PHP

INTRODUCTION

PHPcodeisexecutedontheserver.

WhatYouShouldAlreadyKnow

Beforeyoucontinueyoushouldhaveabasicunderstandingofthefollowing:

- HTML
- CSS
- JavaScript

IfyouwanttostudythesesubjectsfirstfindthetutorialsonourHomepage.

WhatisPHP?

- PHPisanacronymfor"PHP:HypertextPreprocessor"
- PHPisawidely-used,opensourcescriptinglanguage
- PHPscriptsareexecutedonthe server
- PHPisfreetodownloadanduse

PHPisanamazingandpopularlanguage!
Itispowerfulenoughtobeatthecoreofthebiggestbloggingsystemonthe web (WordPress)!
Itisdeepenoughtorunlargesocial networks!
Itisalsoeasyenoughtobeabeginner'sfirstserversidelanguage!

WhatisaPHP File?

- PHPfilescancontaintext,HTML,CSS,JavaScript,andPHPcode
- PHPcodeisexecutedontheserver,andtheresultisreturnedtothe browser as plain HTML
- PHPfileshaveextension".php"

WhatCanPHPDo?

- PHPcangeneratedynamicpage content
- PHPcancreate,open,read,write,delete,andclosefilesontheserver
- PHPcancollectform data
- PHPcansendandreceivecookies
- PHPcanadd,delete,modifydatainyourdatabase
- PHPcanbeusedtocontroluser-access
- PHPcanencryptdata

With PHP you are not limited to output HTML. You can output images, PDF files,andevenFlashmovies.Youcanalsooutputanytext,suchasXHTMLand XML.

WhyPHP?

- PHPrunsonvariousplatforms(Windows,Linux,Unix,MacOSX,etc.)
- PHPiscompatiblewithalmostallserversusedtoday(Apache,IIS,etc.)
- PHPsupportsawiderangeof databases
- PHPisfree.DownloaditfromtheofficialPHPresource: www.php.net
- PHPiseasytolearnandrunsefficientlyontheserverside

What'snewinPHP7

- PHP7ismuchfasterthanthepreviouspopularstablerelease(PHP5.6)
- PHP7hasimprovedError Handling
- PHP7supportsstricterTypeDeclarationsforfunctionarguments
- PHP7supportsnewoperators(likethespaceshipoperator:<=>)

INSTALLATION

WhatDoI Need?

TostartusingPHP,youcan:

- FindawebhostwithPHPandMySQLsupport
- InstallawebserveronyourownPC,andtheninstallPHPandMySQL

UseaWebHostWithPHPSupport

If yourserver has activatedsupportfor PHPyoudo not needto do anything. Justcreatesome.phpfiles,placetheminyourwebdirectory,andtheserver will automatically parse them for you.

Youdonotneedtocompileanythingorinstallanyextratools.Because PHP is free, most web hosts offer PHP support.

SetUpPHPonYourOwnPC

However,ifyourserverdoesnotsupportPHP,youmust:

- installaweb server
- installPHP
- installadatabase,suchas MySQL

TheofficialPHPwebsite(PHP.net)hasinstallationinstructionsfor PHP:
http://php.net/manual/en/install.php

PHPOnlineCompiler/Editor

Withw3schools'onlinePHPcompiler,youcaneditPHPcode,andviewthe result in your browser.

```
<!DOCTYPEhtml>
<html>
<body>

<?php
$txt="PHP";echo "I
love $txt!";
?>

</body>
</html>
```

IlovePHP!

Clickonthe"TryitYourself"buttontoseehowitworks.

SYNTAX

APHPscriptisexecutedontheserver,andtheplainHTMLresultissentback to the browser.

BasicPHPSyntax

APHPscriptcanbeplacedanywhereinthedocument.A PHP script starts with <?php and ends with ?>:

<?php
//PHPcodegoeshere?>

ThedefaultfileextensionforPHPfilesis".php".

A PHPfilenormally contains HTMLtags,andsomePHPscriptingcode. Below, wehaveanexampleofasimplePHPfile,withaPHPscriptthatusesabuilt-in PHP function "echo" to output the text "Hello World!" on a web page:

Example:

```
<!DOCTYPEhtml>
<html>
<body>

<h1>MyfirstPHPpage</h1>

<?php
echo"HelloWorld!";
?>

</body>
</html>
```

Note:PHPstatementsendwithasemicolon (;).

PHPCaseSensitivity

InPHP,keywords(e.g. if,else,while,echo,etc.),classes,functions,and userdefined functions are not case-sensitive.

Intheexamplebelow,allthreeechostatementsbelowareequalandlegal:

Example:

```
<!DOCTYPEhtml>
<html>
<body>

<?php
ECHO"HelloWorld!<br>";echo "Hello
World!<br>";
EcHo"HelloWorld!<br>";
?>

</body>
</html>
```

Note: However;allvariablenamesarecase-sensitive!

Look at the example below; only the first statement will display the value of the$colorvariable!Thisisbecause$color,$COLOR,and$coLORaretreatedas three different variables:

Example:

```
<!DOCTYPEhtml>
<html>
<body>

<?php
$color="red";
echo"Mycaris".$color."<br>";echo "My
house is ". $COLOR . "<br>"; echo "My
boat is ". $coLOR . "<br>";
```

```
?>

</body>
</html>
```

COMMENTS

CommentsinPHP

AcommentinPHPcodeisalinethatisnotexecutedasapartoftheprogram. Its only purpose is to be read by someone who is looking at the code.

Commentscanbeusedto:

- Letothersunderstandyour code
- Remind yourself of what you did - Most programmers have experienced comingbacktotheirownworkayearortwolaterandhavingtorefigure outwhattheydid.Commentscanremindyouofwhatyouwerethinking when you wrote the code

PHPsupportsseveralwaysof commenting:

Example:

Syntaxforsingle-linecomments:

```
<!DOCTYPE html>
<html>
<body>

<?php
//Thisisasingle-linecomment

#Thisisalsoasingle-linecomment
?>

</body>
</html>
```

Example:

Syntaxformultiple-linecomments:

```
<!DOCTYPEhtml>
<html>
<body>

<?php
/*
Thisisamultiple-linescommentblockthat spans
over multiple
lines*/
?>

</body>
</html>
```

Example:

Usingcommentstoleaveoutpartsofthe code:

```
<!DOCTYPEhtml>
<html>
<body>

<?php
//Youcanalsousecommentstoleaveoutpartsofacodeline
$x=5/*+15*/+5; echo $x;
?>

</body>
</html>
```

VARIABLES

Variablesare"containers"forstoringinformation.

Creating(Declaring)PHPVariables

InPHP,avariablestartswiththe$sign,followedbythenameofthevariable:

Example:

```
<!DOCTYPEhtml>
<html>
<body>

<?php
$txt="Helloworld!";
$x=5;
$y=10.5;

echo $txt;
echo "<br>";
echo$x;echo
"<br>"; echo
$y;
?>

</body>
</html>
```


- After theexecutionof thestatementsabove,thevariable $txt will holdthe valueHelloworld!,thevariable$xwillholdthevalue5,andthevariable$y will hold the value 10.5.
- **Note:**Whenyouassignatextvaluetoavariable,putquotes aroundthe value.

- **Note:** Unlike other programming languages, PHP has no command for declaringavariable.Itiscreatedthemomentyoufirstassignavaluetoit.

Thinkofvariablesascontainersforstoringdata.

PHPVariables

Avariablecanhaveashortname(likexandy)oramoredescriptivename (age, carname, total_volume).

RulesforPHPvariables:

- Avariablestartswiththe$sign,followedbythenameofthevariable
- Avariablenamemuststartwithaletterortheunderscorecharacter
- Avariablenamecannotstartwitha number
- Avariablenamecanonlycontainalpha-numericcharactersand underscores (A-z, 0-9, and _)
- Variablenamesarecase-sensitive($ageand$AGEaretwodifferent variables)

RememberthatPHP variablenamesarecase-sensitive!

OutputVariables

ThePHPechostatementisoftenusedtooutputdatatothescreen.The following example will show how to output text and a variable:

Example:

```
<!DOCTYPEhtml>
<html>
<body>

<?php
$txt="ditrp.com";echo "I
love $txt!";
?>

</body>
```

```
</html>
```

Thefollowingexamplewillproducethesameoutputastheexampleabove:

Example:

```
<!DOCTYPEhtml>
<html>
<body>

<?php
$txt="ditrp.com";echo "I
love ". $txt . "!";
?>

</body>
</html>
```

Thefollowingexamplewilloutputthesumoftwovariables: Example:

```
<!DOCTYPEhtml>
<html>
<body>

<?php
$x=5;$y=4;
echo $x + $y;
?>
</body>
</html>
```

Note: Youwilllearnmoreabouttheechostatementandhowtooutputdatato the screen in the next chapter.

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PHPisaLoosely TypedLanguage

- Intheexampleabove,noticethatwedidnothavetotellPHPwhichdata type the variable is.
- PHPautomaticallyassociatesadatatypetothevariable,dependingonits value. Since the data types are not set in a strict sense, you can do things like adding a string to an integer without causing an error.
- InPHP7,typedeclarationswereadded.Thisgivesanoptiontospecifythe data type expected when declaring a function, and by enabling the strict requirement, it will throw a "Fatal Error" on a type mismatch.
- Youwilllearnmoreaboutstrictandnon-strictrequirements,anddatatype declarations in the PHP Functions chapter.

VARIABLESSCOPE

PHPVariablesScope

InPHP,variablescanbedeclaredanywhereinthescript.

Thescopeofavariableisthepartofthescriptwherethevariablecanbe referenced/used.

PHPhasthreedifferentvariablescopes:

- local
- global
- static

GlobalandLocal Scope

Avariabledeclared**outside**afunctionhasaGLOBALSCOPEandcanonlybe accessed outside a function: Example:

Variablewithglobalscope:

```
<!DOCTYPEhtml>
<html>
<body>
```

```
<?php
$x=5;//globalscope

functionmyTest(){
 //usingxinsidethisfunctionwillgenerateanerror echo
"<p>Variable x inside function is: $x</p>";
}
myTest();

echo"<p>Variablexoutsidefunctionis:$x</p>";
?>

</body>
</html>
```

Avariabledeclared**within**afunctionhasaLOCALSCOPEandcanonlybe accessed within that function:

Example:
Variablewithlocal scope:

```
<!DOCTYPEhtml>
<html>
<body>

<?php function
myTest(){$x=5;//
local scope
 echo"<p>Variablexinsidefunctionis:$x</p>";
}
myTest();
```

```
//usingxoutsidethefunctionwillgenerateanerrorecho "<p>Variable
x outside function is: $x</p>";
?>

</body>
</html>
```

You can have local variables with the same name in different functions, becauselocalvariablesareonlyrecognizedbythefunctioninwhichtheyare declared.

PHPTheglobal Keyword

Theglobalkeywordisusedtoaccessaglobalvariablefromwithinafunction. To do this, use the global keyword before the variables (inside the function):

Example:

```
<!DOCTYPEhtml>
<html>
<body>

<?php
$x=5;
$y=10;

functionmyTest(){
global $x, $y;
  $y= $x+$y;
}

myTest();
echo$y;//outputs15
?>
```

```
</body>
</html>
```

PHPalsostoresallglobalvariablesinanarraycalled$GLOBALS[*index*].The *index* holds the name of the variable. This array is also accessible from within functions and can be used to update global variables directly. The example above can be rewritten like this:

Example:

```
<!DOCTYPEhtml>
<html>
<body>

<?php
$x=5;
```

```
$y=10;

functionmyTest(){
  $GLOBALS['y']=$GLOBALS['x']+$GLOBALS['y'];
}

myTest();echo
$y;
?>

</body>
</html>
```

PHPThestatic Keyword

Normally, when a function is completed/executed, all of its variables are deleted.However,sometimeswewantalocalvariableNOTtobedeleted.We need it for a further job.

Todothis,usethestatickeywordwhenyoufirstdeclarethevariable: Example:

```
<!DOCTYPEhtml>
<html>
<body>

<?php function
myTest(){static
$x=0;echo$x;
  $x++;
}

myTest();echo
"<br>";
myTest();echo
```

"
";
myTest();
?>
</body>
</html>

Then, each time the function is called, that variable will still have the informationitcontainedfromthelasttimethefunctionwascalled. **Note:** The variable is still local to the function.

ECHOANDPRINTSTATEMENTS

- WithPHP,therearetwobasicwaystogetoutput:echoandprint.
- In this tutorial we use echo or print in almost every example. So, this chaptercontainsalittlemoreinfoaboutthosetwooutputstatements.

PHPechoandprintStatements

- echoandprintaremoreorlessthesame.Theyarebothusedtooutput data to the screen.
- Thedifferencesaresmall:echohasnoreturnvaluewhileprinthasareturn value of 1 so it can be used in expressions. echo can take multiple parameters (although such usage is rare) while print can take one argument. echo is marginally faster than print.

ThePHPechoStatement

Theechostatementcanbeusedwithorwithoutparentheses:echoorecho().

DisplayText

Thefollowingexampleshowshowtooutputtextwiththeechocommand (notice that the text can contain HTML markup):

Example:

<!DOCTYPEhtml>

```
<html>
<body>

<?php
echo "<h2>PHP is Fun!</h2>"; echo
"Helloworld!<br>";echo"I'mabout to
learn PHP!<br>"; echo "This ", "string
", "was ", "made ", "with multiple
parameters.";
?>

</body>
</html>
```

DisplayVariables

Thefollowingexampleshowshowtooutputtextandvariableswiththe echo statement:

Example:

```
<!DOCTYPEhtml>
<html>
<body>

<?php
$txt1="LearnPHP";
$txt2="ditrp.com";
$x=5;
$y=4;

echo "<h2>". $txt1 . "</h2>"; echo
"StudyPHPat".$txt2."<br>";echo
$x+$y;
?>
</body>
</html>
```

ThePHPprintStatement

Theprintstatementcanbeusedwithorwithoutparentheses:printorprint().

DisplayText

Thefollowingexampleshowshowtooutputtextwiththe printcommand (notice that the text can contain HTML markup):

Example:

```
<!DOCTYPEhtml>
<html>
<body>
```

```
<?php
print"<h2>PHPisFun!</h2>";
print"Helloworld!<br>";print
"I'm about to learn PHP!";
?>

</body>
</html>
```

DisplayVariables

Thefollowingexampleshowshowtooutputtextandvariableswiththe print statement:

Example:

```
<!DOCTYPEhtml>
<html>
<body>

<?php
$txt1="LearnPHP";
$txt2="ditrp.com";
$x=5;
$y=4;

print "<h2>". $txt1 . "</h2>"; print
"StudyPHPat".$txt2."<br>";print
$x+$y;
?>

</body>
</html>
```

DATA TYPES

PHPDataTypes

Variablescanstoredataofdifferenttypes,anddifferentdatatypescando different things.

PHPsupportsthefollowingdatatypes:

- String
- Integer
- Float(floatingpointnumbers-alsocalleddouble)
- Boolean
- Array
- Object
- NULL
- Resource

PHPString

Astringisasequenceofcharacters,like"Helloworld!".

Astringcanbeanytextinsidequotes.Youcanusesingleordoublequotes: Example:

```
<?php
$x="Helloworld!";
$y='Hello world!';

echo$x;echo
"<br>"; echo
$y;
?>
```

PHPInteger

Anintegerdatatypeisanon-decimalnumberbetween-2,147,483,648and 2,147,483,647.

Rulesforintegers:

- Anintegermusthaveatleastonedigit
- An integer must not have a decimal point □ Anintegercanbeeither positive or negative
- Integerscanbespecifiedin:decimal(base10),hexadecimal(base16), octal (base 8), or binary (base 2) notation

Inthefollowingexample$xisaninteger.ThePHPvar_dump()functionreturns the data type and value:

Example:

```
<?php
$x=5985;var_dump($x);
?>
```

PHPFloat

Afloat(floatingpointnumber)isanumberwithadecimalpointoranumberin exponential form.

Inthefollowingexample$xisafloat.ThePHPvar_dump()functionreturnsthe data type and value:

Example:

```
<?php
$x=10.365;var_dump($x);
?>
```

PHPBoolean

ABooleanrepresentstwopossiblestates:TRUEorFALSE.

```
$x= true;
$y= false;
```

Booleansareoftenusedinconditionaltesting.Youwilllearnmoreabout conditional testing in a later chapter of this tutorial.

PHPArray

Anarraystoresmultiplevaluesinonesinglevariable.

Inthefollowingexample$carsisanarray.ThePHPvar_dump()function returns the data type and value:

Example:

```
<?php
$cars=array("Volvo","BMW","Toyota");var_dump($cars);
?>
```

Youwilllearnalotmoreaboutarraysinlaterchaptersofthis tutorial.

PHPObject

Classesandobjectsarethetwomainaspectsofobject-orientedprogramming. A class is a template for objects, and an object is an instance of a class. When the individual objects are created, they inherit all the properties and behaviorsfromtheclass,buteachobjectwillhavedifferentvaluesforthe properties.

Let'sassumewehaveaclassnamedCar.ACarcanhavepropertieslikemodel, color, etc. We can define variables like $model, $color, and so on, to hold the values of these properties.

When the individual objects (Volvo, BMW, Toyota, etc.) are created, they inheritallthepropertiesandbehaviorsfromtheclass,buteachobjectwill have different values for the properties.

If you create a __construct()function,PHPwillautomaticallycallthisfunction when you create an object from a class.

Example:

```
<?php
classCar{
public$color;
public$model;
 public function __construct($color,$model) {
  $this->color=$color;
  $this->model=$model;
 }
 publicfunctionmessage(){
  return"Mycarisa ".$this->color."".$this->model."!";
 }
}

$myCar=newCar("black","Volvo");
echo $myCar -> message(); echo
"<br>";
$myCar=newCar("red","Toyota");echo
$myCar->message();
?>
```

PHPNULL Value

Nullisaspecialdatatypewhichcanhaveonlyonevalue:NULL.

AvariableofdatatypeNULLisavariablethathasnovalueassignedtoit. **Tip:** If a variable is created without a value, it is automatically assigned a value of NULL.

VariablescanalsobeemptiedbysettingthevaluetoNULL: Example:

```
<?php
$x="Helloworld!";
$x=null;var_dump($x);
?>
```

PHPResource

ThespecialresourcetypeisnotanactualdatatypeItisthestoringofa reference to functions and resources external to PHP.

AcommonexampleofusingtheresourcedatatypeisadatabasecallWewillnottalkabouttheresourcetypehere,sinceitisanadvancedtopic.

STRINGS

Astringisasequenceofcharacters,like"Helloworld!".

PHPString Functions

Inthis chapterwewilllookatsomecommonlyusedfunctionstomanipulate strings.

strlen()-ReturntheLengthofaString

ThePHPstrlen()functionreturnsthelengthofastring.

Example:

Returnthelengthofthestring"Helloworld!":

```
<?php
echostrlen("Helloworld!");//outputs12
```

```
?>
```

str_word_count()-CountWordsina String

ThePHPstr_word_count()functioncountsthenumberofwordsinastring. Example: Countthenumberofwordinthestring"Helloworld!":

```
<?php
echostr_word_count("Helloworld!");//outputs2
?>
```

strrev()-ReverseaString

ThePHPstrrev()functionreversesastring.Example: Reversethestring"Helloworld!":

```
<?php
echostrrev("Helloworld!");//outputs!dlrowolleH
?>
```

strpos()-Search ForaTextWithina String

ThePHPstrpos()functionsearchesforaspecifictextwithinastring.Ifamatch is found, the function returns the character position of the first match. If no match is found, it will return FALSE.

Example:

Searchforthetext"world"inthestring"Helloworld!":

```
<?php
echostrpos("Helloworld!","world");//outputs6
?>
```

Tip: Thefirstcharacterpositioninastringis0(not1).

str_replace()-ReplaceTextWithina String

ThePHPstr_replace()functionreplacessomecharacterswithsomeother characters in a string.

Example:

Replacethetext"world"with"Dolly":

```
<?phpechostr_replace("world","Dolly","Helloworld!");//outputsHello Dolly! ?>
```

NUMBERS

InthischapterwewilllookindepthintoIntegers,Floats,andNumberStrings.

PHPNumbers

OnethingtonoticeaboutPHPisthatitprovidesautomaticdatatype conversion.

So, if you assign an integer value to a variable, the type of that variable will automaticallybeaninteger.Then,ifyouassignastringtothesamevariable,the type will change to a string.

Thisautomaticconversioncansometimesbreakyourcode.

PHPIntegers

2,256,-256,10358,-179567areallintegers.

Anintegerisanumberwithoutanydecimalpart.

An integer data type is a non-decimal number between -2147483648 and 2147483647 in 32 bit systems, and between -9223372036854775808 and 9223372036854775807in64bitsystems.Avaluegreater(or lower)thanthis,will bestoredasfloat,becauseitexceedsthelimitofaninteger.

Note: Anotherimportantthingtoknowisthatevenif4*2.5is 10,theresultisstored as float, because one of the operands is a float (2.5).

Herearesomerulesfor integers:

- Anintegermusthaveatleastonedigit
- AnintegermustNOThaveadecimalpoint
- Anintegercanbeeitherpositiveor negative
- Integerscanbespecifiedinthreeformats:decimal(10-based),hexadecimal(16-based - prefixed with 0x) or octal (8-based - prefixed with 0)

PHPhasthefollowingpredefinedconstantsforintegers:

- PHP_INT_MAX - The largest integer supported
- PHP_INT_MIN-Thesmallestintegersupported
- PHP_INT_SIZE-Thesizeofanintegerinbytes

PHPhasthefollowingfunctionstocheckifthetypeofavariableis integer:

- is_int()
- is_integer()-aliasofis_int()
- is_long()-aliasofis_int()Example:

Check if the type of a variable is integer:

```
<?php
$x=5985;
var_dump(is_int($x));
```

```
$x=59.85;
var_dump(is_int($x));
?>
```

PHPFloats

Afloatisanumberwithadecimalpointoranumberinexponentialform. 2.0, 256.4, 10.358, 7.64E+5, 5.56E-5 are all floats.

Thefloatdatatypecancommonlystoreavalueupto1.7976931348623E+308(platform dependent), and have a maximum precision of 14 digits.

PHPhasthefollowingpredefinedconstantsforfloats(fromPHP7.2):

- PHP_FLOAT_MAX-Thelargestrepresentablefloatingpointnumber
- PHP_FLOAT_MIN-Thesmallestrepresentablepositivefloatingpointnumber
- -PHP_FLOAT_MAX-Thesmallestrepresentablenegativefloatingpointnumber
- PHP_FLOAT_DIG-Thenumberofdecimaldigitsthatcanberoundedintoa float and back without precision loss
- PHP_FLOAT_EPSILON-Thesmallestrepresentablepositivenumberx,sothatx +1.0!=1.0

PHPhasthefollowingfunctionstocheckifthetypeofavariableis float:

- is_float()
- is_double()-aliasofis_float()

Example

Checkifthetypeofavariableisfloat:

```
<?php
$x=10.365;
var_dump(is_float($x));
?>
```

PHPInfinity

A numeric value that is larger than PHP_FLOAT_MAX is considered infinite.

PHPhasthefollowingfunctionstocheckifanumericvalueisfiniteorinfinite:

- is_finite()
- is_infinite()

However,thePHPvar_dump()functionreturnsthedatatypeandvalue: Example:

Checkifanumericvalueisfiniteor infinite:

```
<?php
$x=1.9e411;
var_dump($x);?>
```

PHPNaN

NaNstandsforNotaNumber.

NaNisusedforimpossiblemathematicaloperations.

PHPhasthefollowingfunctionstocheckifavalueisnotanumber:

- is_nan()

However,thePHPvar_dump()functionreturnsthedatatypeandvalue:Example

Invalidcalculationwillreturna NaNvalue:

```
<?php
$x=acos(8);var_dump($x);
?>
```

PHPNumericalStrings

The PHP is_numeric() function can be used to find whether a variable is numeric. The function returns true if the variable is a number or a numeric string, false otherwise.

Example:

Checkifthevariableisnumeric:

```
<?php
$x=5985;
var_dump(is_numeric($x));

$x="5985";
var_dump(is_numeric($x));

$x="59.85"+100;
```

```
var_dump(is_numeric($x));

$x = "Hello";
var_dump(is_numeric($x));
?>
```

Note: From PHP 7.0: The is_numeric() function will return FALSE for numeric stringsinhexadecimalform(e.g.0xf4c3b00c),astheyarenolongerconsidered as numeric strings.

PHPCastingStringsandFloatstoIntegers

Sometimesyouneedtocastanumericalvalueintoanotherdatatype.The (int), (integer), or intval() function are often used to convert a value to an integer.

Example:

Castfloatandstringtointeger:

```
<?php
//Castfloattoint
$x=23465.768;
$int_cast=(int)$x;
echo $int_cast;

echo"<br>";

//Caststringto int
$x="23465.768";
$int_cast=(int)$x;echo
$int_cast;
?>
```


MATH

PHPhasasetofmathfunctionsthatallowsyoutoperformmathematicaltaskson numbers.

PHPpi()Function

Thepi()functionreturnsthevalueofPI:

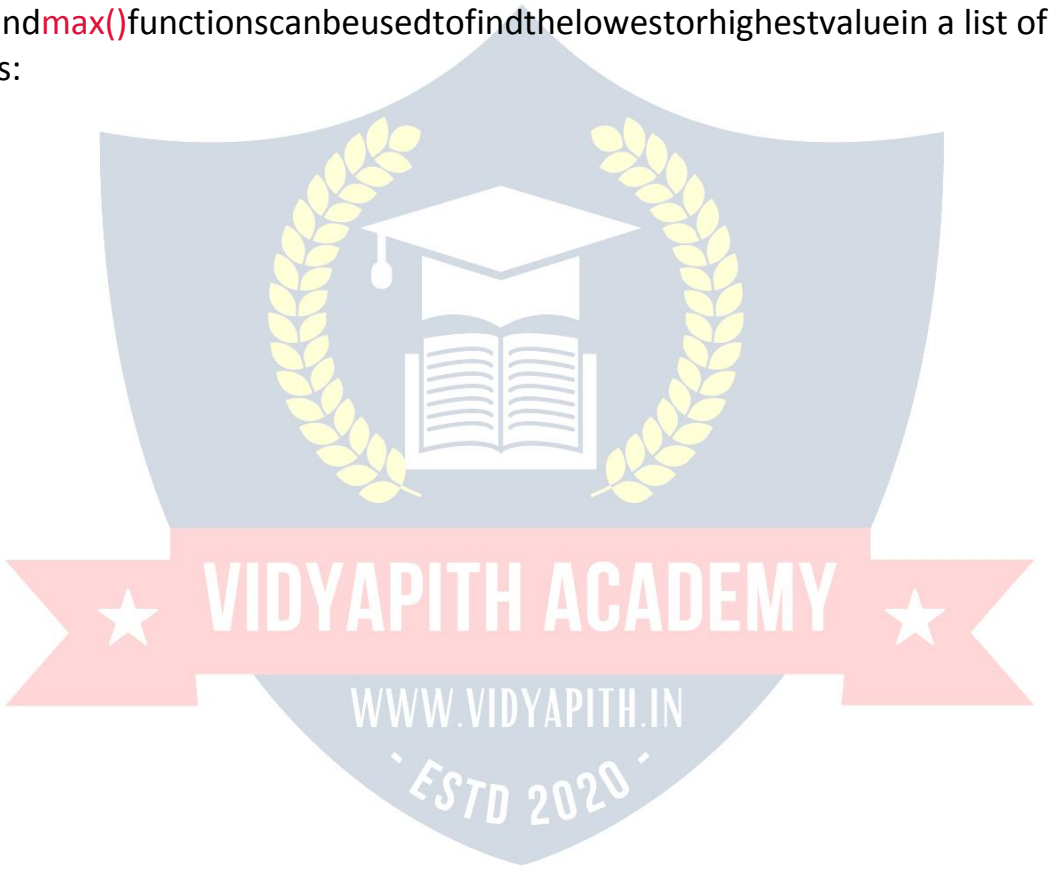
Example:<?php

echo(pi());//returns3.1415926535898

?>

PHPmin()andmax()Functions

Themin()andmax()functionscanbeusedtofindthelowestorhighestvaluein a list of arguments:



Example:<?php
echo(min(0,150,30, 20,-8,-200));//returns-200echo(max(0,
150,30,20,-8,-200));//returns150
?>

PHPabs()Function

Theabs()functionreturnstheabsolute(positive)valueofanumber:

Example:<?php
echo(abs(-6.7));//returns6.7
?>

PHPsqrt()Function

Thesqrt()functionreturnsthesquarerootofanumber:

Example: <?php
echo(sqrt(64));//returns8
?>

PHPround()Function

Theround()functionroundsafloating-pointnumbertoitsnearestinteger:

Example:<?php
echo(round(0.60));//returns1echo(round(0.49));
//returns0
?>

RandomNumbers

Therand()functiongeneratesarandomnumber:

Example:<?php
echo(rand());
?>

To get more control over the random number, you can add the optional *min* and*max*parameterstospecifythelowestintegerandthehighestintegertobe returned.

Forexample,ifyouwantarandomintegerbetween10and100(inclusive),use rand(10, 100):

Example: <?php

echo(rand(10,100));

?>

CONSTANTS

Constantsarelikevariablesexceptthatoncetheyaredefinedtheycannotbechanged or undefined.

PHPConstants

Aconstantisanidentifier(name)forasimplevalue.Thevaluecannotbechanged during the script.

Avalidconstantnamestartswithaletterorunderscore(no$signbeforetheconstant name).

Note: Unlikevariables,constantsareautomaticallyglobalacrosstheentirescript.

CreateaPHP Constant

Tocreateaconstant,usethedefine()function.

Syntax

define(*name*,*value*,*case-insensitive*)Parameters:

- *name*:Specifiesthenameoftheconstant
- *value*:Specifiesthevalueoftheconstant
- *case-insensitive*:Specifieswhethertheconstantnameshouldbe caseinsensitive. Default is false Example:

Createaconstantwitha**case-sensitive**name:

<?php

define("GREETING","WelcometoW3Schools.com!"); echo GREETING;

?>

Example:

Createaconstantwitha**case-insensitive**name:

```
<?php
define("GREETING","WelcometoW3Schools.com!",true);echo
greeting;
?>
```

PHPConstantArrays

InPHP7,youcancreateanArrayconstantusingthedefine()function. Example:

CreateanArray constant:

```
<?php
define("cars",[ "Alf
a Romeo", "BMW",
 "Toyota"
]);
echocars[0];
?>
```

ConstantsareGlobal

Constants are automatically global and can be used across the entire script. Example:

Thisexampleusesaconstantinsideafunction,evenifitisdefinedoutsidethefunction:

```
<?php
define("GREETING","WelcometoW3Schools.com!");

functionmyTest(){
 echo GREETING;
}

myTest();
?>
```

OPERATORS

PHPOperators

Operatorsareusedtoperformoperationsonvariablesandvalues. PHP divides the operators in the following groups:

- Arithmeticoperators
- Assignmentoperators
- Comparisonoperators
- Increment/Decrementoperators
- Logical operators
- Stringoperators
- Arrayoperators
- Conditionalassignmentoperators

PHPArithmetic Operators

The PHP arithmetic operators are used with numeric values to perform common arithmetical operations, such as addition, subtraction, multiplication etc.

Operator	**Name**	**Example**	**Result**
+	Addition	$x+$y	Sumof$xand$y
-	Subtraction	$x-$y	Differenceof$xand$y
*	Multiplication	$x*$y	Productof$xand$y
/	Division	$x/$y	Quotientof$xand$y
%	Modulus	$x% $y	Remainderof$xdividedby$y
**	Exponentiation	$x**$y	Resultofraising$xtothe$y'th power

PHPAssignmentOperators

ThePHPassignmentoperatorsareusedwithnumericvaluestowriteavaluetoa variable. ThebasicassignmentoperatorinPHPis"=".Itmeansthattheleftoperandgets set to the value of the assignment expression on the right.

Assignment	Sameas...	Description
x =y	x =y	Theleftoperandgetssettothevalueofthe expression on the right
x+=y	x =x +y	Addition
x-=y	x =x -y	Subtraction
x*=y	x =x *y	Multiplication
x/=y	x =x /y	Division
x%=y	x =x % y	Modulus

PHPComparisonOperators

ThePHPcomparisonoperatorsareusedtocomparetwovalues(numberorstring):

Operator	Name	Example	Result
==	Equal	$x==$y	Returnstrueif$xisequalto$y
===	Identical	$x=== $y	Returns true if $x is equal to $y, andthey are of the same type
!=	Not equal	$x!=$y	Returnstrueif$xisnotequalto$y
<>	Not equal	$x<>$y	Returnstrueif$xisnotequalto$y
!==	Not identical	$x!== $y	Returnstrueif$xisnotequalto$y, or they are not of the same type
>	Greaterthan	$x>$y	Returnstrueif$xisgreaterthan $y
<	Lessthan	$x<$y	Returnstrueif$xislessthan $y
>=	Greaterthan or equal to	$x>=$y	Returnstrueif$xisgreaterthanor equal to $y
<=	Lessthanor equal to	$x<=$y	Returnstrueif$xislessthanorequal to $y
<=>	Spaceship	$x<=> $y	Returnsanintegerlessthan,equalto, or greater than zero, depending on if $xislessthan,equalto,orgreater than$y.IntroducedinPHP 7.

PHPIncrement/Decrement Operators

The PHP increment operators are used to increment a variable's value.

ThePHPdecrementoperatorsareusedtodecrementavariable'svalue.

Operator	Name	Description
++$x	Pre-increment	Increments$xbyone,thenreturns$x
$x++	Post-increment	Returns$x,thenincrements$xbyone
--$x	Pre-decrement	Decrements$xbyone,thenreturns$x
$x--	Post-decrement	Returns$x,thendecrements$xbyone

PHPLogicalOperators

ThePHPlogicaloperatorsareusedtocombineconditionalstatements.

Operator	Name	Example	Result
and	And	$xand$y	Trueifboth$xand$yaretrue
or	Or	xory	Trueifeitherxoryis true
xor	Xor	$xxor $y	Trueifeitherxoryistrue, but not both
&&	And	$x&&$y	Trueifboth$xand$yaretrue
||	Or	$x\|\|$y	Trueifeitherxoryis true
!	Not	!$x	Trueif$xisnottrue

PHPString Operators

PHPhastwooperatorsthatarespeciallydesignedforstrings.

Operator	Name	Example	Result
.	Concatenation	$txt1. $txt2	Concatenationof$txt1 and $txt2
.=	Concatenation assignment	$txt1.= $txt2	Appends$txt2to$txt1

PHPArrayOperators

ThePHParrayoperatorsareusedtocomparearrays.

Operator	Name	Example	Result

+	Union	$x+$y	Unionof$xand $y
==	Equality	$x==$y	Returnstrueif$xand$yhavethesame key/value pairs
===	Identity	$x=== $y	Returns true if $x and $y have the same key/valuepairsinthesameorderandof the same types
!=	Inequality	$x!=$y	Returnstrueif$xisnotequalto$y
<>	Inequality	$x<>$y	Returnstrueif$xisnotequalto$y
!==	Non-identity	$x!==$y	Returnstrueif$xisnotidenticalto$y

PHPConditionalAssignmentOperators

ThePHPconditionalassignmentoperatorsareusedtosetavaluedependingon conditions:

Operator	**Name**	**Example**	**Result**
?:	Ternary	$x =*expr1*?*expr2*:*expr3*	Returnsthevalueof$x. Thevalueof$xis*expr2* if*expr1*=TRUE.The valueof$xis*expr3*if *expr1*= FALSE
??	Null coalescing	$x=*expr1*??*expr2*	Returns the value of $x. Thevalueof$xis*expr1*if *expr1* exists, and is not NULL. If*expr1*doesnotexist,oris NULL, the value of $x is *expr2*. IntroducedinPHP7

IF...ELSE...ELSEIFSTATEMENTS

Conditionalstatementsareusedtoperformdifferentactionsbasedondifferent conditions.

PHPConditionalStatements

Very often when you write code, you want to perform different actions for differentconditions.Youcanuseconditionalstatementsinyourcodetodothis. In PHP we have the following conditional statements:

- ifstatement-executessomecodeifoneconditionistrue
- if...elsestatement-executessomecodeifaconditionistrueandanothercodeif that condition is false
- if...elseif...elsestatement-executesdifferentcodesformorethantwoconditions
- switchstatement-selectsoneofmanyblocksofcodetobeexecuted

PHP-Theif Statement

Theifstatementexecutessomecodeifoneconditionis true.

Syntax

if(*condition*){
  codetobeexecutedifconditionistrue;
}

Example:

Output"Haveagoodday!"ifthecurrenttime(HOUR)islessthan 20:

```
<?php
$t= date("H");
```

```
if($t<"20"){
  echo"Haveagoodday!";
}
?>
```

PHP-Theif...elseStatement

Theif...elsestatementexecutessomecodeifaconditionistrueandanother code if that condition is false. **Syntax**

```
if(condition){
  codetobeexecutedifconditionistrue;
}else{
  codetobeexecutedifconditionisfalse;
}
```

Example:

Output"Haveagoodday!"ifthecurrenttimeislessthan20,and"Haveagood night!" otherwise: <?php

```
$t= date("H");

if($t<"20"){
  echo"Haveagoodday!";
}else{
  echo"Haveagoodnight!";
}
?>
```

PHP-Theif...elseif...else Statement

Theif...elseif...elsestatementexecutesdifferentcodesformorethantwo conditions. **Syntax**

```
if(condition){
  codetobeexecutedifthisconditionistrue;
}elseif(condition){
```

codetobeexecutediffirstconditionisfalseandthisconditionistrue;}else
{
codetobeexecutedifallconditionsarefalse;
}

Example:

Output "Have a good morning!" if the current time is less than 10, and "Have a good day!" if the current time is less than 20. Otherwise it will output "Have a good night!": <?php

$t= date("H");

if($t<"10"){
echo"Haveagoodmorning!";
}elseif($t<"20"){
echo"Haveagoodday!";
}else{
echo"Haveagoodnight!";
}
?>

SWITCHSTATEMENT

Theswitchstatementisusedtoperformdifferentactionsbasedondifferent conditions.

ThePHPswitchStatement

Usetheswitchstatementto**selectoneofmanyblocksofcodetobe executed**.

Syntax switch (*n*) {case *label1:*

codetobeexecutedif n=label1;

break;

case*label2:*

codetobeexecutedif n=label2;

```
    break;
case label3:
    codetobeexecutedif n=label3;
    break;
    ...
default:
    codetobeexecutedifnisdifferentfromall labels;
}
```

Thisishowitworks:Firstwehaveasingleexpression*n*(mostoftenavariable), that is evaluated once. The value of the expression is then compared with the values for each case in the structure. If there is a match, the block of code associated with that case is executed. Use break to prevent the code from running into the next case automatically. The default statement is used if no match is found.

Example:

```
<?php
$favcolor="red";

switch($favcolor){
case "red":
    echo"Yourfavoritecolorisred!";
break;case "blue":
    echo"Yourfavoritecolorisblue!";
break;case "green":
    echo"Yourfavoritecolorisgreen!";
break;default:
    echo"Yourfavoritecolorisneitherred,blue,norgreen!";
}
?>
```


PHPBREAKANDCONTINUE

PHPBreak

Youhavealreadyseenthe breakstatementusedinanearlierchapterofthis tutorial. It was used to "jump out" of a switch statement.

Thebreakstatementcanalsobeusedtojumpoutofaloop. This example jumps out of the loop when **x** is equal to **4**:

Example:

```
<?php
for($x=0;$x<10;$x++){ if
 ($x == 4) {
   break;
 }
 echo"Thenumberis:$x<br>";
}
?>
```

PHPContinue

Thecontinuestatementbreaksoneiteration(intheloop),ifaspecified condition occurs, and continues with the next iteration in the loop.

Thisexampleskipsthevalueof**4**:

Example:

```
<?php
for($x=0;$x<10;$x++){ if
 ($x == 4) {
   continue;
 }
 echo"Thenumberis:$x<br>";
}
?>
```


BreakandContinueinWhileLoop

Youcanalsousebreakandcontinueinwhileloops: Break

Example:

```
<?php
$x=0;

while($x<10){ if
($x == 4) {
   break;
 }
```

```
 echo"Thenumberis:$x<br>";
 $x++;
}
?>
```

ContinueExample:

```
<?php
$x=0;

while($x<10){ if
($x == 4) {
$x++;
continue;
 }
 echo"Thenumberis:$x<br>";
 $x++;
}
?>
```

PHPGLOBALVARIABLES-SUPERGLOBALS

Superglobalswereintroducedin PHP4.1.0,andarebuilt-invariablesthatare always available in all scopes.

PHPGlobalVariables-Superglobals

Some predefined variables in PHP are "superglobals", which means that they arealwaysaccessible,regardlessofscope-andyoucanaccessthemfromany function, class or file without having to do anything special.

ThePHPsuperglobalvariablesare:

- $GLOBALS
- $_SERVER
- $_REQUEST
- $_POST
- $_GET

- $_FILES
- $_ENV
- $_COOKIE
- $_SESSION

Thenextchapterswillexplainsomeofthesuperglobals,andtherestwillbe explained in later chapters.

PHPSUPERGLOBAL-$_GET

Superglobalvariablesarebuilt-invariablesthatarealwaysavailableinall scopes.

PHP$_GET

PHP$_GETisaPHPsuperglobalvariablewhichisusedtocollectformdata after submitting an HTML form with method="get".

$_GETcanalsocollectdatasentintheURL.

AssumewehaveanHTMLpagethatcontainsahyperlinkwithparameters:

```
<html>
<body>

<ahref="test_get.php?subject=PHP&web=W3schools.com">Test$GET</a>

</body>
</html>
```

Whenauser clicks onthelink "Test$GET",theparameters "subject"and "web"aresentto"test_get.php",andyoucanthenaccesstheirvaluesin "test_get.php" with $_GET.

Theexamplebelowshowsthecodein"test_get.php":Example:

```
<html>
<body>

<?php
```

```
echo"Study".$_GET['subject']."at".$_GET['web'];
?>

</body>
</html>
```

Tip: Youwilllearnmoreabout$_GETinthePHPFormschapter.

PHPREGULAREXPRESSIONS

WhatisaRegular Expression?

A regular expression is a sequence of characters that forms a search pattern. Whenyousearchfordatainatext,youcanusethissearchpatterntodescribe what you are searching for.

Aregularexpressioncanbeasinglecharacter,oramorecomplicatedpattern. Regular expressions can be used to perform all types of text search and text replace operations.

Syntax

InPHP,regularexpressionsarestringscomposedofdelimiters,apatternand optional modifiers.

```
$exp="/DITRPSELFSTUDY/i";
```

Intheexampleabove, /is the **delimiter**, *w3schools* is the**pattern** thatis being searched for, and i is a **modifier** that makes the search case-insensitive. The delimitercanbeanycharacterthatisnotaletter,number,backslashorspace. The most common delimiter is the forward slash (/), but when your pattern contains forward slashes it is convenient to choose other delimiters such as # or ~.

RegularExpressionFunctions

PHP provides a variety of functions that allow you to use regular expressions. Thepreg_match(),preg_match_all()andpreg_replace()functionsaresomeof the most commonly used ones:

Function	**Description**
preg_match()	Returns1ifthepatternwasfoundinthestringand0if not
preg_match_all()	Returnsthenumberoftimesthepatternwasfoundin the string, which may also be 0
preg_replace()	Returnsanewstringwherematchedpatternshavebeen replaced with another string

Usingpreg_match()

Thepreg_match()functionwilltellyouwhetherastringcontainsmatchesofa pattern.

Example:

Usearegularexpressiontodoacase-insensitivesearchfor"w3schools"ina string:

```
<?php
$str="VisitW3Schools";
$pattern="/w3schools/i";
echopreg_match($pattern,$str);//Outputs1
?>
```

Usingpreg_match_all()

Thepreg_match_all()functionwilltellyouhowmanymatcheswerefoundfor a pattern in a string.

Example:

Usearegularexpressiontodoacase-insensitivecountofthenumberof occurrences of "ain" in a string:

```
<?php
$str="TherainінSPAINfallsmainlyontheplains.";
$pattern="/ain/i";
echopreg_match_all($pattern,$str);//Outputs4
?>
```

Usingpreg_replace()

Thepreg_replace()functionwillreplaceallofthematchesofthepatternina string with another string.

Example:

Useacase-insensitiveregularexpressiontoreplaceMicrosoftwithW3Schools in a string:

```
<?php
```

```
$str="VisitMicrosoft!";
$pattern="/microsoft/i";
echopreg_replace($pattern,"W3Schools",$str);//Outputs"Visit
W3Schools!"?>
```

RegularExpressionModifiers

Modifierscanchangehowasearchis performed.

Modifier	**Description**
i	Performsacase-insensitivesearch
m	Performsamultilinesearch(patternsthatsearchforthe beginningorendofastringwillmatchthebeginningorend of each line)
u	EnablescorrectmatchingofUTF-8encodedpatterns

RegularExpressionPatterns

Bracketsareusedtofindarangeofcharacters:

Expression	**Description**
[abc]	Findonecharacterfromtheoptionsbetweenthebrackets
[^abc]	FindanycharacterNOTbetweenthebrackets
[0-9]	Findonecharacterfromtherange0to9

Metacharacters

Metacharactersarecharacterswithaspecialmeaning:

Metacharacter	**Description**
|	Findamatchforanyoneofthepatternsseparatedby|as in: cat|dog|fish
.	Findjustoneinstanceofanycharacter
^	Findsamatchasthebeginningofastringasin:^Hello
$	Findsamatchatthe endofthestringasin:World$
\d	Findadigit
\s	Findawhitespacecharacter

\b	Findamatchatthebeginningofawordlikethis:\bWORD, or at the end of a word like this: WORD\b
\uxxxx	FindtheUnicodecharacterspecifiedbythehexadecimal number xxxx

Quantifiers

Quantifiersdefinequantities:

Quantifier	**Description**
n+	Matchesanystringthatcontainsatleastone*n*
n*	Matchesanystringthatcontainszeroormoreoccurrencesof *n*
n?	Matchesanystringthatcontainszerooroneoccurrencesof *n*
n{x}	Matchesanystringthatcontainsasequenceof*X**n*'s
n{x,y}	Matchesanystringthatcontainsasequenceof*X*to*Y* *n*'s
n{x,}	Matchesanystringthatcontainsasequenceofatleast*X**n*'s

Note: If your expression needs to search for one of the special characters you can use a backslash (\ ) to escape them. For example, to search for one or morequestionmarksyoucanusethefollowingexpression:$pattern='/\?+/';

Grouping

Youcanuseparentheses()toapplyquantifierstoentirepatterns.Theyalso can be used to select parts of the pattern to be used as a match.

Example:

Usegroupingtosearchfortheword"banana"bylookingfor *ba*followedby two instances of *na*:

```
<?php
$str="Applesandbananas.";
$pattern="/ba(na){2}/i";
echopreg_match($pattern,$str);//Outputs1
?>
```

SQL SEVER

INTRODUCTIONTOSQL

SQLisastandardlanguageforaccessingandmanipulatingdatabases.

WhatisSQL?

- SQLstandsforStructuredQueryLanguage
- SQLletsyouaccessandmanipulatedatabases
- SQL became a standard of the American National Standards Institute (ANSI)in1986,andoftheInternationalOrganizationforStandardization (ISO) in 1987

WhatCanSQLdo?

- SQLcanexecutequeriesagainstadatabase
- SQLcanretrievedatafromadatabase
- SQLcaninsertrecordsina database
- SQLcanupdaterecordsinadatabase
- SQLcandeleterecordsfroma database
- SQLcancreatenew databases
- SQLcancreatenewtablesina database
- SQLcancreatestoredproceduresina database
- SQLcancreateviewsina database
- SQLcansetpermissionsontables,procedures,andviews

SQLisaStandard-BUT....

AlthoughSQLisanANSI/ISOstandard,therearedifferentversionsoftheSQL language.

However,tobecompliantwiththeANSIstandard,theyallsupportatleastthe major commands (such as SELECT, UPDATE, DELETE, INSERT, WHERE) in a similar manner.

Note: MostoftheSQLdatabaseprogramsalsohavetheirownproprietary extensions in addition to the SQL standard!

UsingSQLinYourWebSite

Tobuildawebsitethatshowsdatafromadatabase,youwillneed:

- AnRDBMSdatabaseprogram(i.e.MSAccess,SQLServer,MySQL)
- Touseaserver-sidescriptinglanguage,likePHPorASP
- TouseSQLtogetthedatayouwant
- TouseHTML/CSStostylethepage

RDBMS

- RDBMSstandsforRelationalDatabaseManagementSystem.
- RDBMSisthebasisforSQL,andforallmoderndatabasesystemssuchas MS SQL Server, IBM DB2, Oracle, MySQL, and Microsoft Access.
- ThedatainRDBMSisstoredindatabaseobjectscalledtables.Atableisa collection of related data entries and it consists of columns and rows.
- Lookatthe"Customers"table:

Example:

SELECT*FROMCustomers;Result:

Number of Records: 10

Customer ID	Customer Name	Contact Name	Address	City	Postal Code	Country
1	Alfreds Futterkiste	Maria Anders	ObereStr.57	Berlin	12209	Germany
2	Ana Trujillo Emparedados y helados	Ana Trujillo	Avda.dela Constitución 2222	México D.F.	05021	Mexico
3	Antonio Moreno Taquería	Antonio Moreno	Mataderos 2312	México D.F.	05023	Mexico
4	Aroundthe Horn	Thomas Hardy	120Hanover Sq.	London	WA1 1DP	UK

5	Berglunds snabbköp	Christina Berglund	Berguvsvägen 8	Luleå	S-958 22	Sweden
6	Blauer See Delikatessen	Hanna Moos	Forsterstr. 57	Mannheim	68306	Germany
7	Blondelpère et fils	Frédérique Citeaux	24,place Kléber	Strasbourg	67000	France
8	Bólido Comidas preparadas	Martín Sommer	C/Araquil,67	Madrid	28023	Spain
9	Bon app'	Laurence Lebihans	12,ruedes Bouchers	Marseille	13008	France
10	Bottom-Dollar Marketse	Elizabeth Lincoln	23Tsawassen Blvd.	Tsawassen	T2F 8M4	Canada

- Everytableis brokenupinto smallerentities calledfields. Thefields inthe Customers table consist of CustomerID, CustomerName, ContactName, Address,City,PostalCodeandCountry.Afieldisacolumninatablethatis designedto maintain specific information about every recordin the table. Arecord,alsocalledarow,iseachindividualentrythatexistsinatable. For example, there are 91records inthe above Customers table. A record is a horizontal entity in a table.
- Acolumnisaverticalentityinatablethatcontainsallinformation associated with a specific field in a table.

SQL SYNTAX

DatabaseTables

- Adatabasemostoftencontainsoneormoretables.Eachtableisidentified by a name (e.g. "Customers" or "Orders"). Tables contain records (rows) with data.
- Inthistutorialwewillusethewell-knownNorthwindsampledatabase (included in MS Access and MS SQL Server).
- Belowisaselectionfromthe"Customers"table:

Customer ID	CustomerName	Contact Name	Address	City	Postal Code	Country

1	Alfreds Futterkiste	Maria Anders	ObereStr.57	Berlin	12209	Germany
2	Ana Trujillo Emparedadosy helados	Ana Trujillo	Avda.dela Constitución 2222	México D.F.	05021	Mexico
3	Antonio Moreno Taquería	Antonio Moreno	Mataderos 2312	México D.F.	05023	Mexico
4	Aroundthe Horn	Thomas Hardy	120Hanover Sq.	London	WA1 1DP	UK
5	Berglunds snabbköp	Christina Berglund	Berguvsvägen 8	Luleå	S-958 22	Sweden

- Thetableabovecontainsfiverecords(oneforeachcustomer)andseven columns (CustomerID, CustomerName, ContactName, Address, City, PostalCode, and Country).

SQLStatements

MostoftheactionsyouneedtoperformonadatabasearedonewithSQL statements.

ThefollowingSQLstatementselectsalltherecordsinthe"Customers"table:

Example:

```
SELECT*FROMCustomers;
```

InthistutorialwewillteachyouallaboutthedifferentSQLstatements.

KeepinMind That...

 SQLkeywordsareNOTcasesensitive:selectisthesameasSELECTIn this tutorial we will write all SQL keywords in upper-case.

Semicolonafter SQL Statements?

- Somedatabasesystemsrequireasemicolonattheendofeach SQL statement.
- Semicolonisthestandardwaytoseparateeach SQLstatementindatabase systems that allow more than one SQL statement to be executed in the same call to the server.
- Inthistutorial,wewillusesemicolonattheendofeach SQLstatement.

SomeoftheMostImportantSQL Commands

- SELECT-extractsdatafroma database
- UPDATE-updatesdatainadatabase
- DELETE-deletesdatafroma database
- INSERTINTO-insertsnewdataintoa database
- CREATEDATABASE-createsanewdatabase
- ALTERDATABASE-modifiesadatabase
- CREATETABLE-createsanewtable
- ALTERTABLE-modifiesatable
- DROPTABLE-deletesatable
- CREATE INDEX - creates an index (search key) DROPINDEX-deletes an index

SQLSELECTSTATEMENT

TheSQLSELECTStatement

The SELECT statement is used to select data from a database.

Thedatareturnedis storedinaresulttable,calledtheresult-set.

SELECTSyntax:

SELECT*column1*,*column2*,...FROM
table_name;

Here,column1,column2,...arethefieldnamesofthetableyouwanttoselect data from. If you want to select all the fields available in the table, use the following syntax:

SELECT*FROM*table_name*;

DemoDatabase

Belowisaselectionfromthe"Customers"tableintheNorthwindsample database:

Customer ID	Customer Name	Contact Name	Address	City	Postal Code	Country
1	Alfreds Futterkiste	Maria Anders	ObereStr.57	Berlin	12209	Germany
2	Ana Trujillo Emparedadosy helados	Ana Trujillo	Avda.dela Constitución 2222	México D.F.	05021	Mexico
3	Antonio Moreno Taquería	Antonio Moreno	Mataderos 2312	México D.F.	05023	Mexico
4	Aroundthe Horn	Thomas Hardy	120Hanover Sq.	London	WA1 1DP	UK
5	Berglunds snabbköp	Christina Berglund	Berguvsvägen 8	Luleå	S-958 22	Sweden

SELECTColumnExample

ThefollowingSQLstatementselectsthe"CustomerName"and"City"columns from the "Customers" table:

Example:

SELECTCustomerName,CityFROMCustomers;

Result:

NumberofRecords:9

CustomerName	City
AlfredsFutterkiste	Berlin
AnaTrujilloEmparedadosyhelados	MéxicoD.F.
AntonioMorenoTaquería	MéxicoD.F.
AroundtheHorn	London
Berglundssnabbköp	Luleå
BlauerSeeDelikatessen	Mannheim
Blondelpèreetfils	Strasbourg
BólidoComidaspreparadas	Madrid
Bonapp'	Marseille

SQLSELECTDISTINCTStatement

TheSQLSELECTDISTINCT Statement

- TheSELECTDISTINCTstatementisusedtoreturnonlydistinct(different) values.
- Insideatable,acolumnoftencontainsmanyduplicatevalues;and sometimes you only want to list the different (distinct) values.

SELECTDISTINCTSyntax:

SELECTDISTINCT*column1,column2,...*

FROM*table_name*;

DemoDatabase

Belowisaselectionfromthe"Customers"tableintheNorthwindsample database:

Customer ID	CustomerName	Contact Name	Address	City	Postal Code	Country
1	Alfreds Futterkiste	Maria Anders	ObereStr.57	Berlin	12209	Germany

2	Ana Trujillo Emparedadosy helados	Ana Trujillo	Avda.dela Constitución 2222	México D.F.	05021	Mexico
3	Antonio Moreno Taquería	Antonio Moreno	Mataderos 2312	México D.F.	05023	Mexico
4	Aroundthe Horn	Thomas Hardy	120Hanover Sq.	London	WA1 1DP	UK
5	Berglunds snabbköp	Christina Berglund	Berguvsvägen 8	Luleå	S-958 22	Sweden

SELECTExample WithoutDISTINCT

ThefollowingSQLstatementselectsall(includingtheduplicates)valuesfrom the "Country" column in the "Customers" table:

Example:

SELECTCountryFROMCustomers;Result:

Country
Germany
Mexico
Mexico
UK

Now,letususetheSELECTDISTINCTstatementandseethe result.

SELECTDISTINCTExamples

ThefollowingSQLstatementselectsonlytheDISTINCTvaluesfromthe "Country" column in the "Customers" table:

Example:

SELECTDISTINCTCountryFROMCustomers;Result:

Country
Germany
Mexico

UK
Sweden

ThefollowingSQLstatementliststhenumberofdifferent(distinct)customer countries:

Example:

```
SELECTCOUNT(DISTINCTCountry)FROMCustomers;
```

Note: The example above will not work in Firefox! Because COUNT(DISTINCT*column_name*)isnotsupportedinMicrosoftAccess databases. Firefox is using Microsoft Access in our examples.

HereistheworkaroundforMSAccess:

Example:

```
SELECTCount(*)ASDistinctCountries
FROM(SELECTDISTINCTCountryFROMCustomers);
```

SQLWHERE CLAUSE

TheSQLWHERE Clause

TheWHEREclauseisusedtofilterrecords.

Itisusedtoextractonlythoserecordsthatfulfillaspecifiedcondition.

WHERE Syntax:

```
SELECTcolumn1,column2,...
FROMtable_name
WHEREcondition;
```

Note: TheWHEREclauseisnotonlyusedinSELECTstatements,itisalsoused in UPDATE, DELETE, etc.!

DemoDatabase

Belowisaselectionfromthe"Customers"tableintheNorthwindsample database:

Customer ID	Customer Name	Contact Name	Address	City	Postal Code	Country
1	Alfreds Futterkiste	Maria Anders	ObereStr.57	Berlin	12209	Germany
2	Ana Trujillo Emparedadosy helados	Ana Trujillo	Avda.dela Constitución 2222	México D.F.	05021	Mexico
3	Antonio Moreno Taquería	Antonio Moreno	Mataderos 2312	México D.F.	05023	Mexico
4	Aroundthe Horn	Thomas Hardy	120Hanover Sq.	London	WA1 1DP	UK
5	Berglunds snabbköp	Christina Berglund	Berguvsvägen 8	Luleå	S-958 22	Sweden

WHEREClauseExample

ThefollowingSQLstatementselectsallthecustomersfromthecountry "Mexico", in the "Customers" table:

Example:

```
SELECT*FROMCustomers
WHERE  Country='Mexico';
```

Result:

NumberofRecords:5

Customer ID	CustomerName	Contact Name	Address	City	Postal Code	Country
2	Ana Trujillo Emparedadosy helados	Ana Trujillo	Avda.dela Constitución 2222	México D.F.	05021	Mexico
3	AntonioMoreno Taquería	Antonio Moreno	Mataderos 2312	México D.F.	05023	Mexico

13	Centrocomercial Moctezuma	Francisco Chang	Sierras de Granada9993	México D.F.	05022	Mexico
58	PericlesComidas clásicas	Guillermo Fernández	CalleDr.Jorge Cash 321	México D.F.	05033	Mexico
80	Tortuga Restaurante	Miguel Angel Paolino	Avda.Azteca 123	México D.F.	05033	Mexico

TextFieldsvs.NumericFields

SQLrequiressinglequotesaroundtextvalues(mostdatabasesystemswillalso allow double quotes).

However,numericfieldsshouldnotbeenclosedinquotes: Example:

SELECT*FROMCustomers

WHERE CustomerID=1;

OperatorsinTheWHERE Clause

ThefollowingoperatorscanbeusedintheWHEREclause:

Operator	Description	Example
=	Equal	Try it
>	Greaterthan	Try it
<	Lessthan	Try it
>=	Greaterthanorequal	Try it
<=	Lessthanorequal	Try it
<>	Not equal. Note: In some versions of SQL this operator may be written as !=	Try it
BETWEEN	Betweenacertainrange	Try it
LIKE	Searchforapattern	Try it
IN	Tospecifymultiplepossiblevaluesforacolumn	Try it

SQLAND,ORandNOT Operators

TheSQLAND,ORandNOT Operators

TheWHEREclausecanbecombinedwithAND,OR,andNOToperators.The AND and OR operators are used to filter records based on more than one condition:

- TheANDoperatordisplaysarecordifalltheconditionsseparated by AND are TRUE.
- TheORoperatordisplaysarecordifanyoftheconditionsseparated by OR is TRUE.

TheNOToperatordisplaysarecordifthecondition(s)isNOTTRUE.

AND Syntax:

SELECT*column1,column2,...*
FROM*table_name*
WHERE*condition1*AND*condition2*AND*condition3 ...*;

ORSyntax:

SELECT*column1,column2,...*
FROM*table_name*
WHERE*condition1*OR*condition2*OR*condition3...*;

NOTSyntax:

SELECT*column1,column2,...*
FROM*table_name*
WHERENOT*condition*;

DemoDatabase

Thetablebelowshowsthecomplete"Customers"tablefromtheNorthwind sample database:

Customer ID	Customer Name	Contact Name	Address	City	Postal Code	Country

1	Alfreds Futterkiste	Maria Anders	Obere Str.57	Berlin	12209	Germany
2	Ana Trujillo Emparedados y helados	Ana Trujillo	Avda.de la Constitución 2222	México D.F.	05021	Mexico
3	Antonio Moreno Taquería	Antonio Moreno	Matadores 2312	México D.F.	05023	Mexico
4	AroundtheHorn	Thomas Hardy	120 Hanover Sq.	London	WA1 1DP	UK
5	Berglunds snabbköp	Christina Berglund	Berguvsvägen 8	Luleå	S-958 22	Sweden
6	Blauer See Delikatessen	Hanna Moos	Forsterstr.57	Mannheim	68306	Germany
7	Blondel père et fils	Frédérique Citeaux	24,place Kléber	Strasbourg	67000	France

8	Bólido Comidas preparadas	Martín Sommer	C/ Araquil, 67	Madrid	28023	Spain
9	Bonapp'	Laurence Lebihans	12,ruedes Bouchers	Marseille	13008	France
10	Bottom-Dollar Marketse	Elizabeth Lincoln	23 Tsawassen Blvd.	Tsawassen	T2F 8M4	Canada
11	B's Beverages	Victoria Ashworth	Fauntleroy Circus	London	EC2 5NT	UK
12	Cactus Comidasparallevar	Patricio Simpson	Cerrito333	Buenos Aires	1010	Argentina
13	Centro comercial Moctezuma	Francisco Chang	Sierrasde Granada 9993	México D.F.	05022	Mexico
14	Chopsuey Chinese	Yang Wang	Hauptstr .29	Bern	3012	Switzerland
15	Comércio Mineiro	Pedro Afonso	Av. dos Lusíadas,23	São Paulo	05432-043	Brazil
16	Consolidated Holdings	ElizabethBrown	Berkeley Gardens12 Brewery	London	WX1 6LT	UK
17	Drachenblut Delikatessend	Sven Ottlieb	Walserweg 21	Aachen	52066	Germany

18	Dumonde entier	Janine Labrune	67,ruedes Cinquante Otages	Nantes	44000	France
19	Eastern Connection	Ann Devon	35King George	London	WX3 6FW	UK
20	ErnstHandel	Roland Mendel	Kirchgasse6	Graz	8010	Austria
21	Familia Arquibaldo	Aria Cruz	Rua Orós,92	São Paulo	05442-030	Brazil
22	FISSA FabricaInter. Salchicha s S.A.	Diego Roel	C/ Moralzar zal, 86	Madrid	28034	Spain
23	Folies gourman des	Martine Rancé	184,chaussé edeTournai	Lille	59000	France
24	Folkochfä HB	Maria Larsson	Åkergatan24	Bräcke	S-844 67	Sweden
25	Frankenv ersand	Peter Franken	Berliner Platz43	Münche n	80805	Germany
26	France restauration	Carine Schmitt	54,rue Royale	Nantes	44000	France
27	FranchiS.p.A.	Paolo Accorti	Via MonteBianco 34	Torino	10100	Italy
28	Furia Bacalhaue Frutos do Mar	Lino Rodrigu ez	Jardimdas rosasn.32	Lisboa	1675	Portugal

29	Galería del gastrónomo	Eduardo Saavedra	Ramblade Cataluña ,23	Barcelona	08022	Spain
30	Godos Cocina Típica	José Pedro Freyre	C/ Romero,33	Sevilla	41101	Spain
31	Gourmet Lanchonetes	André Fonseca	Av. Brasil, 442	Campinas	04876-786	Brazil
32	Great Lakes Food Market	Howard Snyder	2732 Baker Blvd.	Eugene	97403	USA
33	GROSELLA-Restaurante	Manuel Pereira	5ª Ave. LosPalos Grandes	Caracas	1081	Venezuela
34	Hanari Carnes	Mario Pontes	RuadoPaço, 67	Rio de Janeiro	05454-876	Brazil
35	HILARIÓN-Abastos	Carlos Hernández	Carrera22con Ave. Carlos Soublette#8-35	San Cristóbal	5022	Venezuela
36	Hungry Coyote Import Store	Yoshi Latimer	City Center Plaza516 Main St.	Elgin	97827	USA
37	HungryOwl All-Night Grocers	Patricia McKenna	8 Johnstown Road	Cork		Ireland

38	Island Trading	Helen Bennett	Garden House Crowther Way	Cowes	PO31 7PJ	UK
39	Königlich Essen	Philip Cramer	Maubels tr. 90	Branden burg	14776	German y
40	La corne d'abondance	Daniel Tonini	67,avenuede l'Europe	Versaille s	78000	France
41	Lamaison d'Asie	Annette Roulet	1 rue AlsaceLorraine	Toulouse	31000	France
42	Laughing Bacchus Wine Cellars	Yoshi Tannam uri	1900OakSt.	Vancouv er	V3F 2K1	Canada
43	Lazy K Kountry Store	John Steel	12Orchestra Terrace	Walla Walla	99362	USA
44	Lehmann s Marktstand	Renate Messne r	Magazinweg 7	Frankfur t a.M.	60528	German y
45	Let'sStop N Shop	Jaime Yorres	87Polk St.Suite5	San Francisc o	94117	USA
46	LILA-Supermer cado	Carlos Gonzále z	Carrera52con Ave. Bolívar#65-98 Llano Largo	Barquisi meto	3508	Venezue la

47	LINODelicatesses	Felipe Izquierdo	Ave.5de Mayo Porlamar	I.de Margarita	4980	Venezuela
48	Lonesome Pine Restaurant	Fran Wilson	89Chiaroscuro Rd.	Portland	97219	USA
49	Magazzini Alimentari Riuniti	Giovanni Rovelli	ViaLudovicoil Moro 22	Bergamo	24100	Italy
50	Maison Dewey	Catherine Dewey	Rue JosephBens 532	Bruxelles	B-1180	Belgium
51	Mère Paillarde	Jean Fresnière	43rue St. Laurent	Montréal	H1J 1C3	Canada
52	Morgenstern Gesundkost	AlexanderFeuer	Heerstr.22	Leipzig	04179	Germany
53	North/South	Simon Crowther	South House 300 Queensbridge	London	SW7 1RZ	UK
54	Océano Atlántico Ltda.	Yvonne Moncada	Ing. Gustavo Moncada8585Piso 20-A	Buenos Aires	1010	Argentina

55	Old World Delicatessen	Rene Phillips	2743Bering St.	Anchorage	99508	USA
56	Ottilies Käseladen	Henriette Pfalzheim	Mehrheimerstr.369	Köln	50739	Germany
57	Paris spécialités	Marie Bertrand	265,boulevard Charonne	Paris	75012	France
58	Pericles Comidas clásicas	Guillermo Fernández	CalleDr.Jorge Cash 321	México D.F.	05033	Mexico
59	Piccolound mehr	Georg Pipps	Geislweg14	Salzburg	5020	Austria
60	Princesa Isabel Vinhoss	Isabel de Castro	Estrada da saúden.58	Lisboa	1756	Portugal
61	Que Delícia	Bernardo Batista	Rua da Panificadora, 12	Rio de Janeiro	02389-673	Brazil
62	Queen Cozinha	Lúcia Carvalho	Alamedados	São Paulo	05487-020	Brazil
			Canàrios,891			
63	QUICK-Stop	Horst Kloss	Tauchers traße 10	Cunewalde	01307	Germany
64	Rancho grande	Sergio Gutiérrez	Av. del Libertador 900	Buenos Aires	1010	Argentina

65	Rattlesnake Canyon Grocery	Paula Wilson	2817Milton Dr.	Albuquerque	87110	USA
66	Reggiani Caseifici	Maurizio Moroni	Strada Provinciale 124	Reggio Emilia	42100	Italy
67	Ricardo Adocicados	Janete Limeira	Av. Copacabana, 267	Rio de Janeiro	02389-890	Brazil
68	Richter Supermarkt	Michael Holz	Grenzacherweg237	Genève	1203	Switzerland
69	Romeroy tomillo	Alejandra Camino	Gran Vía,1	Madrid	28001	Spain
70	Santé Gourmet	Jonas Bergulfsen	Erling Skakkesgate 78	Stavern	4110	Norway
71	Save-a-lot Markets	Jose Pavarotti	187 SuffolkLn.	Boise	83720	USA
72	Seven Seas Imports	Hari Kumar	90 WadhurstRd.	London	OX15 4NB	UK
73	Simonsbistro	Jytte Petersen	Vinbæltet 34	København	1734	Denmark
74	Spécialités du monde	Dominique Perrier	25, rue Lauriston	Paris	75016	France
75	Split Rail Beer&Ale	Art Braunschweiger	P.O.Box555	Lander	82520	USA

76	Suprêmes délices	Pascale Cartrain	Boulevard Tirou, 255	Charleroi	B-6000	Belgium
77	TheBig Cheese	Liz Nixon	89 Jefferson Way Suite2	Portland	97201	USA
78	The Cracker Box	Liu Wong	55 Grizzly Peak Rd.	Butte	59801	USA
79	Toms Spezialitäten	Karin Josephs	Luisenstr.48	Münster	44087	Germany
80	Tortuga Restaurante	Miguel Angel Paolino	Avda. Azteca 123	México D.F.	05033	Mexico
81	Tradição Hipermercados	Anabela Domingues	Av.Inêsde Castro,414	São Paulo	05634-030	Brazil
82	Trail's Head Gourmet Provisioners	Helvetius Nagy	722 DaVinciBlvd.	Kirkland	98034	USA
83	Vaffeljern et	Palle Ibsen	Smagsløget 45	Århus	8200	Denmark
84	Victuaillesen stock	Mary Saveley	2,ruedu Commerce	Lyon	69004	France
85	Vinset alcools Chevalier	Paul Henriot	59ruede l'Abbaye	Reims	51100	France
86	Die Wandernde Kuh	Rita Müller	Adenauerallee 900	Stuttgart	70563	Germany

87	Wartian Herkku	Pirkko Koskitalo	Torikatu38	Oulu	90110	Finland
88	Wellington Importadora	Paula Parente	Rua do Mercado ,12	Resende	08737-363	Brazil
89	White Clover Markets	Karl Jablonski	305-14th Ave. S. Suite3B	Seattle	98128	USA
90	Wilman Kala	Matti Karttunen	Keskuskatu 45	Helsinki	21240	Finland
91	Wolski	Zbyszek	ul.Filtrowa68	Walla	01-012	Poland

ANDExample

ThefollowingSQLstatementselectsallfieldsfrom"Customers"wherecountry is "Germany" AND city is "Berlin":

Example:

```
SELECT*FROMCustomers
WHERECountry='Germany'ANDCity='Berlin';
```

OR Example

ThefollowingSQLstatementselectsallfieldsfrom"Customers"wherecityis "Berlin" OR "München":

Example:

```
SELECT*FROMCustomers
WHERECity='Berlin'ORCity='München';
```

ThefollowingSQLstatementselectsallfieldsfrom"Customers"wherecountry is "Germany" OR "Spain":

Example:

```
SELECT*FROMCustomers
WHERECountry='Germany'ORCountry='Spain';
```

NOTExample

ThefollowingSQLstatementselectsallfieldsfrom"Customers"wherecountry is NOT "Germany":

Example:

```
SELECT * FROM Customers
WHERENOTCountry='Germany';
```

CombiningAND,ORandNOT

- YoucanalsocombinetheAND,ORandNOToperators.
- ThefollowingSQLstatementselectsallfieldsfrom"Customers"where country is "Germany" AND city must be "Berlin" OR "München" (use parenthesis to form complex expressions):

Example:

```
SELECT*FROMCustomers
WHERECountry='Germany'AND(City='Berlin'ORCity='München');
```

ThefollowingSQLstatementselectsallfieldsfrom"Customers"wherecountry is NOT "Germany" and NOT "USA":

Example

```
SELECT*FROMCustomers
WHERENOTCountry='Germany'ANDNOTCountry='USA';
```


SQLORDERBYKeyword

TheSQLORDERBYKeyword

- TheORDERBYkeywordisusedtosorttheresult-setinascendingor descending order.
- TheORDERBYkeywordsortstherecordsinascendingorderbydefault.To sort the records in descending order, use the DESC keyword.

ORDERBYSyntax:

SELECT*column1,column2,...*

FROM*table_name*

ORDERBY*column1,column2,...*ASC|DESC;

DemoDatabase

Belowisaselectionfromthe"Customers"tableintheNorthwindsample database:

Customer ID	Customer Name	Contact Name	Address	City	Postal Code	Country
1	Alfreds Futterkiste	Maria Anders	ObereStr.57	Berlin	12209	Germany
2	Ana Trujillo Emparedados y helados	Ana Trujillo	Avda. de la Constitución 2222	México D.F.	05021	Mexico
3	Antonio Moreno Taquería	Antonio Moreno	Mataderos 2312	México D.F.	05023	Mexico
4	Around theHorn	Thomas Hardy	120Hanover Sq.	London	WA1 1DP	UK
5	Berglunds snabbköp	Christina Berglund	Berguvsvägen 8	Luleå	S-958 22	Sweden

ORDERBYExample

ThefollowingSQLstatementselectsallcustomersfromthe"Customers"table, sorted by the "Country" column:

Example:

SELECT*FROMCustomers

ORDER BY Country;

ORDERBYDESC Example

ThefollowingSQLstatementselectsallcustomersfromthe"Customers"table, sorted DESCENDING by the "Country" column:

Example:

```
SELECT*FROMCustomers
ORDER BY Country DESC;
```

ORDERBYSeveralColumns Example

ThefollowingSQLstatementselectsallcustomersfromthe"Customers"table, sorted by the "Country" and the "CustomerName" column. This means that it orders by Country, but if some rows have the same Country, it orders them by CustomerName:

Example:

```
SELECT*FROMCustomers
ORDERBYCountry,CustomerName;
```

ORDERBYSeveralColumnsExample2

ThefollowingSQLstatementselectsallcustomersfromthe"Customers"table, sorted ascending by the "Country" and descending by the "CustomerName" column: Example:

```
SELECT*FROMCustomers
ORDERBYCountryASC,CustomerNameDESC;
```


SQLINSERTINTOStatement

TheSQLINSERTINTO Statement

TheINSERTINTOstatementisusedtoinsertnewrecordsinatable.

INSERTINTOSyntax

ItispossibletowritetheINSERTINTOstatementintwoways:

1. Specifybothethecolumnnamesandthevaluestobeinserted:

```
INSERT INTO table_name (column1, column2, column3, ...)
```

VALUES(*value1*,*value2*,*value3*,...);

2. Ifyouareaddingvaluesforallthecolumnsofthetable,youdo notneedto specify the column names in the SQL query. However, makesure the order of the values is in the same order as the columns in the table. Here, the INSERT INTO syntax would be as follows:

INSERTINTO*table_name*
VALUES(*value1*,*value2*,*value3*,...);

DemoDatabase

Belowisaselectionfromthe"Customers"tableintheNorthwindsample database:

Customer ID	Customer Name	Contact Name	Address	City	Postal Code	Country
89	White Clover Markets	Karl Jablonski	305-14th Ave. S. Suite3B	Seattle	98128	USA
90	Wilman Kala	Matti Karttunen	Keskuskatu 45	Helsinki	21240	Finland
91	Wolski	Zbyszek	ul.Filtrowa 68	Walla	01-012	Poland

INSERTINTO Example

ThefollowingSQLstatementinsertsanewrecordinthe"Customers"table:

Example:

INSERTINTOCustomers(CustomerName,ContactName,Address,City, PostalCode, Country)
VALUES('Cardinal','TomB.Erichsen','Skagen21','Stavanger','4006', 'Norway');

Theselectionfromthe"Customers"tablewillnowlooklikethis:

Customer ID	Customer Name	Contact Name	Address	City	Postal Code	Country
89	White Clover Markets	Karl Jablonski	305-14th Ave. S. Suite3B	Seattle	98128	USA

90	Wilman Kala	Matti Karttunen	Keskuskatu 45	Helsinki	21240	Finland
91	Wolski	Zbyszek	ul.Filtrowa 68	Walla	01-012	Poland
92	Cardinal	Tom B. Erichsen	Skagen21	Stavanger	4006	Norway

DidyounoticethatwedidnotinsertanynumberintotheCustomerIDfield? The CustomerID column is an auto-increment field and will be generated automatically when a new record is inserted into the table.

InsertDataOnlyinSpecified Columns

- Itisalsopossibletoonlyinsertdatainspecificcolumns.
- ThefollowingSQLstatementwillinsertanewrecord,butonlyinsertdatain the "CustomerName", "City", and "Country" columns (CustomerID will be updated automatically):

Example:

```
INSERTINTOCustomers(CustomerName,City,Country)
VALUES ('Cardinal', 'Stavanger', 'Norway');
```

Theselectionfromthe"Customers"tablewillnowlooklikethis:

Customer ID	Customer Name	Contact Name	Address	City	Postal Code	Country
89	White Clover Markets	Karl Jablonski	305-14th Ave. S. Suite3B	Seattle	98128	USA
90	Wilman Kala	Matti Karttunen	Keskuskatu 45	Helsinki	21240	Finland
91	Wolski	Zbyszek	ul.Filtrowa 68	Walla	01-012	Poland
92	Cardinal	null	null	Stavanger	null	Norway

SQLNULL Values

WhatisaNULLValue?

- AfieldwithaNULLvalueisafieldwithnovalue.
- Ifafieldinatableis optional,itispossibletoinsertanewrecordorupdate a record without adding a value to this field. Then, the field will be saved with a NULL value.

Note: A NULL value is different from a zero value or a field that contains spaces.AfieldwithaNULLvalueisonethathasbeenleftblankduringrecord creation!

HowtoTestforNULL Values?

ItisnotpossibletotestforNULLvalueswithcomparisonoperators,suchas=, <,or<>.

WewillhavetousetheISNULLandISNOTNULLoperatorsinstead.

ISNULLSyntax:

SELECT*column_names*
FROM*table_name*
WHERE*column_name*ISNULL;

ISNOTNULLSyntax:

SELECT*column_names*
FROM*table_name*
WHERE*column_name*ISNOTNULL;

DemoDatabase

Belowisaselectionfromthe"Customers"tableintheNorthwindsample database:

Customer I D	Customer Name	Contact Name	Address	City	Postal Code	Country
1	Alfreds Futterkiste	Maria Anders	ObereStr. 57	Berlin	12209	Germany

2	Ana Trujillo Emparedados y helados	Ana Trujillo	Avda. de la Constitución2222	México D.F.	05021	Mexico
3	Antonio Moreno Taquería	Antonio Moreno	Mataderos 2312	México D.F.	05023	Mexico
4	Aroundthe Horn	Thomas Hardy	120 Hanover Sq.	London	WA1 1DP	UK
5	Berglunds snabbköp	Christina Berglund	Berguvsvägen 8	Luleå	S-958 22	Sweden

TheISNULLOperator

TheISNULLoperatorisusedtotestforemptyvalues(NULLvalues).

ThefollowingSQLlistsallcustomerswithaNULLvalueinthe"Address"field:

Example:

```
SELECTCustomerName,ContactName,Address
FROM Customers
WHEREAddressISNULL;
```

Tip: AlwaysuseISNULLtolookforNULLvalues.

TheISNOTNULLOperator

TheISNOTNULLoperatorisusedtotestfornon-emptyvalues(NOTNULL values).

ThefollowingSQLlistsallcustomerswithavalueinthe"Address"field: Example:

```
SELECTCustomerName,ContactName,Address
FROM Customers
WHEREAddressISNOT NULL;
```

SQLUPDATEStatement

TheSQLUPDATEStatement

TheUPDATEstatementisusedtomodifytheexistingrecordsinatable.

UPDATESyntax:

UPDATE*table_name*

SET*column1=value1,column2=value2,...* WHERE

condition;

Note: Becarefulwhenupdatingrecordsinatable!Noticethe WHEREclausein the UPDATE statement. The WHERE clause specifies which record(s) that should be updated. If you omit the WHERE clause, all records in the table will be updated!

DemoDatabase

Belowisaselectionfromthe"Customers"tableintheNorthwindsample database:

Customer ID	Customer Name	Contact Name	Address	City	Postal Code	Country
1	Alfreds Futterkiste	Maria Anders	ObereStr. 57	Berlin	12209	Germany
2	Ana Trujillo Emparedados yhelados	Ana Trujillo	Avda.dela Constitución2222	México D.F.	05021	Mexico
3	Antonio Moreno Taquería	Antonio Moreno	Mataderos 2312	México D.F.	05023	Mexico
4	Aroundthe Horn	Thomas Hardy	120 Hanover Sq.	London	WA1 1DP	UK

5	Berglunds snabbköp	Christina Berglund	Berguvsvägen 8	Luleå	S-95822	Sweden

UPDATETable

ThefollowingSQLstatementupdatesthefirstcustomer(CustomerID=1)with a new contact person *and* a new city.

Example:

```
UPDATECustomers
SETContactName='AlfredSchmidt',City='Frankfurt'WHERE
CustomerID = 1;
```

Theselectionfromthe"Customers"tablewillnowlooklikethis:

Customer ID	Customer Name	Contact Name	Address	City	Postal Code	Country
1	Alfreds Futterkiste	Alfred Schmidt	ObereStr. 57	Frankfurt	12209	Germany
2	Ana Trujillo Emparedados y helados	Ana Trujillo	Avda. de la Constitución 2222	México D.F.	05021	Mexico
3	Antonio Moreno Taquería	Antonio Moreno	Mataderos 2312	México D.F.	05023	Mexico
4	Around theHorn	Thomas Hardy	120 Hanover Sq.	London	WA1 1DP	UK
5	Berglunds snabbköp	Christina Berglund	Berguvsvägen 8	Luleå	S-95822	Sweden

UPDATEMultipleRecords

ItistheWHEREclausethatdeterminesshowmanyrecordswillbeupdated.The followingSQLstatementwill updatetheContactNameto "Juan" for allrecords where country is "Mexico":

Example

```
UPDATECustomers
SET
ContactName='Juan'WHERECo
untry='Mexico';
```

Theselectionfromthe"Customers"tablewillnowlooklikethis:

Customer ID	Customer Name	Contact Name	Address	City	Postal Code	Country
1	Alfreds Futterkiste	Alfred Schmidt	ObereStr. 57	Frankfurt	12209	Germany
2	Ana Trujillo Emparedados y helados	Juan	Avda.dela Constitución2222	México D.F.	05021	Mexico
3	Antonio Moreno Taquería	Juan	Mataderos 2312	México D.F.	05023	Mexico
4	Aroundthe Horn	Thomas Hardy	120 Hanover Sq.	London	WA1 1DP	UK
5	Berglunds snabbköp	Christina Berglund	Berguvsvägen 8	Luleå	S-95822	Sweden

UpdateWarning!

BecarefulwhenupdatingrecordsIfyouomittheWHEREclause,ALLrecords will be updated!

Example:

```
UPDATECustomers
SETContactName='Juan';
```

Theselectionfromthe"Customers"tablewillnowlooklikethis:

Customer ID	Customer Name	Contact Name	Address	City	Postal Code	Country
1	Alfreds Futterkiste	Juan	ObereStr. 57	Frankfurt	12209	Germany
2	Ana Trujillo Emparedados y helados	Juan	Avda.dela Constitución2222	México D.F.	05021	Mexico
3	Antonio Moreno Taquería	Juan	Mataderos 2312	México D.F.	05023	Mexico
4	Aroundthe Horn	Juan	120 Hanover Sq.	London	WA1 1DP	UK
5	Berglunds snabbköp	Juan	Berguvsväg en 8	Luleå	S-958 22	Sweden

SQLDELETE Statement

TheSQLDELETEStatement

TheDELETEstatementisusedtodeleteexistingrecordsinatable.

DELETESyntax:

DELETEFROM*table_name*WHERE*condition*;

Note: Becarefulwhendeletingrecordsinatable!NoticetheWHEREclausein the DELETE statement. The WHERE clause specifies which record(s) should be

deleted.IfyouomittheWHEREclause,allrecordsinthetablewillbedeleted!

DemoDatabase

Belowisaselectionfromthe"Customers"tableintheNorthwindsampledatabase:

Customer ID	Customer Name	Contact Name	Address	City	Postal Code	Country
1	Alfreds Futterkiste	Maria Anders	ObereStr.57	Berlin	12209	Germany
2	AnaTrujillo Emparedados y helados	Ana Trujillo	Avda.dela Constitución 2222	México D.F.	05021	Mexico
3	Antonio Moreno Taquería	Antonio Moreno	Mataderos 2312	México D.F.	05023	Mexico
4	Aroundthe Horn	Thomas Hardy	120Hanover Sq.	London	WA1 1DP	UK
5	Berglunds snabbköp	Christina Berglund	Berguvsvägen 8	Luleå	S-958 22	Sweden

SQLDELETEExample

ThefollowingSQLstatementdeletesthecustomer"AlfredsFutterkiste"fromthe "Customers" table:

Example:

```
DELETEFROMCustomersWHERECustomerName='AlfredsFutterkiste';
```

The"Customers"tablewillnowlooklikethis:

Customer ID	Customer Name	Contact Name	Address	City	Postal Code	Country
2	Ana Trujillo Emparedados y helados	Ana Trujillo	Avda. de la Constitución 2222	México D.F.	05021	Mexico
3	Antonio Moreno Taquería	Antonio Moreno	Mataderos 2312	México D.F.	05023	Mexico

4	Aroundthe Horn	Thomas Hardy	120Hanover Sq.	London	WA1 1DP	UK
5	Berglunds snabbköp	Christina Berglund	Berguvsväge n 8	Luleå	S-958 22	Sweden

DeleteAll Records

Itispossibletodeleteallrowsinatablewithoutdeletingthetable.Thismeans that the table structure, attributes, and indexes will be intact:

DELETEFROM*table_name*;

ThefollowingSQLstatementdeletesallrowsinthe"Customers"table,withoutdeleting the table:

Example:

DELETEFROMCustomers;

SQLTOP,LIMIT,FETCHFIRSTorROWNUMClause

TheSQLSELECTTOPClause

- TheSELECTTOPclauseisusedtospecifythenumberofrecordsto return.
- TheSELECTTOPclauseisusefulonlargetableswiththousandsofrecords. Returning a large number of records can impact performance.

Note: Not all database systems support the SELECT TOP clause. MySQL supportstheLIMITclausetoselectalimitednumberofrecords,whileOracle uses FETCH FIRST *n* ROWS ONLY and ROWNUM.

SQLServer/MSAccess Syntax:

SELECTTOP*number*|*percent*column_name(s)

FROM*table_name*

WHERE*condition*;

MySQLSyntax:

SELECT*column_name(s)*
FROM *table_name*
WHERE *condition*
LIMIT*number*;

Oracle12Syntax:

SELECT*column_name(s)*
FROM*table_name*
ORDERBY*column_name(s)*
FETCHFIRST*number*ROWSONLY;

OlderOracleSyntax:

SELECT*column_name(s)*
FROM*table_name*
WHEREROWNUM<=*number*;

OlderOracleSyntax(withORDERBY):

SELECT*
FROM(SELECT*column_name(s)*FROM*table_name*ORDERBY*column_name(s)*
)
WHEREROWNUM<=*number*;

DemoDatabase

Belowisaselectionfromthe"Customers"tableintheNorthwindsampledatabase:

Customer ID	Customer Name	Contact Name	Address	City	Postal Code	Country
1	Alfreds Futterkiste	Maria Anders	ObereStr.57	Berlin	12209	Germany
2	Ana Trujillo Emparedados y helados	Ana Trujillo	Avda.dela Constitución 2222	México D.F.	05021	Mexico

3	Antonio Moreno Taquería	Antonio Moreno	Mataderos 2312	México D.F.	05023	Mexico
4	Aroundthe Horn	Thomas Hardy	120Hanover Sq.	London	WA1 1DP	UK
5	Berglunds snabbköp	Christina Berglund	Berguvsvägen 8	Luleå	S-958 22	Sweden

SQLTOP,LIMITandFETCHFIRST Examples

ThefollowingSQLstatementselectsthefirstthreerecordsfromthe"Customers" table (for SQL Server/MS Access):

Example:

```
SELECTTOP3*FROMCustomers;
```

ThefollowingSQLstatementshowstheequivalentexampleforMySQL: Example:

```
SELECT*FROMCustomers
LIMIT 3;
```

ThefollowingSQLstatementshowstheequivalentexampleforOracle:

Example:

```
SELECT * FROM Customers
FETCHFIRST3ROWSONLY;
```

SQLTOPPERCENT Example

ThefollowingSQLstatementselectsthefirst50%oftherecordsfromthe"Customers" table (for SQL Server/MS Access):

Example:

```
SELECTTOP50PERCENT*FROMCustomers;
```

ThefollowingSQLstatementshowstheequivalentexampleforOracle:

Example:

```
SELECT*FROMCustomers
FETCHFIRST50PERCENTROWSONLY;
```

ADDaWHERE CLAUSE

The following SQL statement selects the first three records from the "Customers"table,wherethecountryis"Germany"(forSQLServer/MSAccess):

Example:

```
SELECTTOP3*FROMCustomers
WHERE Country='Germany';
```

ThefollowingSQLstatementshowstheequivalentexampleforMySQL: Example

```
SELECT*FROMCustomers
WHERECountry='Germany'
LIMIT 3;
```

ThefollowingSQLstatementshowstheequivalentexampleforOracle: Example:

```
SELECT*FROMCustomers
WHERECountry='Germany'FET
CHFIRST3ROWS ONLY;
```

SQLMIN()andMAX()Functions

TheSQLMIN()andMAX()Functions

TheMIN()functionreturnsthesmallestvalueoftheselectedcolumn.The MAX() function returns the largest value of the selected column.

MIN()Syntax:

SELECTMIN(*column_name*)

FROM *table_name*

WHERE*condition*;

MAX()Syntax:

SELECTMAX(*column_name*)

FROM *table_name*

WHERE*condition*;

DemoDatabase

Belowisaselectionfromthe"Products"tableintheNorthwindsample database:

ProductID	ProductName	SupplierID	CategoryID	Unit	Price
1	Chais	1	1	10boxesx 20bags	18
2	Chang	1	1	24-12oz bottles	19
3	AniseedSyrup	1	2	12-550ml bottles	10
4	ChefAnton'sCajun Seasoning	2	2	48-6oz jars	22
5	ChefAnton's Gumbo Mix	2	2	36boxes	21.35

MIN()Example

ThefollowingSQLstatementfindsthepriceofthecheapestproduct:

Example:

```
SELECTMIN(Price)ASSmallestPrice
FROM Products;
```

MAX()Example

ThefollowingSQLstatementfindsthepriceofthemostexpensiveproduct:

Example:

```
SELECTMAX(Price)ASLargestPrice
FROM Products;
```

SQLCOUNT(),AVG()andSUM()Functions

TheSQLCOUNT(),AVG()andSUM() Functions

TheCOUNT()functionreturnsthenumberofrowsthatmatchesaspecified criterion.

COUNT()Syntax:

```
SELECTCOUNT(column_name)
FROM table_name
WHERECondition;
```

TheAVG()functionreturnstheaveragevalueofanumericcolumn.

AVG() Syntax:

```
SELECTAVG(column_name)
FROM table_name
WHERECondition;
```

TheSUM()functionreturnsthetotalsumofanumericcolumn. SUM()

Syntax:

```
SELECTSUM(column_name)
FROM table_name
```

WHERE*condition*;

DemoDatabase

Belowisaselectionfromthe"Products"tableintheNorthwindsample database:

ProductID	ProductName	SupplierID	CategoryID	Unit	Price
1	Chais	1	1	10boxes x20bags	18
2	Chang	1	1	24-12oz bottles	19
3	AniseedSyrup	1	2	12-550 mlbottles	10
4	Chef Anton's CajunSeasoning	2	2	48-6oz jars	22
5	ChefAnton's Gumbo Mix	2	2	36boxes	21.35

COUNT()Example

ThefollowingSQLstatementfindsthenumberofproducts: Example:

SELECTCOUNT(ProductID)FROM
Products;

Note:NULLvaluesarenot counted.

AVG()Example

ThefollowingSQLstatementfindstheaveragepriceofallproducts: Example:

SELECTAVG(Price)FROM
Products;

Note:NULLvaluesareignored.

DemoDatabase

Belowisaselectionfromthe"OrderDetails"tableintheNorthwindsample database:

OrderDetailID	OrderID	ProductID	Quantity
1	10248	11	12
2	10248	42	10
3	10248	72	5
4	10249	14	9
5	10249	51	40

SUM()Example

ThefollowingSQLstatementfindsthesumofthe"Quantity"fieldsinthe "OrderDetails" table:

Example:

```
SELECTSUM(Quantity)FROM
OrderDetails;
```

Note:NULLvaluesareignored.

SQLBETWEEN Operator

TheSQLBETWEEN Operator

TheBETWEENoperatorselectsvalueswithinagivenrange.Thevaluescanbe numbers, text, or dates.

TheBETWEENoperatorisinclusive:beginandendvaluesareincluded.

BETWEENSyntax:

```
SELECTcolumn_name(s)
FROMtable_name
WHEREcolumn_nameBETWEENvalue1ANDvalue2;
```

DemoDatabase

Belowisaselectionfromthe"Products"tableintheNorthwindsample database:

ProductID	ProductName	SupplierID	CategoryID	Unit	Price
1	Chais	1	1	10boxesx 20bags	18
2	Chang	1	1	24-12oz bottles	19
3	AniseedSyrup	1	2	12-550ml bottles	10
4	ChefAnton'sCajun Seasoning	1	2	48-6oz jars	22
5	ChefAnton'sGumbo Mix	1	2	36boxes	21.35

BETWEEN Example

ThefollowingSQLstatementselectsallproductswithapricebetween10and 20:

Example:

```
SELECT*FROMProducts
WHEREPriceBETWEEN10AND20;
```

NOTBETWEEN Example

Todisplaytheproductsoutsidetherangeofthepreviousexample,use NOT BETWEEN:

Example:

```
SELECT*FROMProducts
```

WHEREPriceNOTBETWEEN10AND20;

BETWEENwithINExample

ThefollowingSQLstatementselectsallproductswithapricebetween10 and 20.Inaddition;donotshowproductswithaCategoryIDof1,2,or3: Example:

SELECT*FROMProducts

WHEREPriceBETWEEN10AND20 AND

CategoryID NOT IN (1,2,3);

BETWEENTextValuesExample

ThefollowingSQLstatementselectsallproductswithaProductNamebetween Carnarvon Tigers and Mozzarella di Giovanni:

Example:

SELECT*FROMProducts

WHEREProductNameBETWEEN'CarnarvonTigers'AND'Mozzarelladi Giovanni'

ORDERBYProductName;

ThefollowingSQLstatementselectsallproductswithaProductNamebetween Carnarvon Tigers and Chef Anton's Cajun Seasoning:

Example:

SELECT*FROMProducts

WHEREProductNameBETWEEN"CarnarvonTigers"AND"ChefAnton'sCajun Seasoning"

ORDERBYProductName;

NOTBETWEENTextValues Example

ThefollowingSQLstatementselectsallproductswithaProductNamenot between Carnarvon Tigers and Mozzarella di Giovanni:

Example:

SELECT*FROMProducts

WHEREProductNameNOTBETWEEN'CarnarvonTigers'AND'Mozzarelladi Giovanni'

ORDERBYProductName;

Sample Table

Belowisaselectionfromthe"Orders"tableintheNorthwindsample database:

OrderID	CustomerID	EmployeeID	OrderDate	ShipperID
10248	90	5	7/4/1996	3
10249	81	6	7/5/1996	1
10250	34	4	7/8/1996	2
10251	84	3	7/9/1996	1
10252	76	4	7/10/1996	2

BETWEENDatesExample

ThefollowingSQLstatementselectsallorderswithanOrderDatebetween '01July-1996' and '31-July-1996':

Example:

SELECT*FROMOrders

WHEREOrderDateBETWEEN#07/01/1996#AND#07/31/1996#; OR:

Example:

SELECT*FROMOrders

WHEREOrderDateBETWEEN'1996-07-01'AND'1996-07-31';

SQL JOINS

SQLJOIN

AJOINclauseisusedtocombinerowsfromtwoormoretables,based ona related column between them.

Let'slookataselectionfromthe"Orders"table:

OrderID	CustomerID	OrderDate
10308	2	1996-09-18
10309	37	1996-09-19
10310	77	1996-09-20

Then,lookataselectionfromthe"Customers" table:

CustomerID	CustomerName	ContactName	Country
1	AlfredsFutterkiste	Maria Anders	Germany
2	AnaTrujilloEmparedadosy helados	Ana Trujillo	Mexico
3	AntonioMorenoTaquería	AntonioMoreno	Mexico

- Notice that the "CustomerID" column in the "Orders" table refers to the "CustomerID"inthe"Customers"table.Therelationshipbetweenthetwo tables above is the "CustomerID" column.
- Then,wecancreatethefollowingSQLstatement(thatcontainsanINNER JOIN), that selects records that have matching values in both tables:

Example:

```
SELECTOrders.OrderID,Customers.CustomerName,Orders.OrderDateFROM Orders
INNERJOINCustomersONOrders.CustomerID=Customers.CustomerID;
```

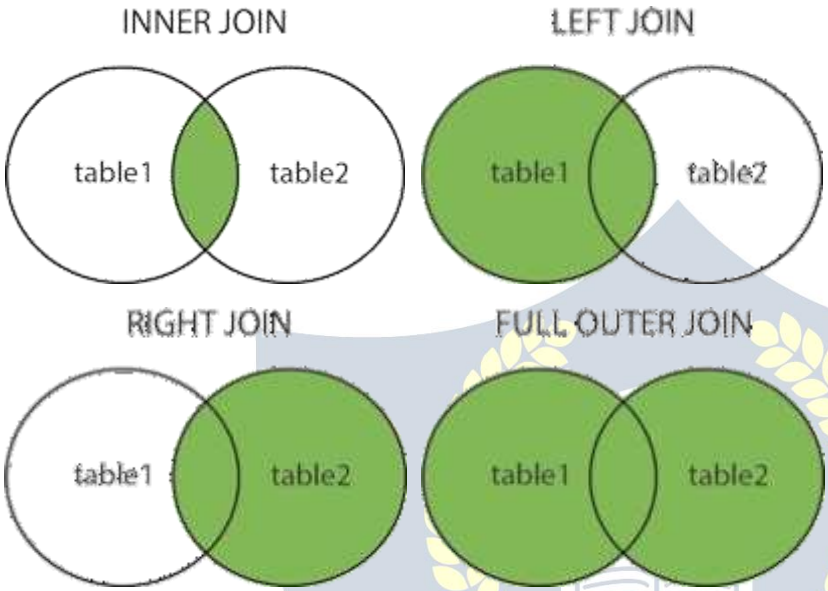
anditwillproducesomethinglikethis:

OrderID	CustomerName	OrderDate
10308	AnaTrujilloEmparedadosyhelados	9/18/1996
10365	AntonioMorenoTaquería	11/27/1996
10383	AroundtheHorn	12/16/1996
10355	AroundtheHorn	11/15/1996
10278	Berglundssnabbköp	8/12/1996

DifferentTypesofSQL JOINs

HerearethedifferenttypesoftheJOINsin SQL:

- (INNER)JOIN:Returnsrecordsthathavematchingvaluesinbothtables
- LEFT(OUTER)JOIN:Returnsallrecordsfromthelefttable,andthe matched records from the right table
- RIGHT(OUTER)JOIN:Returnsallrecordsfromtherighttable,andthe matched records from the left table
- FULL(OUTER)JOIN:Returnsallrecordswhenthereisamatchineither left or right table



SQLUNIONOperator

TheSQL UNION Operator

TheUNIONoperatorisusedtocombinetheresult-setoftwoormore SELECT statements.

- EverySELECTstatementwithinUNIONmusthavethesamenumberof columns
- Thecolumnsmustalsohavesimilardatatypes
- Thecolumnsineveryselectstatementmustalsobeinthesameorder

UNIONSyntax:

SELECT*column_name(s)*FROM*table1*

UNION

SELECT*column_name(s)*FROM*table2*;

UNION ALL Syntax:

TheUNIONoperatorselectsonlydistinctvaluesbydefault.Toallowduplicate values, use UNION ALL:

SELECT*column_name(s)*FROM*table1*
UNION ALL
SELECT*column_name(s)*FROM*table2*;

Note: Thecolumnnamesintheresult-setareusuallyequaltothecolumn names in the first SELECT statement.

DemoDatabase

InthistutorialwewillusethewelI-knownNorthwindsampledatabase. Below is a selection from the "Customers" table:

Customer ID	Customer Name	Contact Name	Address	City	Postal Code	Country
1	Alfreds Futterkiste	Maria Anders	ObereStr. 57	Berlin	12209	Germany
2	Ana Trujillo Emparedados y helados	Ana Trujillo	Avda.dela Constitución2222	México D.F.	05021	Mexico
3	Antonio Moreno Taquería	Antonio Moreno	Mataderos 2312	México D.F.	05023	Mexico

Andaselectionfromthe"Suppliers"table:

Supplier ID	Supplier Name	Contact Name	Address	City	PostalCode	Country
1	Exotic Liquid	Charlotte Cooper	49 Gilbert St.	London	EC1 4SD	UK
2	New Orleans Cajun	Shelley Burke	P.O. Box 78934	New Orleans	70117	USA

	Delights					
3	Grandma Kelly's Homestead	Regina Murphy	707 Oxford Rd.	Ann Arbor	48104	USA

SQLUNION Example

ThefollowingSQLstatementreturnsthecities(onlydistinctvalues)fromboth the "Customers" and the "Suppliers" table:

Example:

```
SELECTCityFROMCustomers
UNION
SELECTCityFROMSuppliers
ORDER BY City;
```

Note: If some customers or suppliers have the same city, each city will only be listedonce,becauseUNIONselectsonlydistinctvalues.UseUNIONALLtoalso select duplicate values!

SQLUNIONALL Example

ThefollowingSQLstatementreturnsthecities(duplicatevaluesalso)from both the "Customers" and the "Suppliers" table:

Example:

```
SELECTCityFROMCustomers
UNION ALL
SELECTCityFROMSuppliers
ORDER BY City;
```

SQLUNIONWithWHERE

ThefollowingSQLstatementreturnstheGermancities(onlydistinctvalues) from both the "Customers" and the "Suppliers" table:

Example:

```
SELECTCity,CountryFROMCustomers
WHERE Country='Germany'
UNION
SELECTCity,CountryFROMSuppliers
WHERE Country='Germany'
ORDERBYCity;
```

SQLUNIONALLWith WHERE

ThefollowingSQLstatementreturnstheGermancities(duplicatevaluesalso) from both the "Customers" and the "Suppliers" table:

Example:

```
SELECTCity,CountryFROMCustomers
WHERE Country='Germany'
UNION ALL
SELECTCity,CountryFROMSuppliers
WHERE Country='Germany'
ORDERBYCity;
```

AnotherUNIONExample

ThefollowingSQLstatementlistsallcustomersandsuppliers: Example:

```
SELECT'Customer'ASType,ContactName,City,Country
FROM Customers
UNION
SELECT'Supplier',ContactName,City,Country
FROM Suppliers;
```


SQLEXISTSOperator

TheSQLEXISTSOperator

TheEXISTSoperatorisusedtotestfortheexistenceofanyrecordina subquery.

TheEXISTSoperatorreturnsTRUEifthesubqueryreturnsoneormorerecords. EXISTS Syntax:

SELECT*column_name(s)*

FROM *table_name*

WHERE EXISTS

(SELECT*column_name*FROM*table_name*WHERE*condition*);

Demo Database:

Belowisaselectionfromthe"Products"tableintheNorthwindsample database:

Product ID	Product Name	Supplier ID	Category ID	Unit	Price
1	Chais	1	1	10boxesx 20bags	18
2	Chang	1	1	24-12oz bottles	19
3	AniseedSyrup	1	2	12-550ml bottles	10
4	ChefAnton'sCajun Seasoning	2	2	48-6oz jars	22
5	ChefAnton's Gumbo Mix	2	2	36boxes	21.35

Andaselectionfromthe"Suppliers"table:

Supplier ID	Supplier Name	Contact Name	Address	City	Postal Code	Country
1	Exotic Liquid	Charlotte Cooper	49Gilbert St.	London	EC1 4SD	UK
2	New Orleans Cajun Delights	Shelley Burke	P.O.Box 78934	New Orleans	70117	USA

3	Grandma Kelly's Homestead	Regina Murphy	707Oxford Rd.	Ann Arbor	48104	USA
4	Tokyo Traders	Yoshi Nagase	9-8Sekimai Musashino-shi	Tokyo	100	Japan

SQLEXISTSExamples

ThefollowingSQLstatementreturnsTRUEandliststhesupplierswitha product price less than 20:

Example:

```
SELECTSupplierName
FROM Suppliers
WHEREEXISTS(SELECTProductNameFROMProductsWHEREProducts.Supplie rID = Suppliers.supplierID AND Price < 20);
```

ThefollowingSQLstatementreturnsTRUEandliststhesupplierswitha product price equal to 22:

Example:

```
SELECTSupplierName
FROM Suppliers
WHEREEXISTS(SELECTProductNameFROMProductsWHEREProducts.Supplie rID = Suppliers.supplierID AND Price = 22);
```

SQLANYandALL Operators

TheSQLANYandALL Operators

TheANYandALLoperatorsallowyoutoperformacomparisonbetweena single column value and a range of other values.

TheSQLANYOperator

TheANYoperator:

- returnsabooleanvalueasaresult
- returnsTRUEifANYofthesubqueryvaluesmeetthecondition

ANYmeansthattheconditionwillbetrueiftheoperationistrueforanyofthe values in the range.

ANYSyntax:

SELECT*column_name(s)*

FROM*table_name*

WHERE*column_name*operatorANY

(SELECT *column_name*

FROM*table_name*

WHERE*condition*);

Note: The*operator*mustbeastandardcomparisonoperator(=,<>,!=,>,>=,<, or <=).

TheSQLALL Operator

TheALLoperator:

- returnsabooleanvalueasaresult
- returnsTRUEifALLofthesubqueryvaluesmeetthecondition
- isusedwithSELECT,WHEREandHAVINGstatements

ALLmeansthattheconditionwillbetrueonlyiftheoperationistrueforall values in the range.

ALL Syntax With SELECT:

SELECTALL*column_name(s)*

FROM *table_name*

WHERE*condition*;

ALLSyntaxWithWHEREorHAVING:

SELECT *column_name(s)*

FROM*table_name*

WHERE*column_name*operatorALL

(SELECT *column_name*

FROM*table_name*

WHERE*condition*);

Note: The*operator*mustbeastandardcomparisonoperator(=,<>,!=,>,>=,<, or <=).

DemoDatabase

Belowisaselectionfromthe**"Products"**tableintheNorthwindsample database:

Product ID	Product Name	Supplier ID	Category ID	Unit	Price
1	Chais	1	1	10boxesx 20bags	18
2	Chang	1	1	24- 12oz bottles	19
3	AniseedSyrup	1	2	12-550ml bottles	10

4	ChefAnton'sCajun Seasoning	2	2	48- 6oz jars	22
5	ChefAnton'sGumbo Mix	2	2	36boxes	21.35
6	Grandma's BoysenberrySpread	3	2	12- 8oz jars	25
7	UncleBob'sOrganic Dried Pears	3	7	12-1lbpkgs.	30
8	Northwoods CranberrySauce	3	2	12- 12oz jars	40
9	MishiKobeNiku	4	6	18-500g pkgs.	97

Andaselectionfromthe**"OrderDetails"**table:

OrderDetailID	OrderID	ProductID	Quantity
1	10248	11	12
2	10248	42	10
3	10248	72	5
4	10249	14	9
5	10249	51	40
6	10250	41	10
7	10250	51	35
8	10250	65	15
9	10251	22	6
10	10251	57	15

SQLANYExamples

The following SQL statement lists the ProductName if it finds ANY records in theOrderDetailstablehasQuantityequalto10(thiswillreturnTRUEbecause the Quantity column has some values of 10):

Example:

```
SELECTProductName
FROM Products
WHEREProductID=ANY
  (SELECT ProductID
  FROM OrderDetails
  WHERE Quantity = 10);
```

ThefollowingSQLstatementliststheProductNameifitfindsANYrecordsin the OrderDetails table has Quantity larger than 99 (this will return TRUE because the Quantity column has some values larger than 99):

Example:

```
SELECTProductName
FROM Products
WHEREProductID=ANY
  (SELECT ProductID
  FROM OrderDetails
  WHERE Quantity > 99);
```

ThefollowingSQLstatementliststheProductNameifitfindsANYrecordsin the OrderDetails table has Quantity larger than 1000 (this will return FALSE because the Quantity column has no values larger than 1000):

Example:

```
SELECTProductName
FROM Products
WHEREProductID=ANY
  (SELECT ProductID
  FROM OrderDetails
  WHEREQuantity>1000);
```

SQLALL Examples

ThefollowingSQLstatementlistsALLtheproductnames:

Example:

```
SELECTALLProductName
FROM Products
WHERETRUE;
```

The following SQL statement lists the ProductName if ALL the records in the OrderDetails table has Quantity equal to 10. This will of course return FALSE becausetheQuantitycolumnhasmanydifferentvalues(notonlythevalueof 10):

Example:

```
SELECTProductName
FROM Products
WHEREProductID=ALL
 (SELECT ProductID
 FROM OrderDetails
 WHEREQuantity=10);
```

SQLINSERTINTOSELECTStatement

TheSQLINSERTINTOSELECTStatement

- TheINSERTINTOSELECTstatementcopiesdatafromonetableand inserts it into another table.
- TheINSERTINTOSELECTstatementrequiresthatthedatatypesin source and target tables matches.
- **Note:**Theexistingrecordsinthetargettableareunaffected.

INSERTINTOSELECTSyntax:

Copyallcolumnsfromonetabletoanothertable: INSERT

```
INTO table2
SELECT*FROMtable1
WHEREcondition;
```

Copyonlysomecolumnsfromonetableintoanother table:

INSERTINTO*table2*(*column1*,*column2*,*column3*,...)SELECT *column1*,*column2*,*column3*,...

FROM *table1*

WHERE*condition*;

DemoDatabase

InthistutorialwewillusethewellknownNorthwindsampledatabase.Below is a selection from the "Customers" table:

Customer ID	Customer Name	Contact Name	Address	City	Postal Code	Country
1	Alfreds Futterkiste	Maria Anders	ObereStr. 57	Berlin	12209	Germany
2	Ana Trujillo Emparedados y helados	Ana Trujillo	Avda.dela Constitución 2222	México D.F.	05021	Mexico
3	Antonio Moreno Taquería	Antonio Moreno	Mataderos 2312	México D.F.	05023	Mexico

Andaselectionfromthe"Suppliers"table:

Supplier ID	Supplier Name	Contact Name	Address	City	Postal Code	Country
1	ExoticLiquid	Charlotte Cooper	49 Gilbert St.	Londona	EC1 4SD	UK
2	NewOrleans Cajun Delights	Shelley Burke	P.O.Box 78934	New Orleans	70117	USA
3	Grandma Kelly's Homestead	Regina Murphy	707 Oxford Rd.	Ann Arbor	48104	USA

SQLINSERTINTOSELECTExamples

ThefollowingSQLstatementcopies"Suppliers"into"Customers"(thecolumns that are not filled with data, will contain NULL):

Example:

```
INSERTINTOCustomers(CustomerName,City,Country)SELECT
SupplierName, City, Country FROM Suppliers;
```

ThefollowingSQLstatementcopies"Suppliers"into"Customers"(fillall columns):

Example:

```
INSERTINTOCustomers(CustomerName,ContactName,Address,City,
PostalCode, Country)
SELECTSupplierName,ContactName,Address,City,PostalCode,
Country FROM Suppliers;
```

ThefollowingSQLstatementcopiesonlytheGermansuppliersinto "Customers":

Example:

```
INSERTINTOCustomers(CustomerName,City,Country)
SELECT SupplierName, City, Country FROM Suppliers
WHERE Country='Germany';
```

SQLNULL Functions

SQLIFNULL(),ISNULL(),COALESCE(),andNVL()Functions

Lookatthefollowing"Products"table:

P_Id	ProductName	UnitPrice	UnitsInStock	UnitsOnOrder
1	Jarlsberg	10.45	16	15
2	Mascarpone	32.56	23	
3	Gorgonzola	15.67	9	20

Supposethatthe"UnitsOnOrder"columnisoptional,andmaycontainNULL values.

LookatthefollowingSELECTstatement:

```
SELECTProductName,UnitPrice*(UnitsInStock+UnitsOnOrder)
FROM Products;
```

Intheexampleabove,ifanyofthe"UnitsOnOrder"valuesareNULL,theresult will be NULL.

Solutions

MySQL

TheMySQLIFNULL()functionletsyoureturnanalternativevalueifan expression is NULL:

```
SELECTProductName,UnitPrice*(UnitsInStock+IFNULL(UnitsOnOrder,0))
FROM Products;
```

orwecanusetheCOALESCE()function,likethis:

```
SELECTProductName,UnitPrice*(UnitsInStock+COALESCE(UnitsOnOrder,0))
FROM Products;
```

SQLServer

TheSQLServerISNULL()functionletsyoureturnanalternativevaluewhenan expression is NULL:

```
SELECTProductName,UnitPrice*(UnitsInStock+ISNULL(UnitsOnOrder,0))
FROM Products;
```

MSAccess

TheMSAccessIsNull()functionreturnsTRUE(-1)iftheexpressionisanull value, otherwise FALSE (0):

```
SELECTProductName,UnitPrice*(UnitsInStock+IIF(IsNull(UnitsOnOrder),0, UnitsOnOrder))
FROMProducts;
```

Oracle

TheOracleNVL()functionachievesthesameresult:

```
SELECTProductName,UnitPrice*(UnitsInStock+NVL(UnitsOnOrder,0)) FROM
Products;
```


SQL Comments

SQLComments

CommentsareusedtoexplainsectionsofSQLstatements,ortoprevent execution of SQL statements.

Note:TheexamplesinthischapterwillnotworkinFirefoxandMicrosoft Edge!

CommentsarenotsupportedinMicrosoftAccessdatabases.Firefoxand Microsoft Edge are using Microsoft Access database in our examples.

SingleLineComments

Singlelinecommentsstartwith--.

Anytextbetween--andtheendofthelinewillbeignored(willnotbe executed).

Thefollowingexampleusesasingle-linecommentasanexplanation: Example:

```
--Select all:
SELECT*FROMCustomers;
```

Thefollowingexampleusesasingle-linecommenttoignorethe endofaline:

Example:

```
SELECT*FROMCustomers--WHERECity='Berlin';
```

Thefollowingexampleusesasingle-linecommenttoignoreastatement: Example:

```
--SELECT*FROMCustomers;
SELECT * FROM Products;
```

Multi-lineComments

Multi-linecommentsstartwith/*andendwith*/. Any text between /* and */ will be ignored.

Thefollowingexampleusesamulti-linecommentasanexplanation:

Example:

```
/*Select all the columns of
all the records in the
Customerstable:*/SELECT
*FROMCustomers;
```

Thefollowingexampleusesamulti-linecommenttoignoremanystatements:

Example:

```
/*SELECT*FROMCustomers;
SELECT * FROM Products;
SELECT * FROM Orders;
SELECT*FROMCategories;*/
SELECT * FROM Suppliers;
```

Toignorejustapartofastatement,alsousethe/**/comment.The following example uses a comment to ignore part of a line:

Example:

```
SELECTCustomerName,/*City,*/CountryFROMCustomers;
```

Thefollowingexampleusesacommenttoignorepartofastatement: Example:

```
SELECT * FROM Customers WHERE (CustomerName LIKE
'L%'OR CustomerName LIKE 'R%'/*OR CustomerName LIKE
'S%' ORCustomerNameLIKE'T%'*/ORCustomerNameLIKE'W%')
AND Country='USA'
ORDERBYCustomerName;
```


SQL Operators

SQLArithmetic Operators

Operator	Description
+	Add

-	Subtract
*	Multiply
/	Divide
%	Modulo

SQLBitwise Operators

Operator	**Description**
&	BitwiseAND
|	BitwiseOR
^	BitwiseexclusiveOR

SQLComparisonOperators

Operator	**Description**
=	Equalto
>	Greaterthan
<	Lessthan
>=	Greaterthanorequalto
<=	Lessthanorequalto
<>	Notequalto

SQLCompoundOperators

Operator	**Description**
+=	Addequals
-=	Subtractequals
*=	Multiplyequals
/=	Divide equals
%=	Moduloequals
&=	BitwiseANDequals
^-=	Bitwiseexclusiveequals
|*=	BitwiseORequals

SQLLogicalOperators

Operator	Description
ALL	TRUEifallofthesubqueryvaluesmeetthecondition
AND	TRUEifalltheconditionsseparatedbyANDisTRUE
ANY	TRUEifanyofthesubqueryvaluesmeetthecondition
BETWEEN	TRUEiftheoperandiswithintherangeof comparisons
EXISTS	TRUEifthesubqueryreturnsoneormorerecords
IN	TRUEiftheoperandisequaltooneofalistof expressions
LIKE	TRUEiftheoperandmatchesapattern
NOT	Displaysarecordifthecondition(s)isNOT TRUE
OR	TRUEifanyoftheconditionsseparatedbyORisTRUE
SOME	TRUEifanyofthesubqueryvaluesmeetthecondition

SQLCREATEDATABASE Statement

TheSQLCREATEDATABASEStatement

TheCREATEDATABASEstatementisusedtocreateanewSQLdatabase. Syntax:

CREATEDATABASE*databasename*;

CREATEDATABASEExample

ThefollowingSQLstatementcreatesadatabasecalled"testDB":

Example:

CREATEDATABASEtestDB;

Tip: Makesureyouhaveadminprivilegebeforecreatinganydatabase.Oncea databaseiscreated,youcancheckitinthelistofdatabaseswiththefollowing SQL command: SHOW DATABASES;

SQLDROPDATABASE Statement

TheSQLDROPDATABASEStatement

TheDROPDATABASEstatementisusedtodropanexistingSQLdatabase. Syntax:

DROPDATABASE*databasename*;

Note: Becarefulbeforedroppingadatabase.Deletingadatabasewillresultinloss of complete information stored in the database!

DROPDATABASE Example

ThefollowingSQLstatementdropstheexistingdatabase"testDB":

Example:

DROPDATABASEtestDB;

SQLBACKUPDATABASEforSQL Server

TheSQLBACKUPDATABASE Statement

TheBACKUPDATABASEstatementisusedinSQLServertocreateafullbackupof an existing SQL database.

Syntax:

BACKUPDATABASE*databasename*

TODISK='*filepath*';

TheSQLBACKUPWITHDIFFERENTIAL Statement

Adifferentialbackuponlybacksupthepartsofthedatabasethathavechanged since the last full database backup.

Syntax:

BACKUPDATABASE*databasename*

TO DISK =

'*filepath*'WITHDIFFER

ENTIAL;

BACKUPDATABASE Example

ThefollowingSQLstatementcreatesafullbackupoftheexistingdatabase"testDB" to the D disk:

Example:

```
BACKUPDATABASEtestDB
TODISK='D:\backups\testDB.bak';
```

Tip: Alwaysbackupthedatabasetoadifferentdrivethantheactualdatabase.Then, if you get a disk crash, you will not lose your backup file along with the database.

BACKUPWITHDIFFERENTIALExample

ThefollowingSQLstatementcreatesadifferentialbackupofthedatabase"testDB": Example:

```
BACKUPDATABASEtestDB
TODISK='D:\backups\testDB.bak'WIT
H DIFFERENTIAL;
```

Tip: Adifferentialbackupreducestheback-uptime(sinceonlythechangesare backed up).

SQLCREATETABLEStatement

TheSQLCREATETABLEStatement

TheCREATETABLEstatementisusedtocreateanewtableinadatabase. Syntax:

```
CREATE TABLE table_name
( column1 datatype,  column2
datatype,    column3
datatype,
  ....
);
```

Thecolumnparametersspecifythenamesofthecolumnsofthetable.The datatype parameter specifies the type of data the column can hold (e.g. varchar, integer, date, etc.).

SQLCREATETABLEExample

Thefollowingexamplecreatesatablecalled"Persons"thatcontainsfivecolumns: PersonID, LastName, FirstName, Address, and City:

Example:

```
CREATETABLEPersons( P
   ersonID int,
   LastName varchar(255),
   FirstNamevarchar(255),
   Address varchar(255),
   City varchar(255)
);
```

- ThePersonIDcolumnisoftypeintandwillholdaninteger.
- TheLastName,FirstName,Address,andCitycolumnsareoftypevarcharandwillhold characters, and the maximum length for these fields is 255 characters.
- Theempty"Persons"tablewillnowlooklikethis:

PersonID	LastName	FirstName	Address	City

Tip: Theempty"Persons"tablecannowbefilledwithdatawiththeSQL INSERT INTO statement.

CreateTable UsingAnother Table

- AcopyofanexistingtablecanalsobecreatedusingCREATETABLE.
- Thenewtablegetsthesamecolumndefinitions.Allcolumnsorspecificcolumns can be selected.
- Ifyoucreateanewtableusinganexistingtable,thenewtablewillbefilledwith the existing values from the old table.

Syntax:

```
CREATETABLEnew_table_nameAS
SELECT column1, column2,...
   FROMexisting_table_name
   WHERE.....;
```

ThefollowingSQLcreatesanewtablecalled"TestTables"(whichisacopyofthe "Customers" table):

Example:

```
CREATETABLETestTableAS
SELECTcustomername,contactname
FROM customers;
```

Tip: Makesureyouhaveadminprivilegebeforedroppingany database.Once a database is dropped, you can check it in the list of databases with the following SQL command: SHOW DATABASES;

SQLDROPTABLE Statement

TheSQL DROPTABLEStatement

TheDROPTABLEstatementisusedtodropanexistingtablein adatabase. Syntax:

```
DROPTABLEtable_name;
```

Note: Becarefulbeforedroppingatable. Deletingatablewillresultinlossofcomplete information stored in the table!

SQLDROPTABLEExample

ThefollowingSQLstatementdropstheexistingtable"Shippers":

Example:

```
DROPTABLEShippers;
```

SQLTRUNCATETABLE

TheTRUNCATETABLEstatementisusedtodeletethedatainsideatable,butnot the table itself.

Syntax:

```
TRUNCATETABLEtable_name;
```

SQLNOTNULL Constraint

SQLNOTNULL Constraint

- Bydefault,acolumncanholdNULLvalues.
- TheNOTNULLconstraintenforcesacolumntoNOTacceptNULLvalues.
- Thisenforcesafieldtoalwayscontainavalue,whichmeansthatyoucannotinserta new record, or update a record without adding a value to this field.

SQLNOTNULLonCREATETABLE

ThefollowingSQLensuresthatthe"ID","LastName",and"FirstName"columns will NOT accept NULL values when the "Persons" table is created:

Example:

```
CREATETABLEPersons(  I
   D int NOT NULL,
   LastName varchar(255) NOT NULL,
   FirstNamevarchar(255)NOTNULL,
   Age int
);
```

SQLNOTNULLonALTERTABLE

TocreateaNOTNULLconstraintonthe"Age"columnwhenthe"Persons"table is already created, use the following SQL:

```
ALTER TABLE Persons
MODIFYAgeintNOTNULL;
```


SQLCHECKConstraint

SQLCHECKConstraint

- TheCHECKconstraintisusedtolimitthevaluerangethat canbeplacedina column.
- IfyoudefineaCHECK constraintonacolumnitwillallowonlycertainvaluesfor this column.
- IfyoudefineaCHECKconstraintonatableitcanlimitthevaluesincertaincolumns based on values in other columns in the row.

SQLCHECKonCREATETABLE

The following SQL creates a CHECK constraint on the "Age" column when the "Persons"tableiscreated.TheCHECKconstraintensuresthattheageofaperson must be 18, or older:

MySQL:

```
CREATETABLEPersons( I
   D int NOT NULL,
   LastNamevarchar(255)NOTNULL,
   FirstName varchar(255),
   Ageint,
   CHECK(Age>=18)
);
```

SQLServer/Oracle/MSAccess:

```
CREATETABLEPersons( I
   D int NOT NULL,
   LastNamevarchar(255)NOTNULL,
   FirstName varchar(255),
   AgeintCHECK(Age>=18)
);
```


ToallownamingofaCHECKconstraint,andfordefiningaCHECKconstraintonmultiple columns, use the following SQL syntax:

MySQL/SQLServer/Oracle/MSAccess:

```
CREATETABLEPersons( I
   D int NOT NULL,
   LastNamevarchar(255)NOTNULL,
   FirstName varchar(255),
   Ageint,
   Cityvarchar(255),
   CONSTRAINTCHK_PersonCHECK(Age>=18ANDCity='Sandnes')
);
```

SQLCHECKonALTERTABLE

TocreateaCHECKconstraintonthe"Age"columnwhenthetableisalreadycreated, use the following SQL:

MySQL/SQLServer/Oracle/MSAccess:

```
ALTER TABLE Persons
ADDCHECK(Age>=18);
```

ToallownamingofaCHECKconstraint,andfordefiningaCHECKconstraintonmultiple columns, use the following SQL syntax:

MySQL/SQLServer/Oracle/MSAccess:

```
ALTERTABLEPersons
ADDCONSTRAINTCHK_PersonAgeCHECK(Age>=18ANDCity='Sandnes');
```

DROPaCHECKConstraint

TodropaCHECKconstraint,usethefollowing SQL:

SQLServer/Oracle/MSAccess:

```
ALTERTABLEPersons
DROPCONSTRAINTCHK_PersonAge;
```

MySQL:

```
ALTERTABLEPersons
DROPCHECKCHK_PersonAge;
```


SQLCREATEINDEX Statement

SQLCREATEINDEXStatement

- TheCREATEINDEXstatementisusedtocreateindexesintables.
- Indexes are used to retrieve data from the database more quickly than otherwise.Theuserscannotseetheindexes,theyarejustusedtospeedup searches/queries.

Note: Updating a table with indexes takes more time than updating a table without(becausetheindexesalsoneedanupdate).So,onlycreateindexeson columns that will be frequently searched against.

CREATEINDEXSyntax:

Createsanindexonatable.Duplicatevaluesareallowed:

CREATEINDEX*index_name*
ON*table_name*(*column1*,*column2*,...);

CREATEUNIQUEINDEXSyntax:
Createsauniqueindexonatable.Duplicatevaluesarenot allowed:

CREATEUNIQUEINDEX*index_name*
ON*table_name*(*column1*,*column2*,...);

Note: Thesyntaxforcreatingindexesvariesamongdifferentdatabases. Therefore: Check the syntax for creating indexes in your database.

CREATEINDEXExample

TheSQLstatementbelowcreatesanindexnamed"idx_lastname"onthe "LastName" column in the "Persons" table:

CREATEINDEXidx_lastname
ON Persons (LastName);

Ifyouwanttocreateanindexonacombinationofcolumns,youcanlistthe column names within the parentheses, separated by commas:

CREATEINDEXidx_pname
ONPersons(LastName,FirstName);

DROPINDEXStatement

TheDROPINDEXstatementisusedtodeleteanindexinatable.

MSAccess:
DROPINDEX*index_name*ON*table_name*;

SQLServer:
DROPINDEX*table_name*.*index_name*;

DB2/Oracle:

DROPINDEX*index_name*;

MySQL:

ALTERTABLE*table_name*

DROPINDEX*index_name*;

SQLWORKINGWITHDATES

SQLDates

The most difficult part when working with dates is to be sure that the format ofthedateyouaretryingtoinsert,matchestheformatofthedatecolumnin the database.

Aslongasyourdatacontainsonlythedateportion,yourquerieswillworkas expected. However, if a time portion is involved, it gets more complicated.

SQLDateData Types

MySQLcomeswiththefollowingdatatypesforstoringadateoradate/time value in the database:

- DATE-formatYYYY-MM-DD
- DATETIME-format:YYYY-MM-DDHH:MI:SS
- TIMESTAMP-format:YYYY-MM-DDHH:MI:SS
- YEAR-formatYYYYorYY

SQLServercomeswiththefollowingdatatypesforstoringadateora date/time value in the database:

- DATE-formatYYYY-MM-DD
- DATETIME-format:YYYY-MM-DDHH:MI:SS
- SMALLDATETIME-format:YYYY-MM-DDHH:MI:SS
- TIMESTAMP-format:aunique number

Note: Thedatetypesarechosenforacolumnwhenyoucreateanewtablein your database!

SQLWorkingwithDates

Lookatthefollowingtable:

OrdersTable

OrderId	ProductName	OrderDate
1	Geitost	2008-11-11
2	CamembertPierrot	2008-11-09
3	Mozzarelladi Giovanni	2008-11-11
4	MascarponeFabioli	2008-10-29

NowwewanttoselecttherecordswithanOrderDateof"2008-11-11"from the table above.

WeusethefollowingSELECTstatement:

```
SELECT*FROMOrdersWHEREOrderDate='2008-11-11'
```

Theresult-setwilllooklikethis:

OrderId	ProductName	OrderDate
1	Geitost	2008-11-11
3	Mozzarelladi Giovanni	2008-11-11

Note: Twodatescaneasilybecomparedifthereisnotimecomponent involved!

Now,assumethatthe"Orders"tablelookslikethis(noticetheadded timecomponent in the "OrderDate" column):

OrderId	ProductName	OrderDate
1	Geitost	2008-11-1113:23:44
2	CamembertPierrot	2008-11-0915:45:21
3	Mozzarelladi Giovanni	2008-11-1111:12:01
4	MascarponeFabioli	2008-10-2914:56:59

IfweusethesameSELECTstatementas above:

SELECT*FROMOrdersWHEREOrderDate='2008-11-11'

wewillgetnoresult!Thisisbecausethequeryislookingonlyfordateswithno time portion.

Tip: Tokeepyourqueriessimpleandeasytomaintain,donotuse timecomponents in your dates, unless you have to!

SQL Injection

SQLInjection

- SQLinjectionisacodeinjectiontechniquethatmightdestroyyour database.
- SQLinjectionisoneofthemostcommonwebhackingtechniques.
- SQLinjectionistheplacementofmaliciouscodeinSQLstatements,viaweb page input.

SQLinWebPages

- SQL injection usually occurs when you ask a user for input, like their username/userid,andinsteadofaname/id,theusergivesyouanSQL statement that you will **unknowingly** run on your database.
- LookatthefollowingexamplewhichcreatesaSELECTstatementbyadding a variable (txtUserId) to a select string. The variable is fetched from user input (getRequestString):

Example: txtUserId = getRequestString("UserId");
txtSQL="SELECT*FROMUsersWHEREUserId="+txtUserId;

Therestofthischapterdescribesthepotentialdangersofusinguserinputin SQL statements.

SQLInjectionBasedon1=1isAlwaysTrue

- Lookattheexampleaboveagain.Theoriginalpurposeofthecodewasto create an SQL statement to select a user, with a given user id.
- Ifthereisnothingtopreventauserfromentering"wrong"input,theuser can enter some "smart" input like this:

UserId: 105 OR 1

- Then,theSQLstatementwilllooklike this:

SELECT*FROMUsersWHEREUserId=105OR1=1;

- TheSQLaboveisvalidandwillreturnALLrowsfromthe"Users"table, since **OR 1=1** is always TRUE.
- Doestheexampleabovelookdangerous?Whatifthe"Users"table contains names and passwords?
- TheSQLstatementaboveismuchthesameasthis:

SELECTUserId,Name,PasswordFROMUsersWHEREUserId=105or1=1;

- Ahackermightgetaccesstoalltheusernamesandpasswordsina database, by simply inserting 105 OR 1=1 into the input field.

SQLInjectionBasedon""=""isAlwaysTrue

Hereisanexampleofauserloginonawebsite:

Username:
JohnDoe

Password:
myPass

Example: uName = getRequestString("username");
uPass=getRequestString("userpassword");

sql='SELECT*FROMUsersWHEREName="'+uName+'"ANDPass="'+ uPass + '"'

Result:
SELECT*FROMUsersWHEREName="JohnDoe"ANDPass="myPass"

Ahackermightgetaccesstousernamesandpasswordsinadatabaseby simply inserting " OR ""=" into the user name or password text box:

UserName:
"or ""="
Password:
"or ""="

ThecodeattheserverwillcreateavalidSQLstatementlikethis:Result:

SELECT*FROMUsersWHEREName=""or""=""ANDPass=""or""=""

TheSQLaboveisvalidandwillreturnallrowsfromthe"Users"table,since **OR ""=""**is always TRUE.

SQLInjectionBasedonBatchedSQL Statements

- MostdatabasessupportbatchedSQLstatement.
- AbatchofSQLstatementsisagroupoftwoormoreSQLstatements, separated by semicolons.
- TheSQLstatementbelowwillreturnallrowsfromthe"Users"table,then delete the "Suppliers" table.

Example:

SELECT*FROMUsers;DROPTABLESuppliers Look at the following example:

Example: txtUserId = getRequestString("UserId");

txtSQL="SELECT*FROMUsersWHEREUserId="+txtUserId; And

the following input:

Userid: 105; DRO

ThevalidSQLstatementwouldlooklikethis:

Result:

SELECT*FROMUsersWHEREUserId=105;DROPTABLESuppliers;

UseSQLParametersfor Protection

- ToprotectawebsitefromSQLinjection,youcanuseSQLparameters.
- SQLparametersarevaluesthatareaddedtoanSQLqueryatexecution time, in a controlled manner.

ASP.NET Razor Example: txtUserId = getRequestString("UserId"); txtSQL = "SELECT * FROM Users WHERE UserId = @0";

db.Execute(txtSQL,txtUserId);

- NotethatparametersarerepresentedintheSQLstatementby a@ marker.
- The SQL engine checks each parameter to ensure that it is correct for its columnandaretreatedliterally,andnotaspartoftheSQLtobeexecuted.

Another Example: txtNam = getRequestString("CustomerName");txtAdd= getRequestString("Address"); txtCit = getRequestString("City");

txtSQL="INSERTINTOCustomers(CustomerName,Address,City) Values(@0,@1,@2)";

db.Execute(txtSQL,txtNam,txtAdd,txtCit);

Examples:

Thefollowingexamplesshowshowtobuildparameterizedqueriesinsome common web languages.

SELECTSTATEMENTINASP.NET:

```
txtUserId=getRequestString("UserId");
sql="SELECT*FROMCustomersWHERECustomerId=@0"; command
= new SqlCommand(sql);
command.Parameters.AddWithValue("@0",txtUserId);
command.ExecuteReader();
```

INSERTINTOSTATEMENTINASP.NET:

```
txtNam=getRequestString("CustomerName");
txtAdd = getRequestString("Address"); txtCit =
getRequestString("City");
txtSQL="INSERTINTOCustomers(CustomerName,Address,City)
Values(@0,@1,@2)"; command = new SqlCommand(txtSQL);
command.Parameters.AddWithValue("@0",txtNam);
command.Parameters.AddWithValue("@1",txtAdd);
command.Parameters.AddWithValue("@2",txtCit);
command.ExecuteNonQuery();
```

INSERTINTOSTATEMENTINPHP:

```
$stmt=$dbh->prepare("INSERTINTOCustomers
(CustomerName,Address,City)
VALUES(:nam,:add,:cit)");
$stmt->bindParam(':nam',$txtNam);
$stmt->bindParam(':add',$txtAdd);
$stmt->bindParam(':cit',$txtCit);
$stmt->execute();
```

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