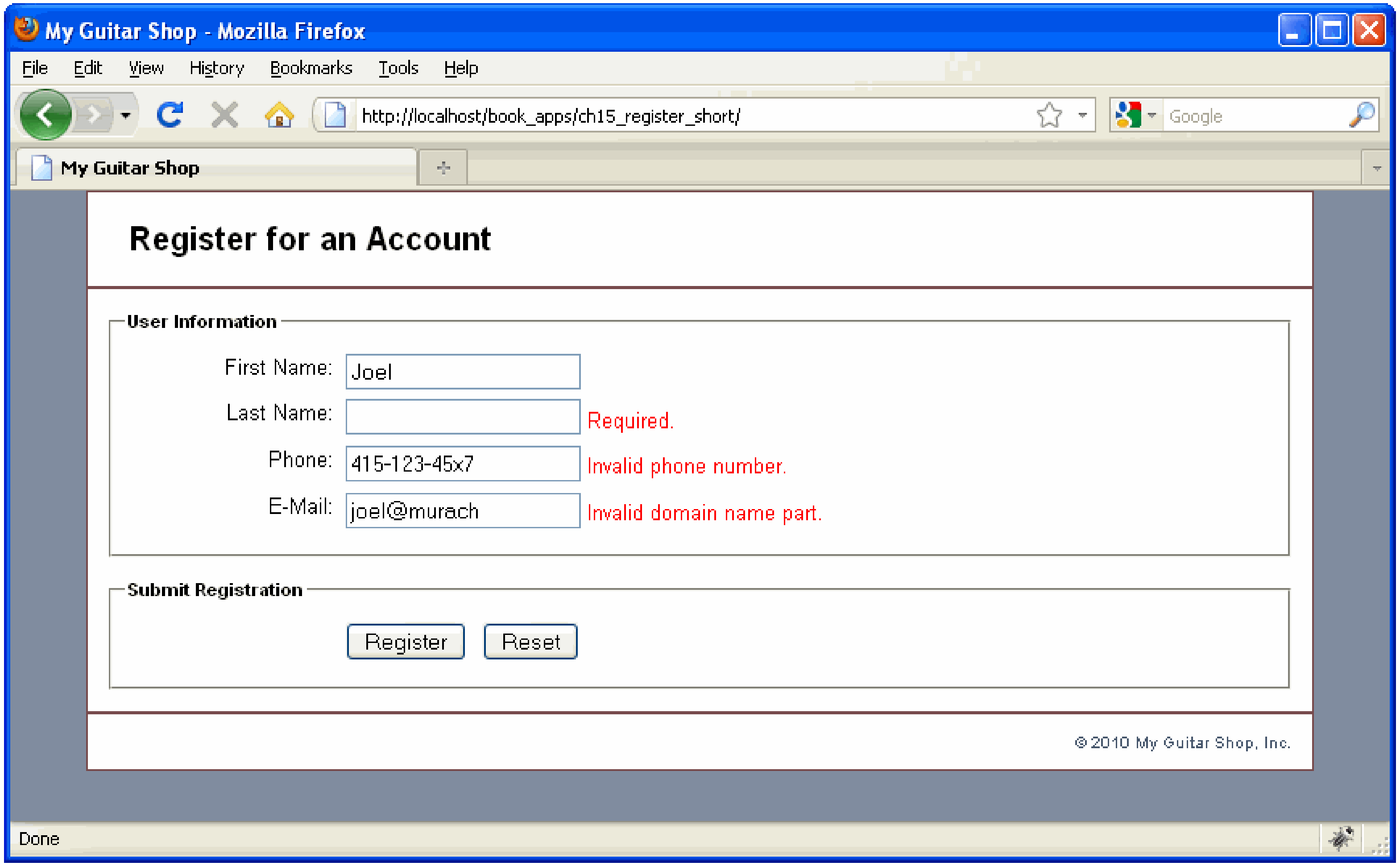
A statement that re-throws an Exception object

```
try {
    $fv = calculate_future_value(
        $investment, $annual_rate, $years);
} catch (Exception $e) {
    throw $e;
}
```

A statement that catches two types of exceptions

```
try {
    $db =
        new PDO($dsn, 'mmuser', 'pa55word', $options);
    // other statements
} catch (PDOException $e) {
    echo 'PDOException: ' . $e->getMessage();
} catch (Exception $e) {
    echo 'Exception: ' . $e->getMessage();
}
```

The user interface


My Guitar Shop - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://localhost/book_apps/ch15_register_short/
Google
My Guitar Shop

Register for an Account

User Information

First Name:	Joel	
Last Name:		Required.
Phone:	415-123-45x7	Invalid phone number.
E-Mail:	joel@murach	Invalid domain name part.

Submit Registration

Register
Reset
© 2010 My Guitar Shop, Inc.
Done

model/fields.php

```
<?php
class Field {
    private $name;
    private $message = '';
    private $hasError = false;

    public function __construct($name, $message = '') {
        $this->name = $name;
        $this->message = $message;
    }
    public function getName()
        { return $this->name; }
    public function getMessage()
        { return $this->message; }
    public function hasError()
        { return $this->hasError; }
```

model/fields.php (continued)

```
    public function setErrorMessage($message) {
        $this->message = $message;
        $this->hasError = true;
    }
    public function clearErrorMessage() {
        $this->message = '';
        $this->hasError = false;
    }

    public function getHTML() {
        $message = htmlspecialchars($this->message);
        if ($this->hasError()) {
            return '<span class="error">' .
                   $message . '</span>';
        } else {
            return '<span>' . $message . '</span>';
        }
    }
}
```

model/fields.php (continued)

```
class Fields {
    private $fields = array();

    public function addField($name, $message = '') {
        $field = new Field($name, $message);
        $this->fields[$field->getName()] = $field;
    }

    public function getField($name) {
        return $this->fields[$name];
    }

    public function hasErrors() {
        foreach ($this->fields as $field) {
            if ($field->hasError()) return true;
        }
        return false;
    }
}
?>
```

model/validate.php

```
<?php
class Validate {
    private $fields;

    public function __construct() {
        $this->fields = new Fields();
    }

    public function getFields() {
        return $this->fields;
    }
```

model/validate.php (continued)

```
// Validate a generic text field
public function text($name, $value, $required = true,
                     $min = 1, $max = 255) {
    // Get Field object
    $field = $this->fields->getField($name);

    // If not required and empty, clear errors
    if (!$required && empty($value)) {
        $field->clearErrorMessage();
        return;
    }
    // Check field and set or clear error message
    if ($required && empty($value)) {
        $field->setErrorMessage('Required.');
    } else if (strlen($value) < $min) {
        $field->setErrorMessage('Too short.');
    } else if (strlen($value) > $max) {
        $field->setErrorMessage('Too long.');
    } else {
        $field->clearErrorMessage(); }
}
```

model/validate.php (continued)

```
// Validate a field with a generic pattern
public function pattern($name, $value, $pattern,
         $message, $required = true) {
    // Get Field object
    $field = $this->fields->getField($name);

    // If not required and empty, clear errors
    if (!$required && empty($value)) {
        $field->clearErrorMessage();
        return;
    }
    // Check field and set or clear error message
    $match = preg_match($pattern, $value);
    if ($match === false) {
        $field->setErrorMessage('Error testing field.');
    } else if ( $match != 1 ) {
        $field->setErrorMessage($message);
    } else {
        $field->clearErrorMessage();
    }
}
```

model/validate.php (continued)

```
public function phone($name, $value,
                      $required = false) {
    $field = $this->fields->getField($name);

    // Call the text method
    // and exit if it yields an error
    $this->text($name, $value, $required);
    if ($field->hasError()) { return; }

    // Call the pattern method
    // to validate a phone number
    $pattern =
    '/^[[:digit:]]{3}-[[:digit:]]{3}-[[:digit:]]{4}$/';

    $message = 'Invalid phone number.';
    $this->pattern(
        $name, $value, $pattern, $message, $required);
}
```

model/validate.php (continued)

```
public function email($name, $value, $required = true) {

    $field = $this->fields->getField($name);

    // If not required and empty, clear errors
    if (!$required && empty($value)) {
        $field->clearErrorMessage();
        return;
    }

    // Call the text method
    // and exit if it yields an error
    $this->text($name, $value, $required);
    if ($field->hasError()) { return; }
```

model/validate.php (continued)

```
// Split email address on @ sign and check parts
$parts = explode('@', $value);
if (count($parts) < 2) {
    $field->setErrorMessage('At sign required.');
    return;
}
if (count($parts) > 2) {
    $field->setErrorMessage(
        'Only one at sign allowed.');
    return;
}
$local = $parts[0];
$domain = $parts[1];
```

model/validate.php (continued)

```
// Check lengths of local and domain parts
if (strlen($local) > 64) {
    $field->setErrorMessage('Username too long.');
    return;
}
if (strlen($domain) > 255) {
    $field->setErrorMessage(
        'Domain name part too long.');
    return;
}
```

model/validate.php (continued)

```
// Patterns for address formatted local part
$atom = '[[:alnum:]_!#$%&\'*+\/=?^`{|}~-]+';
$dotatom = '(\.' . $atom . ')*';
$address = '(^' . $atom . $dotatom . '$)';

// Patterns for quoted text formatted local part
$char = '([^\\\\"])';
$esc  = '(\\\\[\\\\"])';
$text = '(' . $char . '|' . $esc . ')+';
$quoted = '(^"' . $text . '"$)';

// Combined pattern for testing local part
$localPattern =
    '/' . $address . '|' . $quoted . '/';

// Call the pattern method and exit if error
$this->pattern($name, $local, $localPattern,
                'Invalid username part.');
if ($field->hasError()) { return; }
```

model/validate.php (continued)

```
        // Patterns for domain part
        $hostname =
            '([[:alnum:]]([-[:alnum:]]{0,62}[[:alnum:]])?)';
        $hostnames =
            '(' . $hostname . '(\.' . $hostname . ')*)';
        $top = '\.[[:alnum:]]{2,6}';
        $domainPattern = '/^' . $hostnames . $top . '$/';

        // Call the pattern method
        $this->pattern($name, $domain, $domainPattern,
                'Invalid domain name part.');
    }
}
?>
```

The controller (index.php)

```
<?php
require_once('model/fields.php');
require_once('model/validate.php');

// Add fields with optional initial message
$validate = new Validate();
$fields = $validate->getFields();
$fields->addField('first_name');
$fields->addField('last_name');
$fields->addField('phone', 'Use 888-555-1234 format.');
$fields->addField('email', 'Must be a valid email
address.');

if (isset($_POST['action'])) {
    $action =  $_POST['action'];
} else {
    $action =  'reset';
}
```

The controller (index.php) (continued)

```
$action = strtolower($action);
switch ($action) {
    case 'reset':
        include 'view/register.php';
        break;
```

The controller (index.php) (continued)

```
    case 'register':
        // Copy form values to local variables
        $first_name = trim($_POST['first_name']);
        $last_name = trim($_POST['last_name']);
        $phone = trim($_POST['phone']);
        $email = trim($_POST['email']);

        // Validate form data
        $validate->text('first_name', $first_name);
        $validate->text('last_name', $last_name);
        $validate->phone('phone', $phone);
        $validate->email('email', $email);

        // Load appropriate view based on hasErrors
        if ($fields->hasErrors()) {
            include 'view/register.php';
        } else {
            include 'view/success.php'; }
        break;
}
?>
```

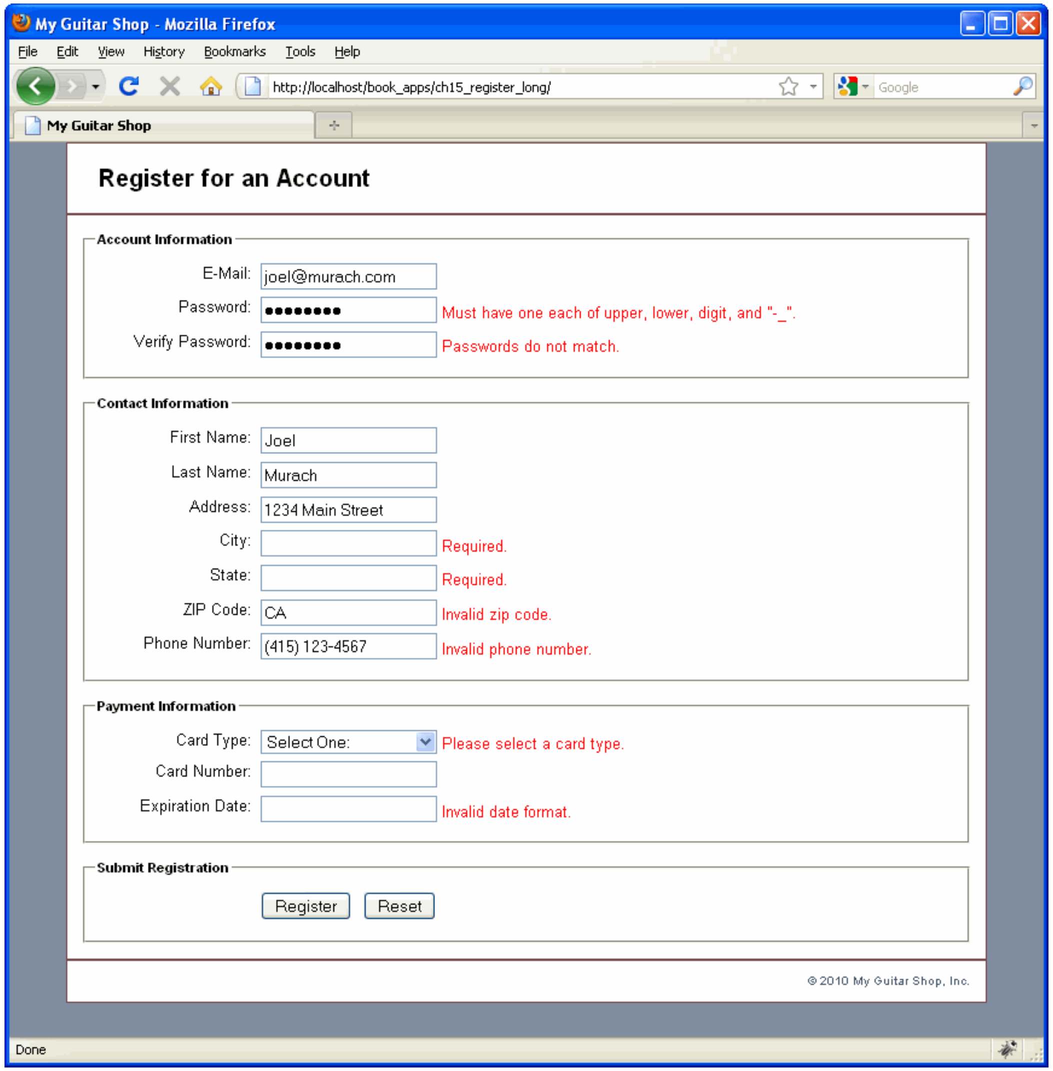
The view (view/register.php)

```
<?php include 'header.php'; ?>
<div id="content">
  <form action="." method="post">
  <fieldset>
    <legend>User Information</legend>
      <label>First Name:</label>
      <input type="text" name="first_name"
        value=
          "<?php echo htmlspecialchars($first_name);?>"/>
        <?php echo
          $fields->getField('first_name')->getHTML(); ?>
      <br />
      <label>Last Name:</label>
      <input type="text" name="last_name"
        value="<?php echo htmlspecialchars($last_name);?>"/>
        <?php echo
          $fields->getField('last_name')->getHTML(); ?>
      <br />
```

The view (view/register.php) (continued)

```
        <label>Phone:</label>
        <input type="text" name="phone"
          value="<?php echo htmlspecialchars($phone);?>"/>
          <?php echo $fields->getField('phone')->getHTML(); ?>
        <br />
        <label>E-Mail:</label>
        <input type="text" name="email"
          value="<?php echo htmlspecialchars($email);?>"/>
          <?php echo $fields->getField('email')->getHTML(); ?>
        <br />
    </fieldset>
    <fieldset>
      <legend>Submit Registration</legend>
        <label>&nbsp;</label>
        <input type="submit" name="action" value="Register"/>
        <input type="submit" name="action" value="Reset" />
        <br />
    </fieldset>
    </form>
</div>
<?php include 'footer.php'; ?>
```

A long version of the Registration application


My Guitar Shop - Mozilla Firefox

http://localhost/book_apps/ch15_register_long/

Register for an Account

Account Information

E-Mail:	joel@murach.com	
Password:	●●●●●●●●	Must have one each of upper, lower, digit, and "-_".
Verify Password:	●●●●●●●●	Passwords do not match.

Contact Information

First Name:	Joel	
Last Name:	Murach	
Address:	1234 Main Street	
City:		Required.
State:		Required.
ZIP Code:	CA	Invalid zip code.
Phone Number:	(415) 123-4567	Invalid phone number.

Payment Information

Card Type:	Select One:	Please select a card type.
Card Number:		
Expiration Date:		Invalid date format.

Submit Registration

Register Reset

© 2010 My Guitar Shop, Inc.

Done