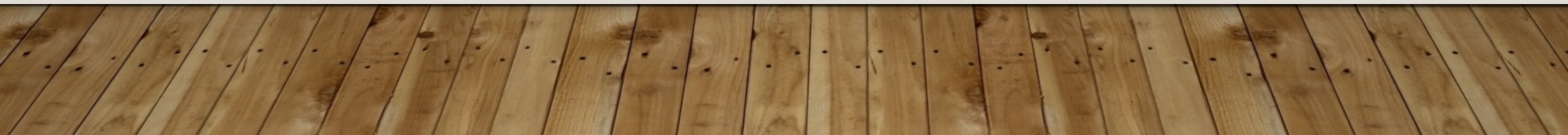
ISIT307 - WEB SERVER PROGRAMMING

LECTURE 2.1 – MANIPULATING STRINGS



LECTURE PLAN

- Construct text strings
- Work with single strings
- Work with multiple strings and parse strings
- Compare strings
- Use regular expressions

CONSTRUCTING TEXT STRINGS

- A text string contains zero or more characters surrounded by double or single quotation marks
- Text strings can be used as literal values or assigned to a variable

```
echo "<p>PHP literal text string</p>";
$StringVariable = "<p>PHP literal text string</p>";
echo $StringVariable;
```

- A string must begin and end with a matching quotation mark (single or double)

CONSTRUCTING TEXT STRINGS (CONTINUED)

- To include a quoted string within a literal string surrounded by double quotation marks, you surround the quoted string with single quotation marks
- To include a quoted string within a literal string surrounded by single quotation marks, you surround the quoted string with double quotation marks

WORKING WITH STRING OPERATORS

In PHP, there are two operators to combine strings:

- **Concatenation operator** (.) combines two strings and assigns the new value to a variable

```
$City = "Paris";
$Country = "France";
$Destination = " <p> " . $City . " is in "
        . $Country . ".</p>";
echo $Destination;
```

WORKING WITH STRING OPERATORS (CONTINUED)

- You can also combine strings using the **concatenation assignment operator** (.=)

```
$Destination = "<p>Paris";
$Destination .= "is in France.</p>";
echo $Destination;
```

ADDING ESCAPE CHARACTERS AND SEQUENCES

- An **escape character** tells the compiler or interpreter that the character that follows it has a special purpose
- In PHP, the escape character is the backslash (\)

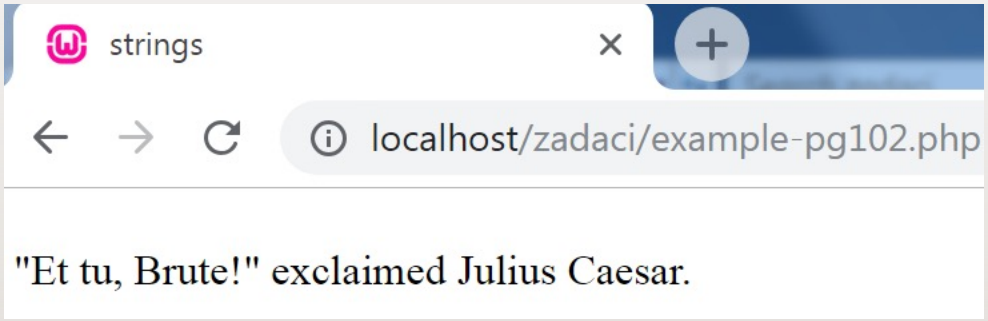
```
echo '<p>This code\'s going to work</p>';
```

- Do not add a backslash before an apostrophe if you surround the text string with double quotation marks

```
echo "<p>This code's going to work.</p>";
```

ADDING ESCAPE CHARACTERS AND SEQUENCES - EXAMPLE

```
$Speaker = "Julius Caesar";
echo "<p>\"Et tu, Brute!\" exclaimed
                              $Speaker.</p>";
```



ADDING ESCAPE CHARACTERS AND SEQUENCES (CONTINUED)

- The escape character combined with one or more other characters is an **escape sequence**
- PHP escape sequences within double quotation marks are as follows

Escape Sequence	Description
\\	Inserts a backslash
\$	Inserts a dollar sign
\r	Inserts a carriage return
\f	Inserts a form feed
\"	Inserts a double quotation mark
\t	Inserts a horizontal tab
\v	Inserts a vertical tab
\n	Inserts a new line
\x*h*	Inserts a character whose hexadecimal value is *h*, where *h* is one or two hexadecimal digits (0-9, A-F), case insensitive
\o	Inserts a character whose octal value is *o*, where *o* is one, two, or three octal digits (0-7)

SIMPLE AND COMPLEX STRING SYNTAX

- **Simple string syntax** uses the value of a variable within a string by including the variable name inside a text string with double quotation marks

```
$Vegetable = "broccoli";
echo "<p>Do you have any $Vegetable?</p>";
```

- When variables are placed within curly braces inside of a string, it is called **complex string syntax**

```
$Vegetable = "carrot";
echo "<p>Do you have any {$Vegetable}s?</p>";
```

WORKING WITH A SINGLE STRING

- PHP provides a number of functions for analyzing, altering, and parsing text strings including:
  - Counting characters and words
  - Transposing, converting, and changing the case of text within a string

COUNTING CHARACTERS AND WORDS IN A STRING

- The most commonly used string counting function is the `strlen()` function, which returns the total number of characters in a string
- Escape sequences, such as `\n`, are counted as one character

```
$BookTitle = "The Cask of Amontillado";
echo "<p>The book title contains " .
      strlen($BookTitle) . "characters.</p>";
```

COUNTING CHARACTERS AND WORDS IN A STRING (CONTINUED)

- The `str_word_count()` function returns the number of words in a string
- Pass the `str_word_count()` function a literal string or the name of a string variable whose words you want to count

```
$BookTitle = "The Cask of Amontillado";
echo "<p>The book title contains " .
     str_word_count($BookTitle). " words.</p>";
```

MODIFYING THE CASE OF A STRING

- PHP provides several functions to manipulate the case of a string
  - The `strtoupper()` function converts all letters in a string to uppercase
  - The `strtolower()` function converts all letters in a string to lowercase
  - The `ucfirst()` function ensures that the first character of a string is uppercase
  - The `lcfirst()` function ensures that the first character of a string is lowercase
  - The `ucwords()` function changes the first character of each word

ENCODING AND DECODING A STRING

- PHP has several built-in functions for processing strings to be used with Web pages
- Some characters in (X)HTML have a special meaning and must be encoded using HTML entities in order to be displayed as text
  - The `htmlspecialchars()` function converts special characters to HTML entities
  - The `html_specialcharacters_decode()` function converts HTML character entities into their equivalent characters

ENCODING AND DECODING A STRING (CONTINUED)

- The characters that are converted with the htmlspecialchars() function are:
  - '&' (ampersand) becomes '&'
  - '"' (double quote) becomes '"' - when ENT_NOQUOTES is disabled
  - ''' (single quote) becomes ''' - only when ENT_QUOTES is enabled.
  - '<' (less than) becomes '<'
  - '>' (greater than) becomes '>'

ENCODING AND DECODING A STRING (CONTINUED)

- The `md5()` function uses a strong encryption algorithm (called the Message-Digest Algorithm) to create a one-way hash
  - A **one-way hash** is a fixed-length string based on the entered text, from which it is nearly impossible to determine the original text
  - The `md5()` function does not have an equivalent decode function, which makes it a useful function for storing passwords in a database

OTHER WAYS TO MANIPULATE A STRING

- PHP provides three functions that remove leading or trailing spaces in a string
  - The `trim()` function will strip (remove) leading or trailing spaces in a string
  - The `ltrim()` function removes only the leading spaces
  - The `rtrim()` function removes only the trailing spaces

OTHER WAYS TO MANIPULATE A STRING (CONTINUED)

- The `substr()` function returns part of a string based on the values of the `start` and `length` parameters
- The syntax for the substr() function is:

```
substr(string, start, optional length);
```

- A positive number in the `start` parameter indicates how many character to skip at the beginning of the string
- A negative number in the `start` parameter indicates how many characters to count in from the end of the string

OTHER WAYS TO MANIPULATE A STRING (CONTINUED)

- A positive value in the in the `length` parameter determines how many characters to return
- A negative value in the `length` parameter skip that many characters at the end of the string and returns the middle portion
- If the length is omitted or is greater than the remaining length of the string, the entire remainder of the string is returned

OTHER WAYS TO MANIPULATE A STRING - EXAMPLE

```
  $ExampleString = "woodworking project";
  echo substr($ExampleString,4) . "<br />\n";
  echo substr($ExampleString,4,7) . "<br />\n";
  echo substr($ExampleString,0,8) . "<br />\n";
  echo substr($ExampleString,-7) . "<br />\n";
  echo substr($ExampleString,-12,4) . "<br />\n";
  echo substr($ExampleString,5,-2) . "<br />\n";
---
  echo strrev($ExampleString) . "<br />\n";
  echo str_shuffle($ExampleString) . "<br />\n";
```

WORKING WITH MULTIPLE STRINGS

- **Parsing** is the act of dividing a string into logical component substrings or tokens
- When programming, parsing refers to the extraction of information from string literals and variables

FINDING AND EXTRACTING CHARACTERS AND SUBSTRINGS

- There are two types of string search and extraction functions:
  - Functions that return a numeric position in a text string
  - Functions that return a character or substring
- Both functions return a value of `FALSE` if the search string is not found

FINDING AND EXTRACTING CHARACTERS AND SUBSTRINGS

- The `strpos()` function performs a case-sensitive search and returns the position of the first occurrence of one string in another string
- Pass two arguments to the `strpos()` function:
  - The first argument is the string you want to search
  - The second argument contains the characters for which you want to search
- If the search string is not found, the `strpos()` function returns a Boolean value of `FALSE`

FINDING, EXTRACTING, REPLACING CHARACTERS AND SUBSTRINGS

- The strchr() and the strrchr() functions return a substring from the specified characters to the end of the string
  - strchr() function starts searching at the beginning of a string
  - strrchr() function starts searching at the end of a string
- The str_replace() and str_ireplace() functions replace the substring within the string. Both accept three arguments:
  - The string you want to search for
  - A replacement string
  - The string in which you want to replace characters

FINDING, EXTRACTING, REPLACING CHARACTERS AND SUBSTRINGS

```
$Email = "my.email@uow.edu.au";

echo "<p>if I use strchr - " . strchr($Email, ".") . "</p>";

echo "<p>if I use strrchr - " . strrchr($Email, ".") . "</p>";

echo "<p> the @ is at position - " . strpos($Email, "@") ."</p>";

echo "<p>if I replace the email - " .
                str_replace("email", "e-mail", $Email) . "</p>";
```

DIVIDING STRINGS INTO SMALLER PIECES

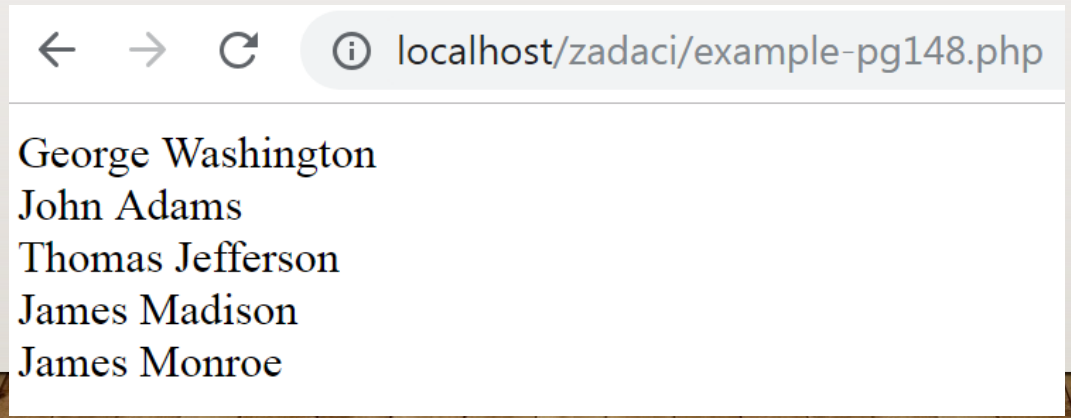
- Use the `strtok()` function to break a string into smaller strings, called **tokens**
- The syntax for the **`strtok()`** function is:

```
$variable = strtok(string, separators);
```

- The `strtok()` function returns the entire string if:
  - An empty string is specified as the second argument of the `strtok()` function
  - The string does not contain any of the separators specified

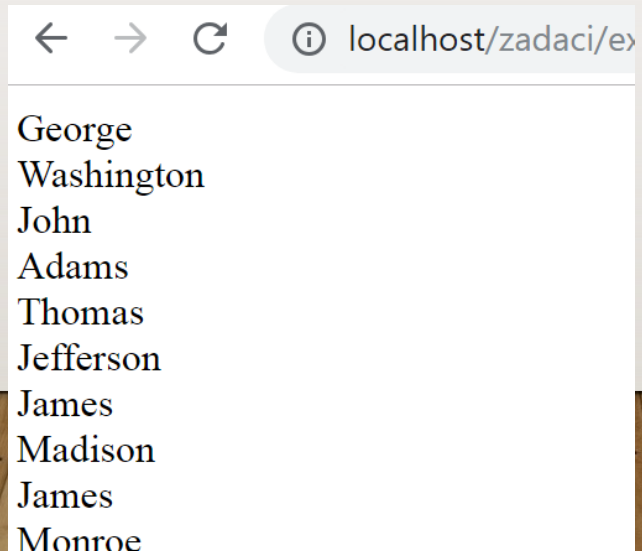
DIVIDING STRINGS INTO SMALLER PIECES - EXAMPLE

```
$Presidents = "George Washington;John Adams;Thomas
              Jefferson;James Madison;James Monroe";
$President = strtok($Presidents, ";");
while ($President != NULL) {
          echo "$President<br />";
          $President = strtok(";");
}
```



DIVIDING STRINGS INTO SMALLER PIECES(CONTINUED)

```
$Presidents = "George Washington;John Adams;Thomas
              Jefferson;James Madison;James Monroe";
$President = strtok($Presidents, "; ");
while ($President != NULL) {
          echo "$President<br />";
          $President = strtok("; ");
}
```



CONVERTING BETWEEN STRINGS AND ARRAYS

- The `str_split()` and `explode()` functions split a string into an indexed array
- The `str_split()` function splits each character in a string into an array element using the syntax:

```
$array = str_split(string[,length]);
```

- The *`length`* argument represents the number of characters you want assigned to each array element

CONVERTING BETWEEN STRINGS AND ARRAYS (CONTINUED)

- The `explode()` function splits a string into an indexed array at a specified separator
- The syntax for the `explode()` function is:

```
$array = explode(separators, string);
```

- The order of the arguments for the `explode()` function is the reverse of the arguments for the `strtok()` function

CONVERTING BETWEEN STRINGS AND ARRAYS (CONTINUED)

```
$Presidents = "George Washington;John Adams;
        Thomas Jefferson;James Madison;James Monroe";
$PresidentArray = explode(";", $Presidents);
foreach ($PresidentArray as $President) {
          echo "$President<br />";
}
```

- If the string does not contain the specified separators, the entire string is assigned to the first element of the array

CONVERTING BETWEEN STRINGS AND ARRAYS (CONTINUED)

- The `explode()` function
  - Does not separate a string at each character that is included in the *separator* argument
  - Evaluates the characters in the *separator* argument as a substring
  - If you pass to the `explode()` function an empty string as the *separator* argument, the function returns a Boolean value of `FALSE`

CONVERTING BETWEEN STRINGS AND ARRAYS (CONTINUED)

- The `implode()` function combines an array's elements into a single string, separated by specified characters
- The syntax is:

```
$variable = implode(separators, array);
```

```
$PresidentsArray = array("George Washington", "John Adams",
        "Thomas Jefferson", "James Madison", "James Monroe");
$Presidents = implode(", ", $PresidentsArray);
echo $Presidents;
```

COMPARING STRINGS

- Comparison operators compare individual characters by their position in the **American Standard Code for Information Interchange** (ASCII), which are numeric representations of English characters
- Most string comparison functions compare strings based on their ASCII values

```
$FirstLetter = "A";
$SecondLetter = "B";
if ($SecondLetter > $FirstLetter)
       echo "<p>The second letter is higher in the alphabet
            than the first letter.</p>";
else
       echo "<p>The second letter is lower in the
           alphabet than the first letter.</p>";
```

COMPARING STRINGS (CONTINUED)

- American Standard Code for Information Interchange (ASCII) values range from 0 to 255
- Lowercase letters are represented by the values 97 (“a”) to 122 (“z”)
- Uppercase letters are represented by the values 65 (“A”) to 90 (“Z”)

STRING COMPARISON FUNCTIONS

- The `strcasecmp()` function performs a case-insensitive comparison of strings
- The `strcmp()` function performs a case-sensitive comparison of strings
  - Both functions accept two arguments representing the strings you want to compare and return 0 if the strings are the same
- The `strncasecmp()` and `strncmp()` have additional argument that represent the number of the first n characters to be compared in the strings

DETERMINING THE SIMILARITY OF TWO STRINGS

- The `similar_text()` and `levenshtein()` functions are used to determine the similarity between two strings
- The `similar_text()` function returns the number of characters that two strings have in common
- The `levenshtein()` function returns the number of characters you need to change for two strings to be the same

DETERMINING THE SIMILARITY OF TWO STRINGS - EXAMPLE

- Both functions accept two string arguments representing the values you want to compare

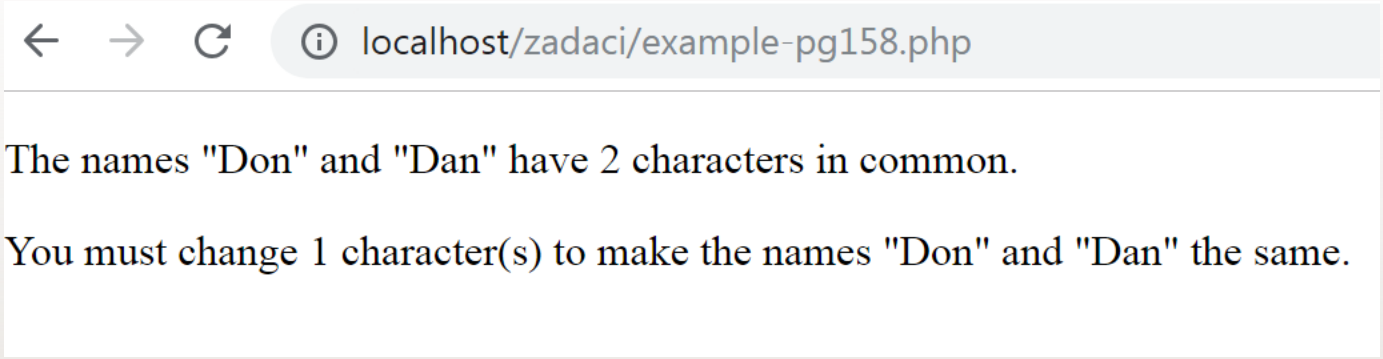
```
$FirstName = "Don";

$SecondName = "Dan";

echo "<p>The names \"$FirstName\" and \"$SecondName\" have " .
      similar_text($FirstName, $SecondName) .
      " characters in common.</p>";

echo "<p>You must change " . levenshtein($FirstName, $SecondName)
     . " character(s) to make the names \"$FirstName\"
     and \"$SecondName\" the same.</p>";
```

DETERMINING THE SIMILARITY OF TWO STRINGS – EXAMPLE OUTPUT



DETERMINING IF WORDS ARE PRONOUNCED SIMILARLY

- The `soundex()` and `metaphone()` functions determine whether two strings are pronounced similarly
- Both functions return a value representing how words sound
  - The `soundex()` function returns a value representing a name's phonetic equivalent
  - The `metaphone()` function returns a code representing an English word's approximate sound

DETERMINING IF WORDS ARE PRONOUNCED SIMILARLY - EXAMPLE

```
$FirstName = "Keen";
$SecondName = "Kean";
$FirstNameSoundsLike = metaphone($FirstName);
$SecondNameSoundsLike = metaphone($SecondName);

if ($FirstNameSoundsLike == $SecondNameSoundsLike)
     echo "<p>The names are pronounced the  same.</p>";
else
     echo "<p>The names are not pronounced the same.</p>";
```

EXAMPLE – WHAT IS THE OUTPUT?

```
<?php
$my_str = "Bob is working";
echo "<p>$my_str</p>";

$my_str[0] = "R";
echo "<p>$my_str</p>";

for($i=0; $i< strlen($my_str); $i++)
     echo "<p>$my_str[$i]</p>";
?>
```

WORKING WITH REGULAR EXPRESSIONS

- **Regular Expressions** are patterns that are used for matching and manipulating strings according to specified rules
- Most commonly these expressions are used to ensure that the user has entered the data in correct format
- PHP supports two types of regular expressions:
  - POSIX Extended
  - Perl Compatible Regular Expressions (PCRE)

WORKING WITH REGULAR EXPRESSIONS - PCRE FUNCTIONS

Function	Description
`preg_match(pattern, string)`	Performs a search for a matching pattern
`preg_match_all(pattern, string)`	Performs a search for a matching pattern, returns the number of matches found
`preg_replace(pattern, replacement, string[, limit])`	Performs a replacement of a matching pattern
`preg_split(pattern, string [, limit])`	Divides an input string into an array of strings that are separated by a specified matching pattern
`preg_grep(pattern, array)`	Filters an input array and returns an array of those elements that match the specified pattern
`preg_quote(string)`	Returns a string that is the input string with any character that has special meaning for a PCRE preceded by the escape character (\)

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WORKING WITH REGULAR EXPRESSIONS

- Pass to the `preg_match()` the regular expression pattern as the first argument and a string containing the text you want to search as the second argument

```
preg_match(pattern, string);
```

- The function returns 1 if the specified pattern is matched or a value of 0 if it is not matched
- The pattern is case-sensitive by default, and need to use following syntax for case-insensitive matching

```
preg_match("/pattern/i", string);
```

WRITING REGULAR EXPRESSION PATTERNS

- A **regular expression pattern** is a special text string that describes a search pattern
- Regular expression patterns consist of literal characters and **metacharacters**, which are special characters that define the pattern-matching rules
- Regular expression patterns are enclosed in opening and closing **delimiters**
  - The most common character delimiter is the forward slash (/)

WRITING REGULAR EXPRESSION PATTERNS - METACHARACTERS

Metacharacter	Description
.	Matches any single character
\	Identifies the next character as a literal value
^	Anchors characters to the beginning of a string
$	Anchors characters to the end of a string
()	Specifies required characters to include in a pattern match
[]	Specifies alternate characters allowed in a pattern match
[^]	Specifies characters to exclude in a pattern match
-	Identifies a possible range of characters to match
|	Specifies alternate sets of characters to include in a pattern match

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MATCHING ANY CHARACTER

- A period (`.`) in a regular expression pattern specifies that the pattern must contain a value at the location of the period
- A return value of `0` indicates that the string does not match the pattern and `1` if it does

```
$ZIP = "015";
preg_match("/...../", $ZIP); // returns 0

$ZIP = "01562";
preg_match("/...../", $ZIP); // returns 1
```

MATCHING CHARACTERS AT THE BEGINNING OR END OF A STRING

- An **anchor** specifies that the pattern must appear at a particular position in a string
- The ^ metacharacter anchors characters to the beginning of a string
- The $ metacharacter anchors characters to the end of a string

```
$URL = "http://www.education.com";
preg_match("/^http/", $URL); // returns 1
```

```
$URL = "http://www.education.com";
preg_match("/com$/", $URL); // returns 1
```

MATCHING SPECIAL CHARACTERS

- To match any metacharacters as literal values in a regular expression, escape the character with a backslash
- For example if we want to ensure that the string contains actual period, can be used

```
$Identifier = "http://www.education.com";

preg_match("/\.com$/", $Identifier);//returns 1
```

MATCHING SPECIAL CHARACTERS

- With some metacharacters the escape sequence is more complicated, so single quotes instead can be used
- For example if we want to ensure that the string contains dollar sign, can be used

```
$Identifier = "$1234.56";

preg_match('/^\$/', $Identifier);//returns 1

preg_match("/^\\\$/", $Identifier);//returns ?
```

SPECIFYING QUANTITY

- Metacharacters that specify the quantity of a match are called **quantifiers**

Quantifier	Description
?	Specifies that the preceding character is optional
+	Specifies that one or more of the preceding characters must match
*	Specifies that zero or more of the preceding characters can match
{*n*}	Specifies that the preceding character repeat exactly *n* times
{*n*,}	Specifies that the preceding character repeat at least *n* times
{,*n*}	Specifies that the preceding character repeat up to *n* times
{*n1*, *n2*}	Specifies that the preceding character repeat at least *n1* times but no more than *n2* times

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SPECIFYING QUANTITY

- A question mark `(?)` quantifier specifies that the preceding character in the pattern is optional (in the following example, the string must begin with 'http' or 'https')

```
$URL = "http://www.education.com";
preg_match("/^https?/", $URL); // returns 1
```

SPECIFYING QUANTITY (CONTINUED)

- The addition (+) quantifier specifies that one or more sequential occurrences of the preceding characters match

  (in the following example, the string must have at least one character)

```
$Name = "Don";
preg_match("/.+/", $Name); // returns 1
```

SPECIFYING QUANTITY (CONTINUED)

- A asterisk (*) quantifier specifies that zero or more sequential occurrences of the preceding characters match
  (in the following examples, the string might begin with one or more leading zeros)

```
NumberString = "00125";
preg_match("/^0*/", $NumberString); //returns 1
---
NumberString = "1234056";
preg_match("/^0*/", $NumberString); //returns 1
```

SPECIFYING QUANTITY (CONTINUED)

- The { } quantifiers specify the number of times that a character must repeat sequentially

(in the following example, the string must contain "ZIP:" plus five characters)

```
preg_match("/ZIP:.{5}$/", " ZIP:01562");
                                  // returns 1
```

- The { } quantifiers can also specify the quantity as a range

(in the following example, the string must contain "ZIP:" plus between five and ten characters)

```
preg_match("/(ZIP:.{5,10})$/", "ZIP:01562-2607");
                                      // returns 1
```

SPECIFYING SUBEXPRESSIONS

- A set of characters enclosed in parentheses are treated as a group -they are referred to as a **subexpression** or **subpattern**
  (in the example below, the 1 and the (nnn) are optional, but if included must be in the following format "1 (nnn)nnn-nnnn")

```
preg_match("/^(1 )?(\(.{3}\))?(.{3})(\-.{4})$/",
                                        "555-1234"); //return 1
preg_match("/^(1 )?(\(.{3}\))?(.{3})(\-.{4})$/",
                                    "(707)555-1234"); //return 1
preg_match("/^(1 )?(\(.{3}\))?(.{3})(\-.{4})$/",
                                  "1 (707)555-1234"); //return 1
```

DEFINING CHARACTER CLASSES

- **Character classes** in regular expressions treat multiple characters as a single item
- Characters enclosed with the ([]) metacharacters represent alternate characters that are allowed in a pattern match

```
preg_match("/analy[sz]e/", "analyse");//returns 1

preg_match("/analy[sz]e/", "analyze");//returns 1

preg_match("/analy[sz]e/", "analyce");//returns 0
```

DEFINING CHARACTER CLASSES (CONTINUED)

- The hyphen metacharacter `(-)` specifies a range of values in a character class
  (the following example ensures that A, B, C, D, or F are the only values assigned to the `$LetterGrade` variable)

```
$LetterGrade = "B";

preg_match("[A-DF]", $LetterGrade);// returns 1
```

DEFINING CHARACTER CLASSES (CONTINUED)

- The `^` metacharacter (placed immediately after the opening bracket of a character class) specifies optional characters to exclude in a pattern match
  (the following example excludes the letter `E` and `G–Z` from an acceptable pattern match in the `$LetterGrade` variable)

```
$LetterGrade = "A";
preg_match("[^EG-Z]", $LetterGrade);
                                    //returns 1
$LetterGrade = "E";
preg_match("[^EG-Z]", $LetterGrade);
                                    //returns 0
```

DEFINING CHARACTER CLASSES – PCRE CHARACTER TYPES

- Also, there are special characters that can be used to represent different types of data

```
preg_match("/^[\w-]+(\.[\w-]+)*@[\w-]+
        (\.[\w-]+)*(\.[a-zA-Z]{2,})$/", $Email);
```

Escape Sequence	Description
\a	alarm (hex 07)
\cx	"control-x", where x is any character
\d	any decimal digit
\D	any character not in \d
\e	escape (hex 1B)
\f	formfeed (hex 0C)
\h	any horizontal whitespace character
\H	any character not in \h
\n	newline (hex 0A)
\r	carriage return (hex 0D)
\s	any whitespace character
\S	any character not in \s
\t	tab (hex 09)
\v	any vertical whitespace character
\V	any character not in \v
\w	any letter, number, or underscore character
\W	any character not in \w

MATCHING MULTIPLE PATTERN CHOICES

- The | metacharacter is used to specify an alternate set of patterns
  - The | metacharacter is essentially the same as using the OR operator to perform multiple evaluations in a conditional expression

```
preg_match("/\.(com|org|net)$/i",
        "http://www.education.gov"); // returns 0

preg_match("/\.(com|org|net)$/i",
         "http://www.education.com"); // returns 1
```

PATTERN MODIFIERS

- **Pattern modifiers** are letters placed after the closing delimiter that change the default rules for interpreting matches
  - The pattern modifier, `i`, indicates that the case of the letter does not matter when searching
  - The pattern modifier, `m`, allows searches across newline characters
  - The pattern modifier, `s`, changes how the . (period) metacharacter works