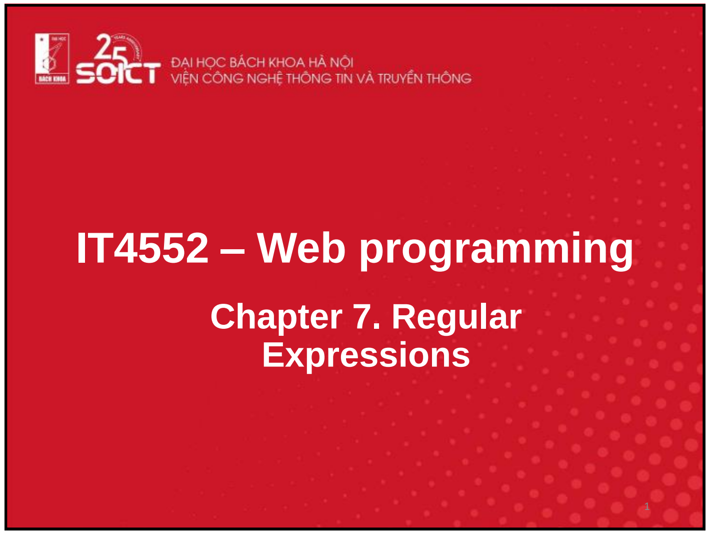
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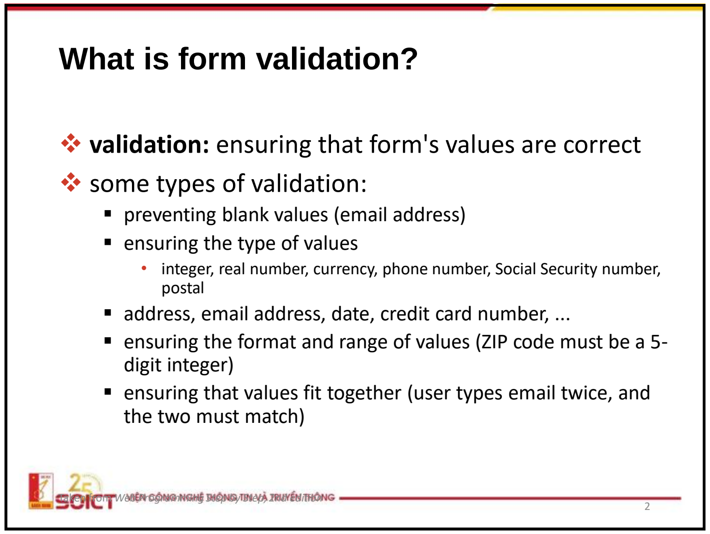
IT4552 – Web programming

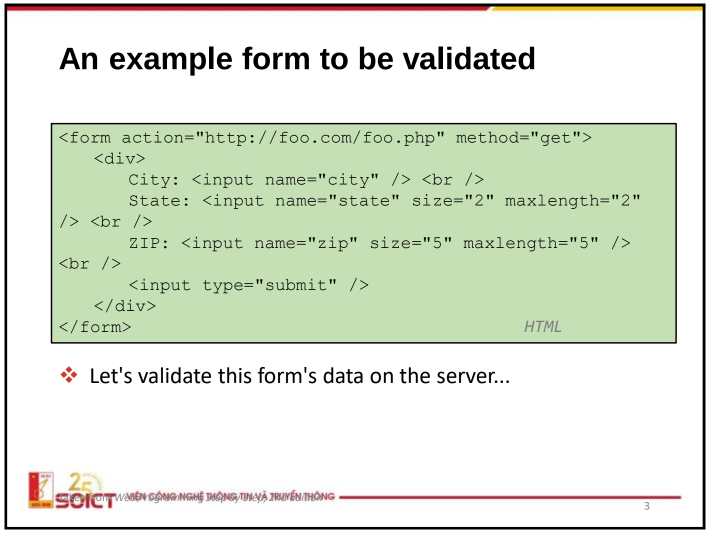
Chapter 7. Regular Expressions

1


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)

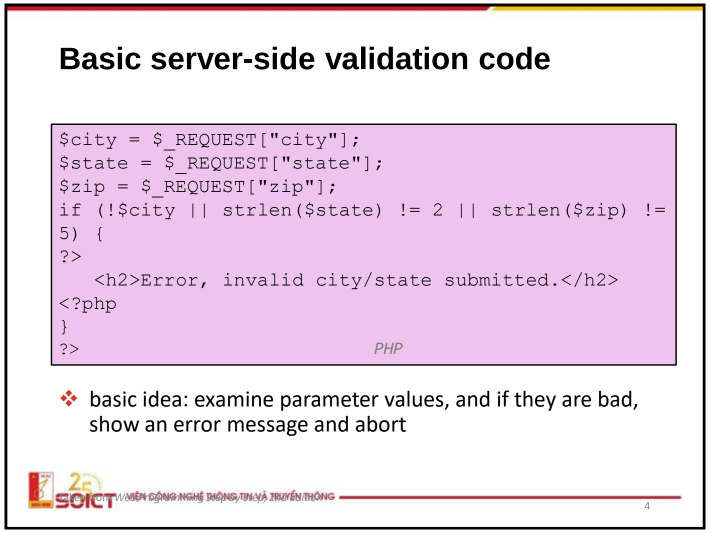
2


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
```

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

3


Basic server-side validation code

```
$city = $_REQUEST["city"];
$state = $_REQUEST["state"];
$zip = $_REQUEST["zip"];
if (!$city || strlen($state) != 2 || strlen($zip) !=
5) {
?>
   <h2>Error, invalid city/state submitted.</h2>
<?php
}
?>                             PHP
```

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

4

More String functions

- int **strpos**(string *str, string find [, int start])*

```
$numToPower = '20^2';
$caretPos = strpos($numToPower, '^');
$num = substr($numToPower, 0, $caretPos);
$power = substr($numToPower, $caretPos + 1);
echo "You're raising $num to the power of $power.";
```

- string **str_replace**(string *find, string replace, string str)*

```
$str = 'My dog knows a cat that knows the ferret
                          that stole my keys.';
$find = array('dog', 'cat', 'ferret');
echo str_replace($find, 'mammal', $str);
```

Basic server-side validation code

- validation code can take a lot of time / lines to write
  - 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?

Why regular expressions?

- Scripting problem may require:
  - verification of input from form
    - was input a 7 digit phone number
  - parsing input from a file
    - `FirstName:LastName:Age:Salary`
- PHP supports three pattern matching functions:
  - `ereg()`, `split()`, and `ereg_replace()`

New version of PHP:
ereg → preg_match split → preg_split ereg_replace →preg_replace

- Regular expressions are used to define very specific match patterns

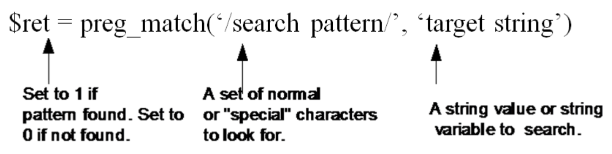
Regular expressions in PHP

- PHP supports three pattern matching functions:

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 the given regex as the delimiter (similar to **explode** but more powerful)

The preg_match() function

- Use preg_match() to check if a string contains a match pattern:


$ret = preg_match('/search pattern/', 'target string')
Set to 1 if pattern found. Set to 0 if not found.
A set of normal or "special" characters to look for.
A string value or string variable to search.

$ret = preg_match('/search pattern/', 'target string')

preg_match() - example

- Consider the following

```
$name = 'Jake Jackson';
$pattern = '/ke/';
     if (preg_match($pattern, $name)){
       print 'Match';
     } else {
       print 'No match';
     }
```

- This code outputs "`Match`" since the string "`ke`" is found.
- If `$pattern` was "`aa`" the above code segment would output "`No match`"

Content

Content

1.1. What are regular expressions?

- Special pattern matching characters with specific pattern matching meanings.
  - Their meanings are defined by an industry standard (the IEEE POSIX 1003.2 standard).
- PHP has:
  - POSIX
  - **Perl regular expressions (**The Perl version is known as PCRE (Perl-Compatible Regular Expressions)**)**

1.1. What are regular expressions?

- For example, a caret symbol (^) returns a match when the pattern that follows starts the target string.

```
 $part = 'AA100';
$pattern = '/^AA/';
if (preg_match($pattern, $part)) {
        print 'Match';
} else {
        print 'No match';
}
```

Check if $part starts with "AA"

Would be output if $part was "AB100", "100AA", or "Apple".

1.1. What are regular expressions?

- Regular Expression Syntax
  - A **literal** is just a character you wish to match in the target
  - A **metacharacter** is a special symbol that acts as a command to the regular expression parser

.	[	]	\	(	)	^	$	|	*	?	{	}	+

  - To use a metacharacter as a literal, you will need to escape it by prefacing it with a backslash (\)
  - Regular Expression Patterns can be combined to form complex expressions

1.1. What are regular expressions?

- In PHP, regexes are strings that begin and end with **/**
- The simplest regexes simply match a particular substring
- '/abc/' -> matches any string containing "abc":
  - YES: "abc", "abcdef", "defabc", ".=.abc.=.", ...
  - NO: "fedcba", "ab c", "PHP", ...
- A trailing **i** at the end of a regex (after the closing /) signifies a case-insensitive match
  - "/xen/i" matches "Xenia", "xenophobic", "Xena the warrior princess", "XEN technologies" ...

1.2. Selected Pattern Matching Characters

Symbol	Description
^	*Matches when the following character starts the string.* *E.g* the following statement is *true* if $name contains “Smith is OK”, “Smithsonian”, or “Smith, Black”. It would be *false* if $name contained only “SMITH” or “Smitty”. `if (preg_match('/^Smith/', $name)){`
$	*Matches when the preceding character ends the string.* *E.g.* the statement below would is *true* if $name contains “Joe Johnson”, “Jackson”, or “This is my son”. It would be *false* if $name contained only “My son Jake” or “MY SON”. `if (preg_match('/son$/', $name )){`

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1.2. Selected Pattern Matching Characters (2)

Symbol	Description
+	*Matches one or more occurrences of the preceding character.* For example, the statement below is *true* if $name contains “AB101”, “ABB101”, or “ABBB101 is the right part”. It would be *false* if $name contained only “Part A101”. `if(preg_match( '/AB+101/', $name)){`
*	*Matches zero or more occurrences of the preceding character.* For example, the statement below is *true* if $part starts with “A” and followed by zero or more “B” characters followed by “101”, (for example, “AB101”, “ABB101”, “A101”, or “A101 is broke”). It would be *false* if $part contained only “A11”. `if (preg_match( '/^AB*101/', $part)){`
?	Matches zero or one occurrences of the preceding character

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1.2. Selected Pattern Matching Characters (3)

Symbol	Description
.	*A wildcard symbol that matches any one character.* For example, the statement is *true* if $name contains “Stop”, “Soap”, “Szxp”, or “Soap is good”. It would be *false* if $name contained only “Sxp”. `if (preg_match( '/^S..p/', $name)){`
|	*An alternation symbol that matches either character pattern.* For example, the statement below would be *true* if $name contains “www.mysite.com”, “www.school.edu”, “education”, or “company”. It would be *false* \ if $name contained only “www.site.net”. `if (preg_match( '/com|edu/', $name)){`

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1.2. Selected Pattern Matching Characters (4)

Symbol	Description
\w	Matches any word character. Equivalent to [a-zA-Z0-9].
\W	Matches any nonword character.
\s	Matches any white-space character.
\S	Matches any nonwhite-space character.
\d	Matches any digit.
\D	Matches any nondigit.
\t	Matches a tab character.
\n	Matches a new-line character.

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For example ...

- Regular expressions are case sensitive by default

```
<br>Enter product code (Use AB## format):<br>
    <input type="text" size="6" name="code">
<br> Please enter description:<br>
    <input type="text" size="50" name="description">
```

- Asks for a product code and description (not to contain “Boat” or “Plane”).

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A Full Script Example

- Consider an example script that enables end-user to select multiple items from a checklist.
  - A survey about menu preferences
  - Wil look at how to send multiple items and how to receive them (later)

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A Full Example ...

```
<html><head><title>Product Information Results </title>
</head><body>
<?php
  $products = array('AB01'=>'25-Pound Sledgehammer',
                    'AB02'=>'Extra Strong Nails',
                    'AB03'=>'Super Adjustable Wrench',
                    'AB04'=>'3-Speed Electric Screwdriver');
  if (preg_match('/boat|plane/', $description)){
     print 'Sorry, we do not sell boats or planes anymore';
  } elseif  (preg_match('/^AB/', $code)){
     if  (isset($products["$code"])){
        print "Code $code Description: $products[$code]";
} else {
        print 'Sorry, product code not found';
}
 } else {
print 'Sorry, all our product codes start with "AB"';
 } ?> </body></html>
```

Create a list of products.

Check if “boat” or “plane”.

Check if valid product number

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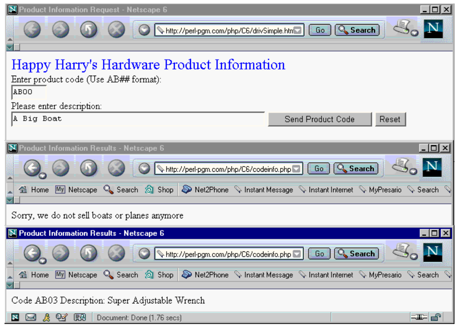
The Output ...


Product Information Request - Netscape 6

http://perl-pgm.com/php/C6/drivSimple.htm

Happy Harry's Hardware Product Information

Enter product code (Use AB## format):

AB00

Please enter description:

A Big Boat

Send Product Code | Reset

Product Information Results - Netscape 6

http://perl-pgm.com/php/C6/codeinfo.php

Sorry, we do not sell boats or planes anymore

Product Information Results - Netscape 6

http://perl-pgm.com/php/C6/codeinfo.php

Code AB03 Description: Super Adjustable Wrench

Document: Done (1.76 secs)

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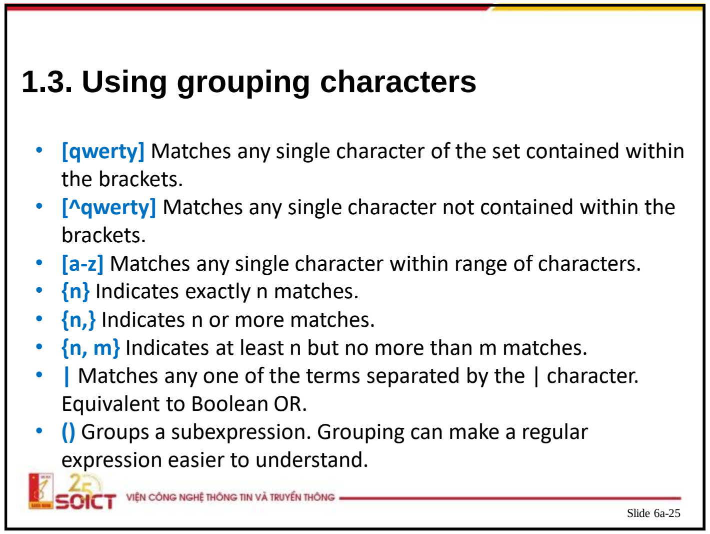
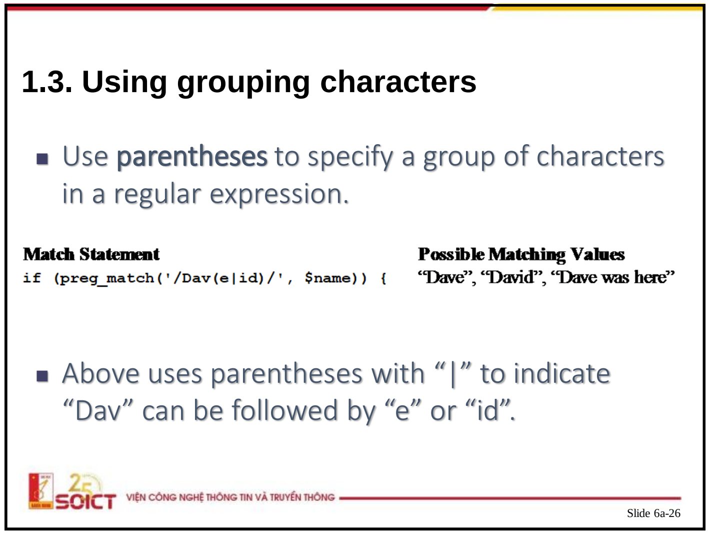


1.3. Using grouping characters

- **[qwerty]** Matches any single character of the set contained within the brackets.
- **[^qwerty]** Matches any single character not contained within the brackets.
- **[a-z]** Matches any single character within range of characters.
- **{n}** Indicates exactly n matches.
- **{n,}** Indicates n or more matches.
- **{n, m}** Indicates at least n but no more than m matches.
- **|** Matches any one of the terms separated by the | character. Equivalent to Boolean OR.
- **()** Groups a subexpression. Grouping can make a regular expression easier to understand.

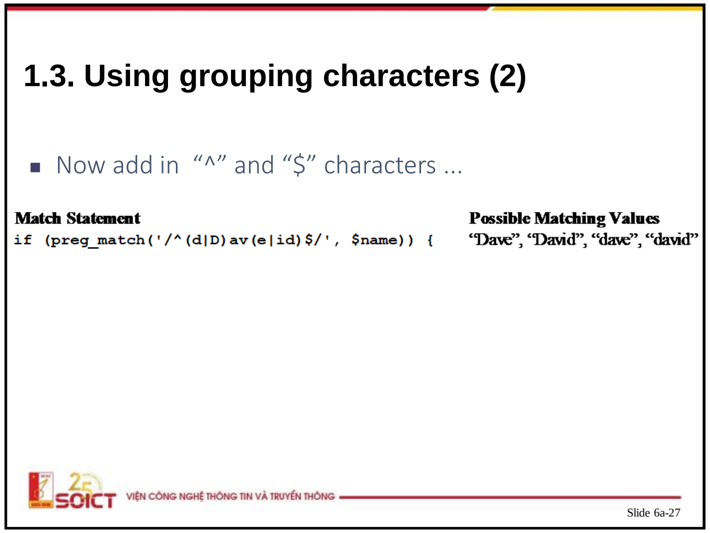


1.3. Using grouping characters

- Use **parentheses** to specify a group of characters in a regular expression.

Match Statement	Possible Matching Values
`if (preg_match('/Dav(e|id)/', $name)) {`	"Dave", "David", "Dave was here"

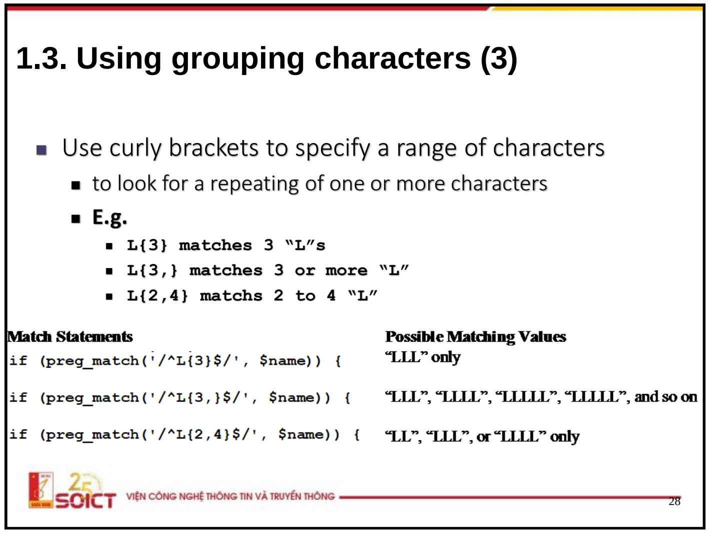
- Above uses parentheses with "|" to indicate "Dav" can be followed by "e" or "id".



1.3. Using grouping characters (2)

- Now add in "^" and "$" characters ...

Match Statement	Possible Matching Values
`if (preg_match('/^(d|D)av(e|id)$/', $name)) {`	"Dave", "David", "dave", "david"



1.3. Using grouping characters (3)

- Use curly brackets to specify a range of characters
  - to look for a repeating of one or more characters
  - **E.g.**
    - `L{3} matches 3 "L"s`
    - `L{3,} matches 3 or more "L"`
    - `L{2,4} matchs 2 to 4 "L"`

Match Statements	Possible Matching Values
`if (preg_match('/^L{3}$/', $name)) {`	"LLL" only
`if (preg_match('/^L{3,}$/', $name)) {`	"LLL", "LLLL", "LLLLL", "LLLLL", and so on
`if (preg_match('/^L{2,4}$/', $name)) {`	"LL", "LLL", or "LLLL" only

1.3. Using grouping characters (4)

- Use square brackets for character classes
  - to match one of character found inside them

Match Statement	Possible Matching Values
`if (preg_match('/Sea[nt]!/', $name)) {`	"Sean!", "Seat!", "Here comes Sean!"

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1.3. Using grouping characters (5)

- Use square brackets with range
  - More common to specify a range of matches
  - For exampe [0-9], [a-z] or [A-Z]

Match Statement	Possible Matching Values
`if (preg_match('/[0-9]/', $prodcode)) {`	"apple1", "24234", "suzy44", "s1mple

  - Or use multiple characters at once ...

Match Statement	Possible Matching Values
`if (preg_match('/[A-Z][A-Z][0-9]/', $code)) {`	"AA9", "Send product AZ9", "MY12"

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1.3. Using grouping characters (6)

- Using caret "^" and square brackets
  - When caret "^" is first character within square brackets it means "not".

Match Statement	Possible Matching Values
`if (preg_match('/[^5-9][0-9][A-Z]/', $code)) {`	"The AA9A is OK", "Product 44X is down", "It was 9Years ago."

  - Note: Within a character class, as in [^ . . .], "^" means *not*. Earlier saw how it can indicate that the character that follows the caret symbol *starts* the match pattern

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1.4. Special Pre-defined character classes

- POSIX (Portable Operating System Interface for uniX) is a collection of standards that define some of the functionality that a Unix operating system should support.
- In addition to the standard rules of regex that we've already discussed, the POSIX regex standard defines the concept of **character classes** as a way to make it even easier to specify character ranges.
- Character classes are always enclosed in a set of **colon characters (:)** and must be enclosed in **square brackets**.

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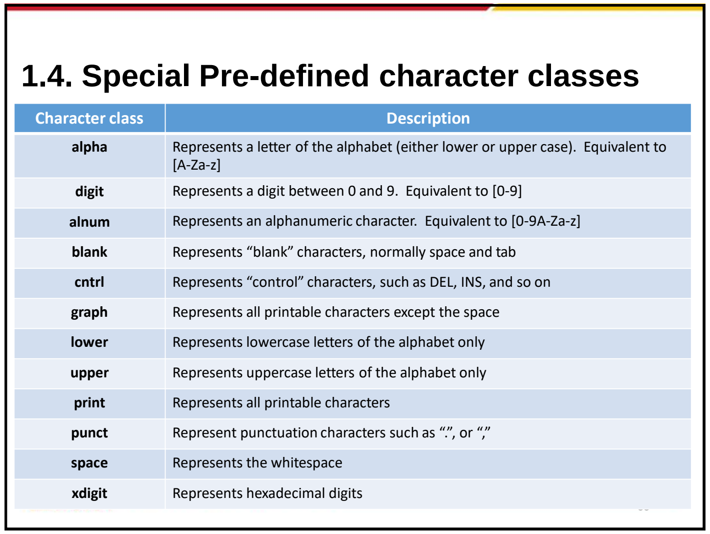

1.4. Special Pre-defined character classes

Character class	Description
alpha	Represents a letter of the alphabet (either lower or upper case). Equivalent to [A-Za-z]
digit	Represents a digit between 0 and 9. Equivalent to [0-9]
alnum	Represents an alphanumeric character. Equivalent to [0-9A-Za-z]
blank	Represents "blank" characters, normally space and tab
cntrl	Represents "control" characters, such as DEL, INS, and so on
graph	Represents all printable characters except the space
lower	Represents lowercase letters of the alphabet only
upper	Represents uppercase letters of the alphabet only
print	Represents all printable characters
punct	Represent punctuation characters such as ".", or ","
space	Represents the whitespace
xdigit	Represents hexadecimal digits

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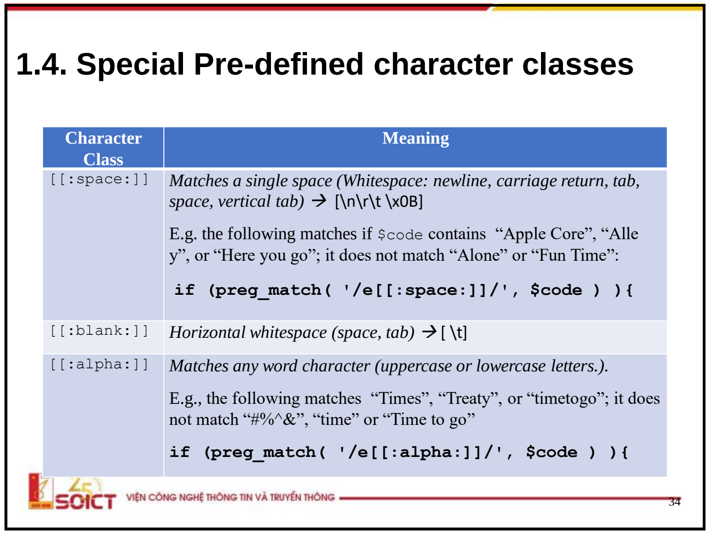

1.4. Special Pre-defined character classes

Character Class	Meaning
`[[:space:]]`	*Matches a single space (Whitespace: newline, carriage return, tab, space, vertical tab)* → [\n\r\t \x0B] E.g. the following matches if `$code` contains "Apple Core", "Alle y", or "Here you go"; it does not match "Alone" or "Fun Time": **`if (preg_match( '/e[[:space:]]/', $code ) ){`**
`[[:blank:]]`	*Horizontal whitespace (space, tab)* →[\t]
`[[:alpha:]]`	*Matches any word character (uppercase or lowercase letters.).* E.g., the following matches "Times", "Treaty", or "timetogo"; it does not match "#%^&", "time" or "Time to go" **`if (preg_match( '/e[[:alpha:]]/', $code ) ){`**

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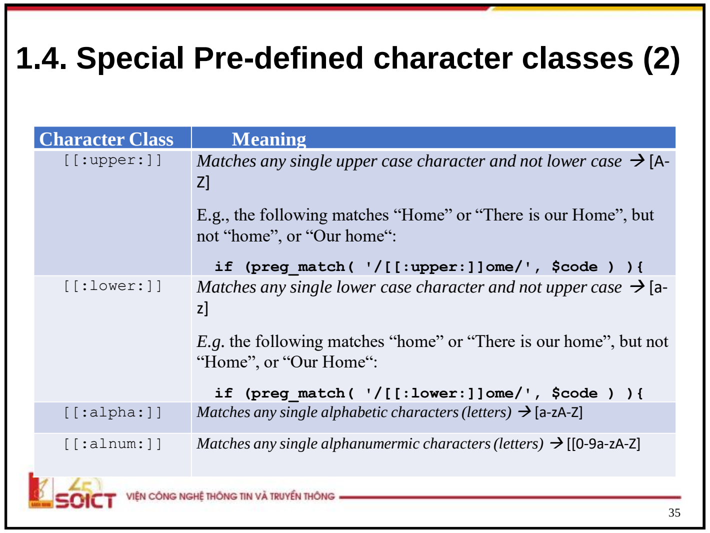

1.4. Special Pre-defined character classes (2)

Character Class	Meaning
`[[:upper:]]`	*Matches any single upper case character and not lower case* →[A-Z] E.g., the following matches "Home" or "There is our Home", but not "home", or "Our home": **`if (preg_match( '/[[:upper:]]ome/', $code ) ){`**
`[[:lower:]]`	*Matches any single lower case character and not upper case* →[a-z] *E.g.* the following matches "home" or "There is our home", but not "Home", or "Our Home": **`if (preg_match( '/[[:lower:]]ome/', $code ) ){`**
`[[:alpha:]]`	*Matches any single alphabetic characters (letters)* →[a-zA-Z]
`[[:alnum:]]`	*Matches any single alphanumermic characters (letters)* →[[0-9a-zA-Z]

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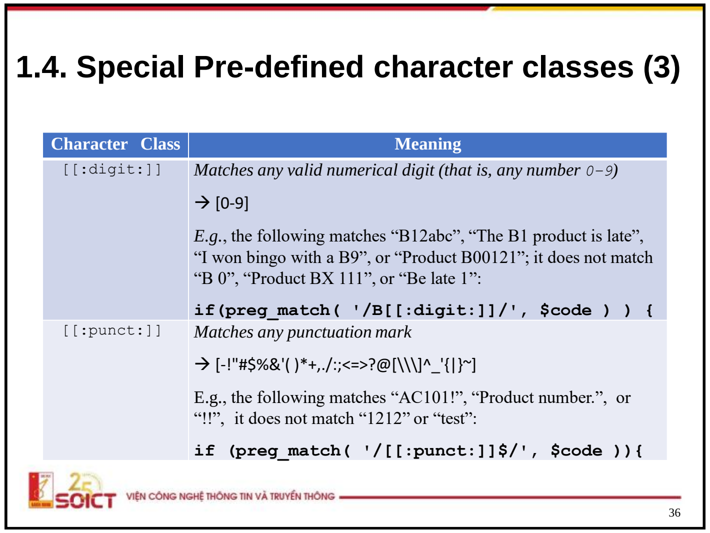

1.4. Special Pre-defined character classes (3)

Character Class	Meaning
`[[:digit:]]`	*Matches any valid numerical digit (that is, any number* 0-9*)* → [0-9] *E.g.*, the following matches "B12abc", "The B1 product is late", "I won bingo with a B9", or "Product B00121"; it does not match "B 0", "Product BX 111", or "Be late 1": **`if(preg_match( '/B[[:digit:]]/', $code ) ) {`**
`[[:punct:]]`	*Matches any punctuation mark* → [-!"#$%&'( )*+,./:;<=>?@[\\\]^_'{\|}~] E.g., the following matches "AC101!", "Product number.", or "!!", it does not match "1212" or "test": **`if (preg_match( '/[[:punct:]]$/', $code )){`**

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1.4. Special Pre-defined character classes (4)

Character Class	Meaning
`[[:<:]]`	*Matches when the following word starts the string.*
`[[:>:]]`	*Matches when the preceding word ends the string*

E.g.,

```
// returns false
preg_match('/[[:<:]]gun[[:>:]]/', 'the Burgundy exploded');
// returns true
preg_match('/gun/', 'the Burgundy exploded');
```

Content

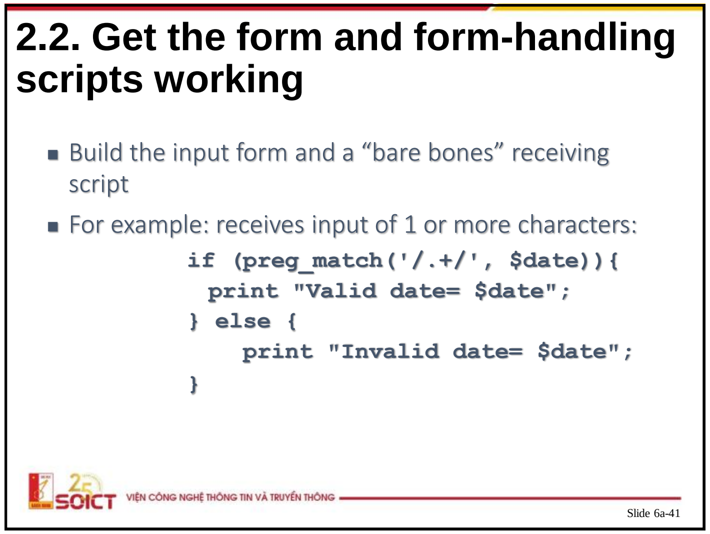
2. Building an example RE

- Building Regular expressions is best done incrementally
- Lets look at a process to build a regular expression to validate a date input field:
  - `mm/dd/yyyy` format (for example, `01/05/2002` but not `1/5/02`).

2.1. Determine the precise field rules

- What is valid input and invalid input
  - You might decide to allow `09/09/2002` but not `9/9/2002` or `Sep/9/2002` as valid date formats.
- Work through several examples as follows:

Rule	Reject These
1. Only accept "/" as a separator	`05 05 2002`—Require slash delimiters
2. Use a four-digit year	`05/05/02`—Four-digit year required
3. Only date data	`The date is 05/05/2002`—Only date fields allowed `05/05/2002 is my date`—Only date fields allowed
4.Require two digits for months and days	`5/05/2002`—Two-digit months required `05/5/2002`—Two-digit days required `5/5/2002`—Two-digit days and months required



2.2. Get the form and form-handling scripts working

- Build the input form and a "bare bones" receiving script
- For example: receives input of 1 or more characters:

```
if (preg_match('/.+/', $date)){
  print "Valid date= $date";
} else {
     print "Invalid date= $date";
}
```

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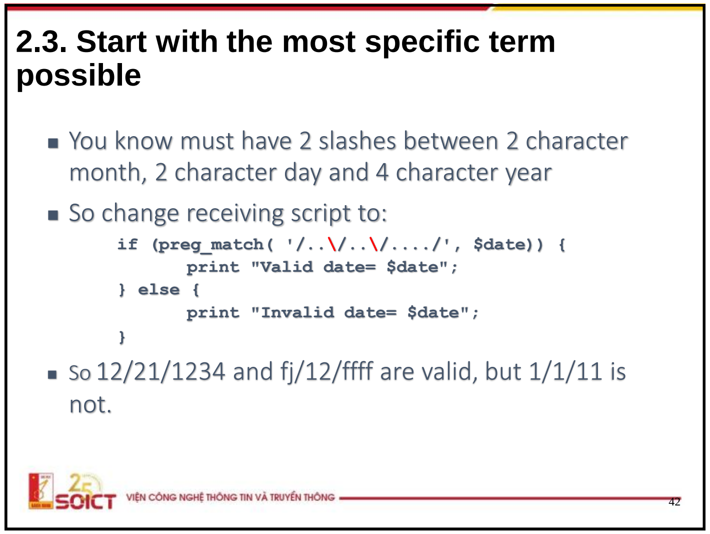

2.3. Start with the most specific term possible

- You know must have 2 slashes between 2 character month, 2 character day and 4 character year
- So change receiving script to:

```
if (preg_match( '/..\/..\/..../', $date)) {
        print "Valid date= $date";
} else {
        print "Invalid date= $date";
}
```

- So 12/21/1234 and fj/12/ffff are valid, but 1/1/11 is not.

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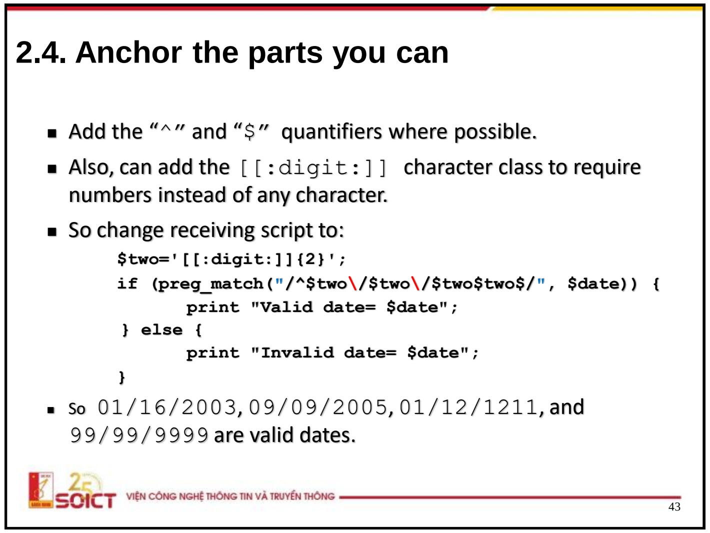

2.4. Anchor the parts you can

- Add the "^" and "$" quantifiers where possible.
- Also, can add the `[[:digit:]]` character class to require numbers instead of any character.
- So change receiving script to:

```
$two='[[:digit:]]{2}';
if (preg_match("/^$two\/$two\/$two$two$/", $date)) {
        print "Valid date= $date";
} else {
        print "Invalid date= $date";
}
```

- So 01/16/2003, 09/09/2005, 01/12/1211, and 99/99/9999 are valid dates.

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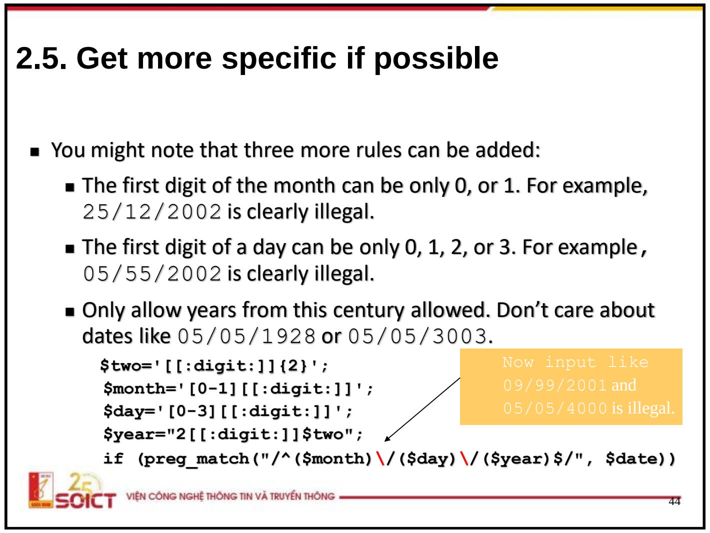

2.5. Get more specific if possible

- You might note that three more rules can be added:
  - The first digit of the month can be only 0, or 1. For example, 25/12/2002 is clearly illegal.
  - The first digit of a day can be only 0, 1, 2, or 3. For example, 05/55/2002 is clearly illegal.
  - Only allow years from this century allowed. Don't care about dates like 05/05/1928 or 05/05/3003.

```
$two='[[:digit:]]{2}';
$month='[0-1][[:digit:]]';
$day='[0-3][[:digit:]]';
$year="2[[:digit:]]$two";
if (preg_match("/^($month)\/($day)\/($year)$/", $date))
```

Now input like 09/99/2001 and 05/05/4000 is illegal.

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A Full Script Example

- Consider an example script that asks end-user for a date
  - Use regular expressions to validate
  - Use the following HTML input

```
<input type="text" size="10" maxlength="10" name="date">
```

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A Full Example ...

```
<html>
<head><title>Decsions</title></head>
<body>
<?php
        $two='[[:digit:]]{2}';
        $month='[0-1][[:digit:]]';
        $day='[0-3][[:digit:]]';
        $year="2[[:digit:]]$two";
        if (preg_match("/^($month)\/($day)\/($year)$/", $date)) {
                print "Got valid date=$date <br>";
         } else {
                print "Invalid date=$date";
         }
?> </body></html>
```

Use same regular expression as before

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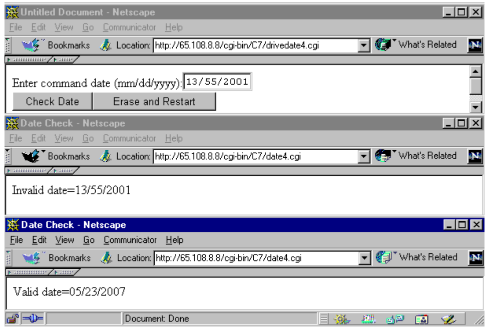
The Output ...



Untitled Document - Netscape
Location: http://65.108.8.8/cgi-bin/C7/drivedate4.cgi

Enter command date (mm/dd/yyyy): 13/55/2001
Check Date | Erase and Restart

Date Check - Netscape
Location: http://65.108.8.8/cgi-bin/C7/date4.cgi

Invalid date=13/55/2001

Date Check - Netscape
Location: http://65.108.8.8/cgi-bin/C7/date4.cgi

Valid date=05/23/2007

Document: Done

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Content

1. Regular Expression
2. Building an Example RE
3. Filter Input Data

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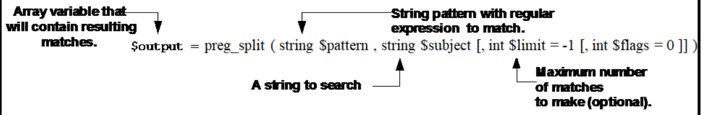
3.1. Matching Patterns With preg_split()

- Use preg_split() to break a string into different pieces based on the presence of a match pattern.


Array variable that will contain resulting matches.
String pattern with regular expression to match.
$output = preg_split (string $pattern , string $subject [, int $limit = -1 [, int $flags = 0]])
A string to search
Maximum number of matches to make (optional).

preg_split (string $pattern , string $subject [, int $limit = -1 [, int $flags = 0]])

3.1. Matching Patterns With preg_split()

- Consider another example:

```
$line = 'Baseball, hot dogs, apple pie';
$item =  preg_split( '/,/', $line );
print ("0=$item[0] 1=$item[1] 2=$item[2]");
```

- These lines will have the following output:

```
0=Baseball 1= hot dogs 2= apple pie
```

3.1. Matching Patterns With preg_split()

- When you know how many patterns you are interested can use list() along with preg_split():

```
$line = 'AA1234:Hammer:122:12';
list($partno, $part, $num, $cost)
                  = preg_split('/:/', $line, 4);
print "partno=$partno part=$part num=$num
          cost=$cost";
```

- The above code would output the following:

```
partno=AA1234 part=Hammer num=122 cost=12
```

Example of preg_split()

- As an example of preg_split() consider the following:

```
$line = 'Please , pass     thepepper';
$result =  preg_split( '/[[:space:]]+/', $line );
```

- Will results in the following:

```
$result[0] = 'Please';
$result[1] = ','
$result[2] = 'pass';
$result[3] = 'thepepper';
```

A Full Script Example

- Consider an example script that updates the date checker just studied:
  - Uses **preg_split()** to further refine date validation
  - Uses the same input form:

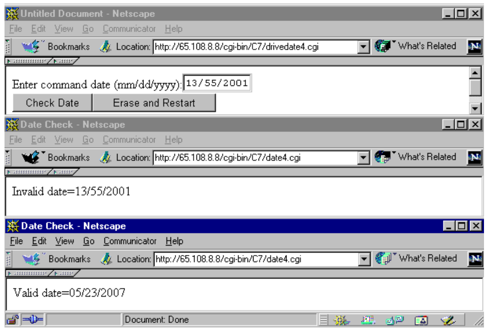
```
<input type="text" size="10" maxlength="10" name="date">
```

A Full Example ...

```
<html>
<head><title>Date Check</title></head>
<body>
<?php
    $two='[[:digit:]]{2}';
    $month='[0-3][[:digit:]]';
    $day='[0-3][[:digit:]]';
    $year="2[[:digit:]]$two";
    if (preg_match("/^($month)\/($day)\/($year)$/", $date)  ) {
        list($mon, $day, $year) = preg_split( '/\//', $date );
        if ( $mon >= 1 && $mon <= 12 ) {
             if ( $day <= 31 ) {
                print "Valid date mon=$mon day=$day year=$year";
             } else {
                print " Illegal day specifed Day=$day";
             }
        } else {
           print " Illegal month specifed Mon=$mon";
        }
    } else {
        print ("Invalid date format= $date");
    }
?></body></html>
```

Use split() and list() to get month, day and year.

The Output ...


Untitled Document - Netscape
File Edit View Go Communicator Help
Bookmarks
Location: http://65.108.8.8/cgi-bin/C7/drivedate4.cgi
What's Related
Check Date
Erase and Restart
Date Check - Netscape
Location: http://65.108.8.8/cgi-bin/C7/date4.cgi
Date Check - Netscape
Location: http://65.108.8.8/cgi-bin/C7/date4.cgi
Document: Done

Enter command date (mm/dd/yyyy) 13/55/2001

Invalid date=13/55/2001

Valid date=05/23/2007

3.2. Using preg_replace()

- Use `preg_replace()` when replacing characters in a string variable.
  - It can be used to replace one string pattern for another in a string variable.
  - E.g:

```
$start = 'AC1001:Hammer:15:150';
$end = preg_replace('/Hammer/', 'Drill', $start );
print "end=$end";
```

The above script segment would output:
`end=AC1001:Drill:15:150`

Summary

- PHP supports a set of operators and functions that are useful for matching and manipulating patterns in strings:
  - The `preg_match()` function looks for and match patterns
  - The `preg_split()` function uses a pattern to split string values into as many pieces as there are matches.
  - The `preg_replace()` function replaces characters in a string variable
- Regular expressions greatly enhance its pattern matching capabilities.

Question?