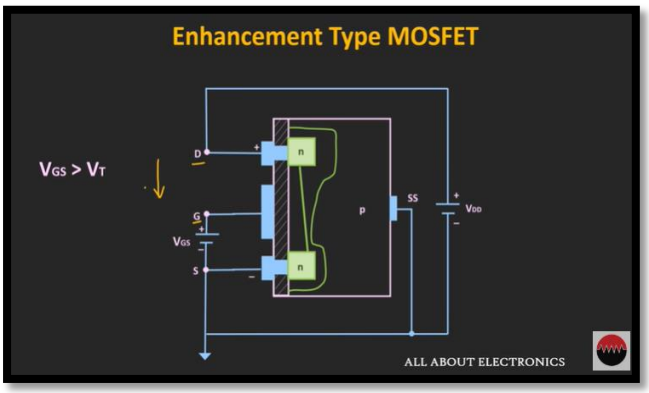
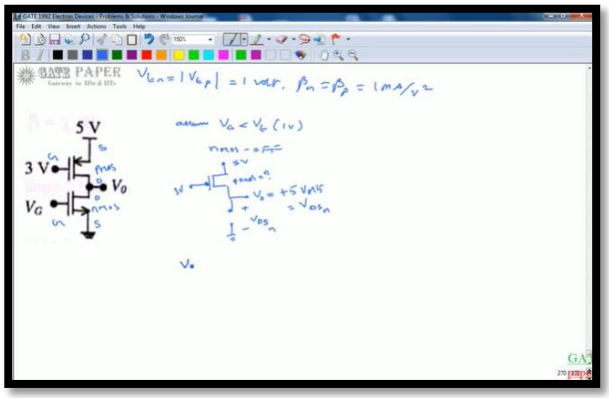
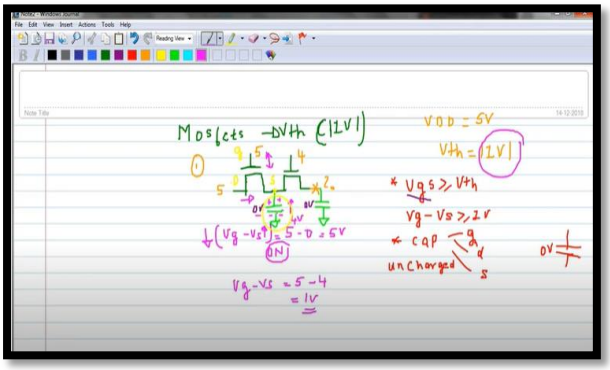
DAILY ASSESSMENT

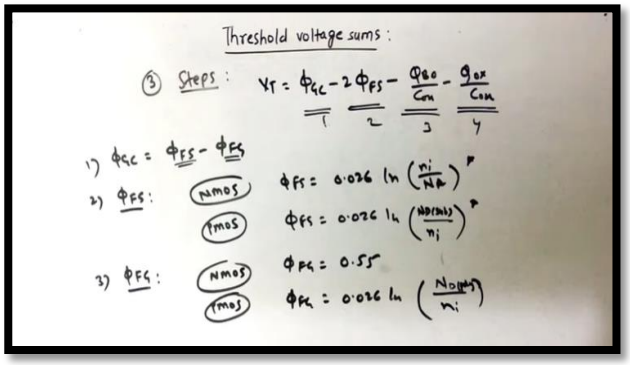
Date:	**9/06/2020**	**Name:**	**Davis S. Patel**
Course:	**VLSI**	**USN:**	**4AL16EC045**
Topic:	• **MOSFET - Enhancement Type MOSFET Explained (Construction, Working and Characteristics Explained)** • **GATE 2009 and 20121 ECE operating region and output voltage of CMOS inverter** • **MOSFET vth based problems** • **MOSFET problems and solutions** • **TRICK to implement 4:1 mux using Transmission Gate & Pass Transistor Logic** • **MOSFET Drain current - graph ,formulae & sums (cutoff, linear & saturation)** • **Realization of logic function using Multiplexer**	**Semester & Section:**	**8th - A**
GitHub Repository:	**Davis**		

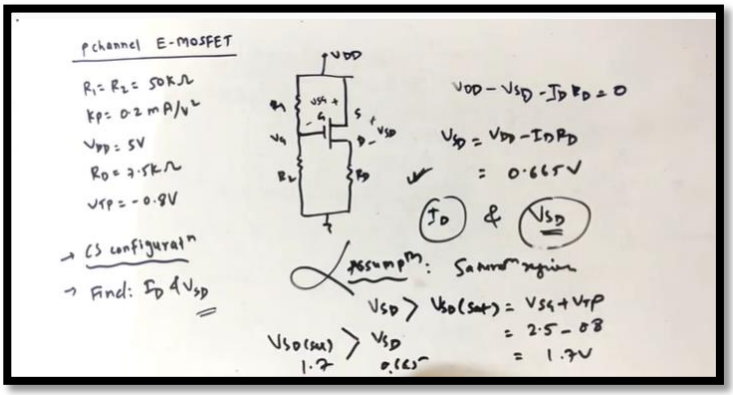
FORENOON SESSION DETAILS
Image of session

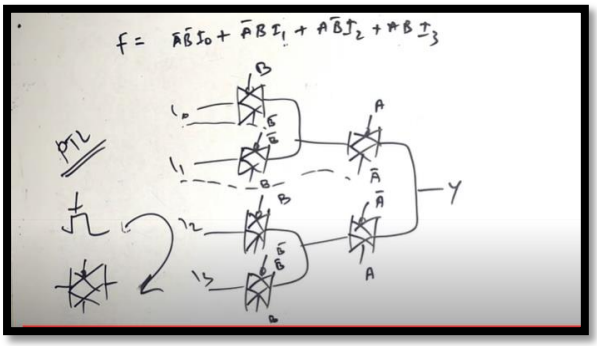


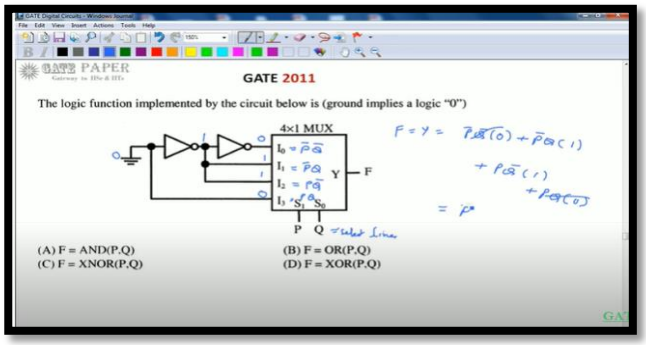



Mosfets -|Vth| (|2V|)
VDD = 5V
Vth = |2V|
* Vgs ≥ Vth
Vg - Vs ≥ 2V
* cap
uncharged
ON
Vg - Vs = 5 - 4
= 1V


Threshold voltage sums :
③ Steps :
1) ϕgc = ϕfs - ϕfs
2) ϕfs : nmos
tmos
3) ϕfc : nmos
tmos


pchannel E-MOSFET
R1 = R2 = 50kΩ
Kp = 0.2 mA/V²
VDD = 5V
RD = 7.5kΩ
VTP = -0.8V
→ CS configuration
→ Find: ID & VSD
VDD - VSD - ID RD = 0
VSD = VDD - ID RD
= 0.665V
ID & VSD
Assumption: Saturation region
VSD > VSD(sat) = VSG + VTP
= 2.5 - 0.8
= 1.7V


f = ĀB̄I0 + ĀBI1 + AB̄I2 + ABI3
DTL
Y


GATE PAPER
GATE 2011
The logic function implemented by the circuit below is (ground implies a logic "0")
4×1 MUX
F = Y =
(A) F = AND(P,Q)
(B) F = OR(P,Q)
(C) F = XNOR(P,Q)
(D) F = XOR(P,Q)

REPORT –

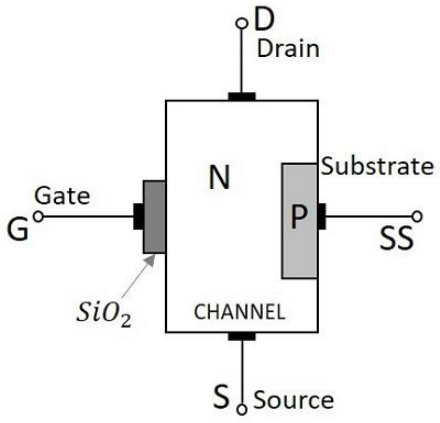
FETs have a few disadvantages like high drain resistance, moderate input impedance and slower operation. To overcome these disadvantages, the MOSFET which is an advanced FET is invented.

MOSFET stands for Metal Oxide Silicon Field Effect Transistor or Metal Oxide Semiconductor Field Effect Transistor. This is also called as IGFET meaning Insulated Gate Field Effect Transistor. The FET is operated in both depletion and enhancement modes of operation. The following figure shows how a practical MOSFET looks like.

Construction of a MOSFET

The construction of a MOSFET is a bit similar to the FET. An oxide layer is deposited on the substrate to which the gate terminal is connected. This oxide layer acts as an insulator (sio_2 insulates from the substrate), and hence the MOSFET has another name as IGFET. In the construction of MOSFET, a lightly doped substrate, is diffused with a heavily doped region. Depending upon the substrate used, they are called as **P-type** and **N-type** MOSFETs.

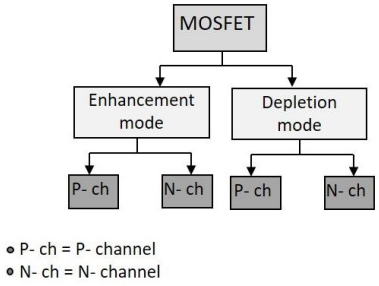
The following figure shows the construction of a MOSFET.



The voltage at gate controls the operation of the MOSFET. In this case, both positive and negative voltages can be applied on the gate as it is insulated from the channel. With negative gate bias voltage, it acts as **depletion MOSFET** while with positive gate bias voltage it acts as an **Enhancement MOSFET**

Classification of MOSFETs

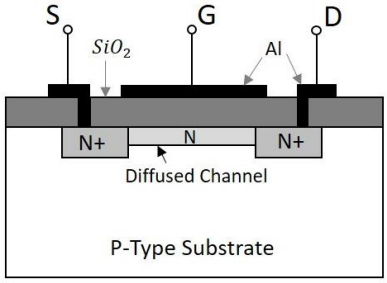
Depending upon the type of materials used in the construction, and the type of operation, the MOSFETs are classified as in the following figure.



After the classification, let us go through the symbols of MOSFET.

Construction of N- Channel MOSFET

Let us consider an N-channel MOSFET to understand its working. A lightly doped P-type substrate is taken into which two heavily doped N-type regions are diffused, which act as source and drain. Between these two N+ regions, there occurs diffusion to form an N-channel, connecting drain and source.



Structure of N-channel MOSFET

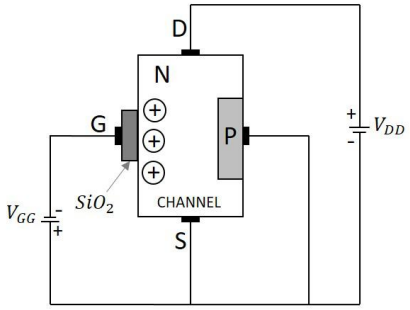
A thin layer of **Silicon dioxide (SiO_2)** is grown over the entire surface and holes are made to draw ohmic contacts for drain and source terminals. A conducting layer of **aluminum** is laid over the entire channel, upon this **SiO_2** layer from source to drain which constitutes the gate. The **SiO_2 substrate** is connected to the common or ground terminals.

Because of its construction, the MOSFET has a very less chip area than BJT, which is 5% of the occupancy when compared to bipolar junction transistor. This device can be operated in modes. They are depletion and enhancement modes.

Working of N - Channel depletion mode

For now, we have an idea that there is no PN junction present between gate and channel in this, unlike a FET. We can also observe that, the diffused channel N between two N+regions between two N+regions, the **insulating dielectric SiO_2** and the aluminum metal layer of the gate together form a **parallel plate capacitor**.

If the NMOS has to be worked in depletion mode, the gate terminal should be at negative potential while drain is at positive potential, as shown in the following figure.



Working of MOSFET in depletion mode

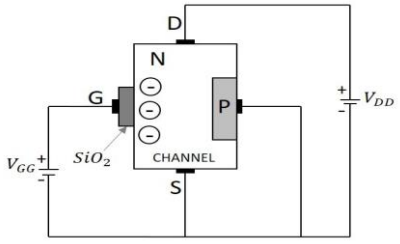
When no voltage is applied between gate and source, some current flows due to the voltage between drain and source. Let some negative voltage is applied at $\mathbf{V_{GG}}$. Then the minority carriers i.e. holes, get attracted and settle near $\mathbf{SiO_2}$ layer. But the majority carriers, i.e., electrons get repelled.

With some amount of negative potential at $\mathbf{V_{GG}}$ a certain amount of drain current $\mathbf{I_D}$ flows through source to drain. When this negative potential is further increased, the electrons get depleted and the current $\mathbf{I_D}$ decreases. Hence the more negative the applied $\mathbf{V_{GG}}$, the lesser the value of drain current $\mathbf{I_D}$ will be.

The channel nearer to drain gets more depleted than at source like in FET like in FET and the current flow decreases due to this effect. Hence it is called as depletion mode MOSFET.

Working of N-Channel MOSFET Enhancement Mode

The same MOSFET can be worked in enhancement mode, if we can change the polarities of the voltage $\mathbf{V_{GG}}$. So, let us consider the MOSFET with gate source voltage $\mathbf{V_{GG}}$ being positive as shown in the following figure.



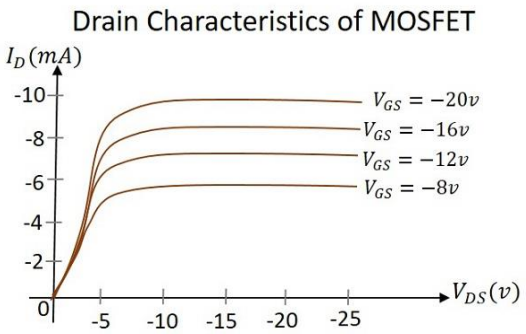
Working of MOSFET in Enhancement mode

When no voltage is applied between gate and source, some current flows due to the voltage between drain and source. Let some positive voltage is applied at $\mathbf{V_{GG}}$. Then the minority carriers i.e. holes, get repelled and the majority carriers i.e. electrons gets attracted towards the $\mathbf{SiO_2}$ layer.

With some amount of positive potential at $\mathbf{V_{GG}}$ a certain amount of drain current $\mathbf{I_D}$ flows through source to drain. When this positive potential is further increased, the current $\mathbf{I_D}$ increases due to the flow of electrons from source and these are pushed further due to the voltage applied at $\mathbf{V_{GG}}$. Hence the more positive the applied $\mathbf{V_{GG}}$, the more the value of drain current $\mathbf{I_D}$ will be. The current flow gets enhanced due to the increase in electron flow better than in depletion mode. Hence this mode is termed as **Enhanced Mode MOSFET**.

Drain Characteristics

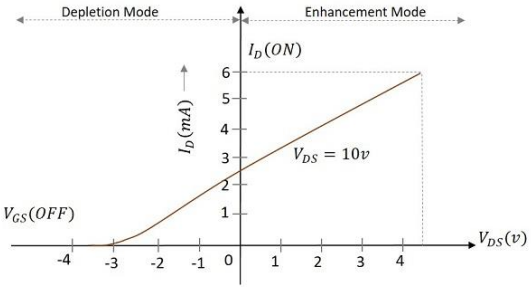
The drain characteristics of a MOSFET are drawn between the drain current $\mathbf{I_D}$ and the drain source voltage $\mathbf{V_{DS}}$. The characteristic curve is as shown below for different values of inputs.



Actually when $\mathbf{V_{DS}}$ is increased, the drain current $\mathbf{I_D}$ should increase, but due to the applied $\mathbf{V_{GS}}$, the drain current is controlled at certain level. Hence the gate current controls the output drain current.

Transfer Characteristics

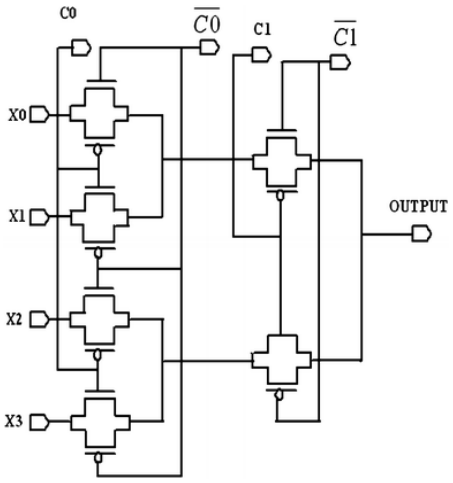
Transfer characteristics define the change in the value of $\mathbf{V_{DS}}$ with the change in $\mathbf{I_D}$ and $\mathbf{V_{GS}}$ in both depletion and enhancement modes. The below transfer characteristic curve is drawn for drain current versus gate to source voltage.



Transfer Characteristics of a MOSFET

Transmission gate logic based 4:1 MUX

This design is the transmission gate type of MUX structure implemented with very minimum transistors compared to the conventional CMOS based design. The back-to-back connected PMOS and NMOS arrangement acts as a switch is so called transmission gate. NMOS devices pass a strong 0 but a weak 1, while PMOS pass a strong 1 but a weak 0. The transmission gate combines the best of both the properties by placing NMOS in parallel with the PMOS device.



Each transmission gate acts as an AND switch to replace the AND logic gate which is used in a conventional gate design of MUX. Hence, the device count is reduced. The transmission gate based 4:1 MUX is shown in Fig above.

MOSFET Drain Current

$$I_D = k(V_{GS} - V_{TH})^2$$

$$V_{DD} = I_D R_D + V_{DS} + I_D R_S$$
$$= I_D (R_D + R_S) + V_{DS}$$

$$\therefore R_D + R_S = \frac{V_{DD} - V_{DS}}{I_D}$$

Then from this we can say that:

$$R_D = \frac{V_{DD} - V_D}{I_D} \quad \text{and} \quad R_S = \frac{V_S}{I_D}$$

And the mosfets gate-to-source voltage, V_{GS} is given as:

$$V_{GS} = V_G - I_S R_S$$

As we have seen above, for proper operation of the eMOSFET, this gate-source voltage must be greater than the threshold voltage of the eMOSFET, that is $V_{GS} > V_{TH}$. Since $I_S = I_D$, the gate voltage, V_G is therefore equal too:

$$V_{GS} = V_G - I_D R_S$$

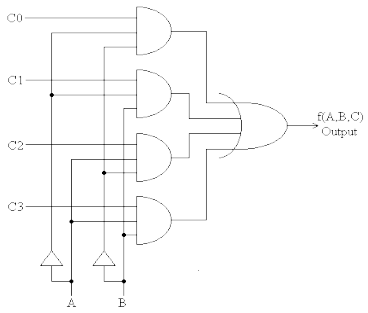
$$\therefore V_G = V_{GS} + I_D R_S$$

$$\text{or } V_G = V_{GS} + V_S$$

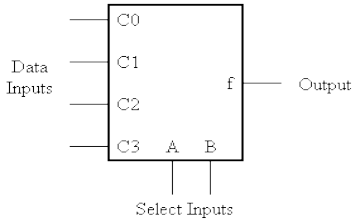
A **multiplexer** performs the function of selecting the input on any one of 'n' input lines and feeding this input to one output line.

Multiplexers are used as one method of reducing the number of integrated circuit packages required by a particular circuit design. This in turn reduces the cost of the system.

Assume that we have four lines, ***C*0, *C*1, *C*2 and *C*3**, which are to be multiplexed on a single line, ***Output (f)***. The four input lines are also known as the ***Data Inputs***. Since there are four inputs, we will need two additional inputs to the multiplexer, known as the ***Select Inputs***, to select which of the ***C*** inputs is to appear at the output. Call these select lines ***A and B***. The gate implementation of a 4-line to 1-line multiplexer is shown below:



The circuit symbol for the above multiplexer is:

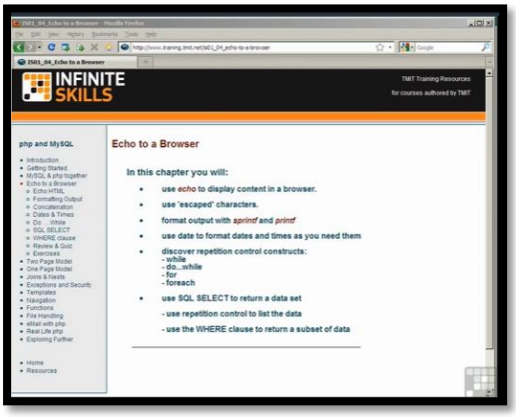


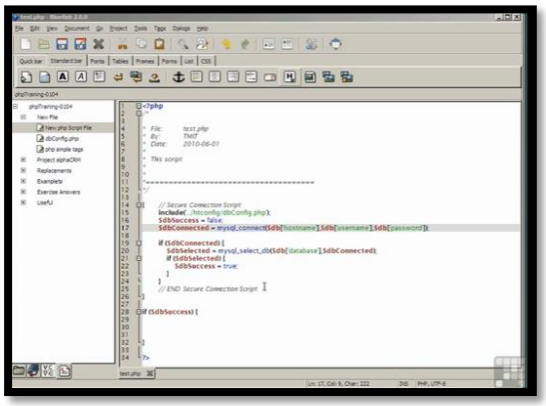
DAILY ASSESSMENT

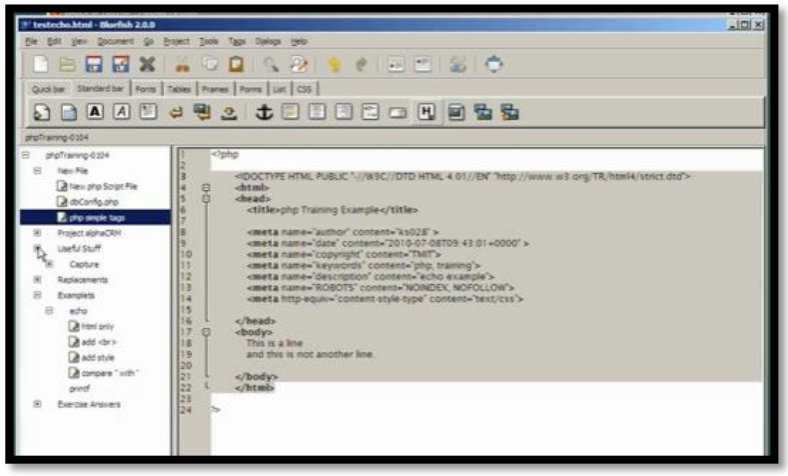
Date:	9/06/2020	Name:	Davis S. Patel
Course:	MySQL	USN:	4AL16EC045
Topic:	Outputting And Processing Data Dealing With Variables	Semester & Section:	8th - A
GitHub Repository:	Davis		

AFTERNOON SESSION DETAILS

Image of Session





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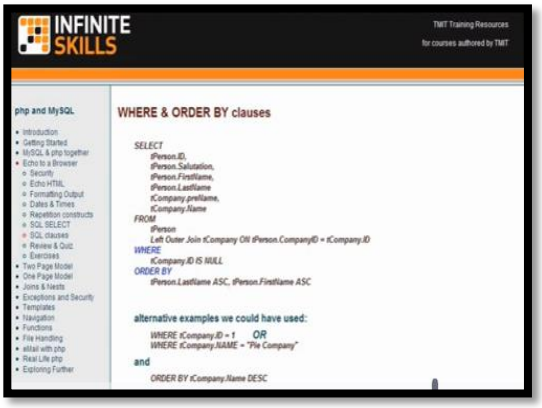
php and MySQL
SQL SELECT
SELECT <column1> , ... , <columnN> FROM <tableName>
eg $SQLscript = SELECT Salutation, FirstName, LastName FROM tPerson
then in php
$result = mysql_query($SQLscript); // just like INSERT etc.
while ($row = mysql_fetch_array($result, $arrayType))
{ process the assoc array $row }
$arrayType is one of 'MYSQL_ASSOC', 'MYSQL_NUM' or MYSQL_BOTH'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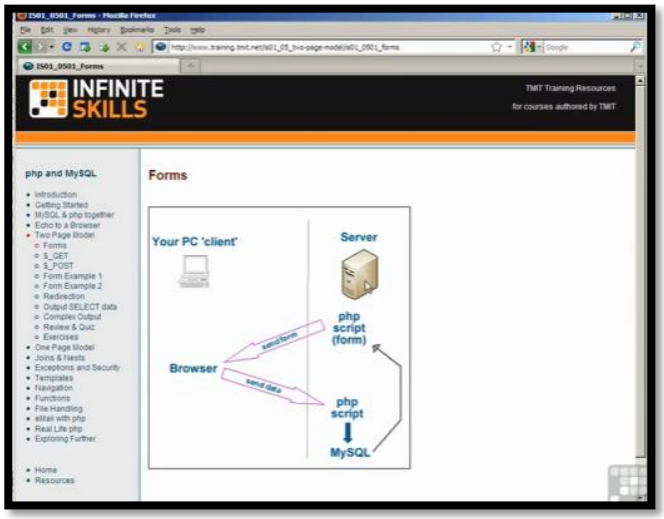
php and MySQL
WHERE & ORDER BY clauses
SELECT
tPerson.ID,
tPerson.Salutation,
tPerson.FirstName,
tPerson.LastName
tCompany.preName,
tCompany.Name
FROM
tPerson
Left Outer Join tCompany ON tPerson.CompanyID = tCompany.ID
WHERE
tCompany.ID IS NULL
ORDER BY
tPerson.LastName ASC, tPerson.FirstName ASC
alternative examples we could have used:
WHERE tCompany.ID = 1 OR
WHERE tCompany.NAME = "Pie Company"
and
ORDER BY tCompany.Name DESC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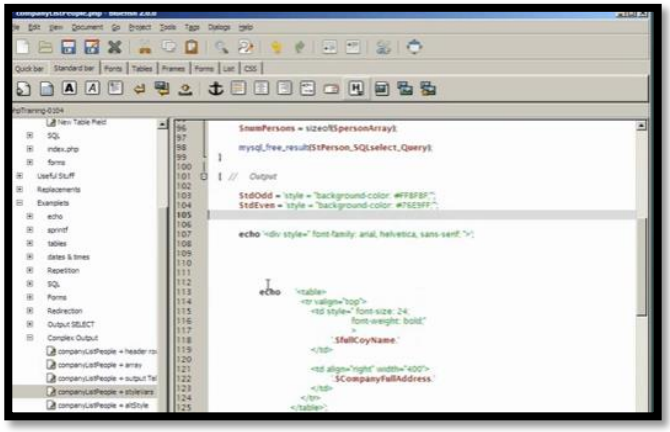
Forms
Your PC 'client'
Server
php script (form)
Browser
send form
send data
php script
MySQL



REPORT –

PHP echo() Function

The echo() function outputs one or more strings. The echo() function is not actually a function, so you are not required to use parentheses with it. However, if you want to pass more than one parameter to echo(), using parentheses will generate a parse error. The echo() function is slightly faster than print(). The echo() function also has a shortcut syntax. Prior to PHP 5.4.0, this syntax only works with the short_open_tag configuration setting enabled.

Example

Write the value of the string variable ($str) to the output:

```php
<?php
$str = "Hello world!";
echo $str;
?>
```

PHP Loops

Often when you write code, you want the same block of code to run over and over again a certain number of times. So, instead of adding several almost equal code-lines in a script, we can use loops. Loops are used to execute the same block of code again and again, as long as a certain condition is true.

In PHP, we have the following loop types:

- while - loops through a block of code as long as the specified condition is true
- do...while - loops through a block of code once, and then repeats the loop as long as the specified condition is true
- for - loops through a block of code a specified number of times
- foreach - loops through a block of code for each element in an array

PHP do...while Loop

The `do-while` loop is a variant of while loop, which evaluates the condition at the end of each loop iteration. With a `do-while` loop the block of code executed once, and then the condition is evaluated, if the condition is true, the statement is repeated as long as the specified condition evaluated to is true.

```
do{
  // Code to be executed
}
while(condition);
```

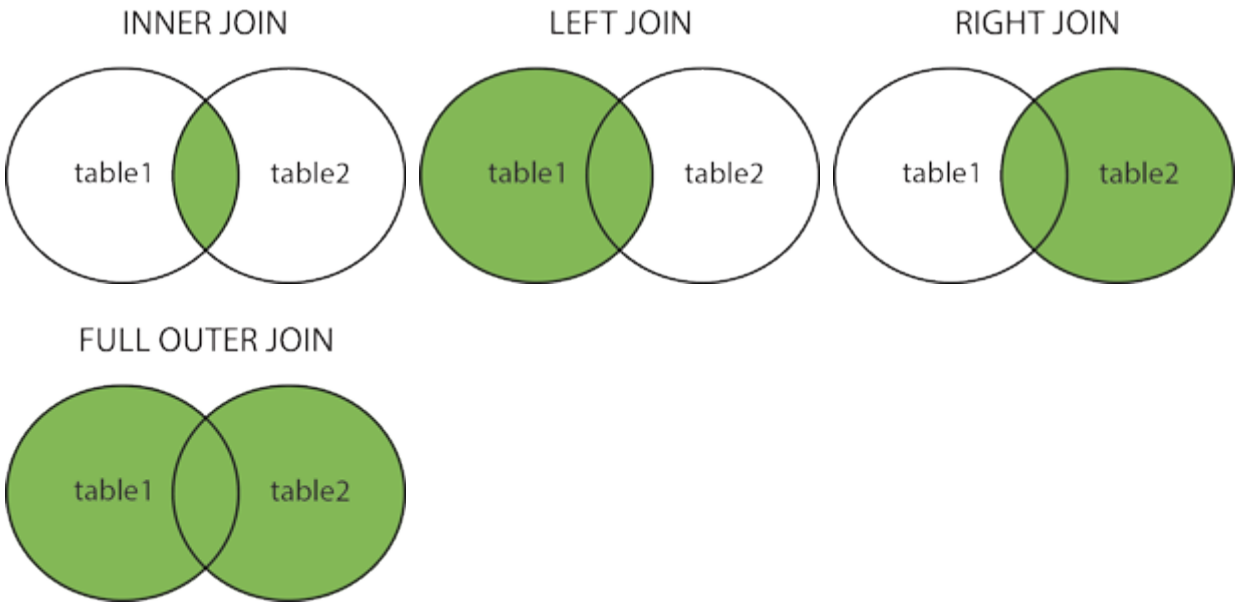
SQL JOIN

A JOIN clause is used to combine rows from two or more tables, based on a related column between them.

Different Types of SQL JOINs

Here are the different types of the JOINs in SQL:

- **(INNER) JOIN**: Returns records that have matching values in both tables
- **LEFT (OUTER) JOIN**: Returns all records from the left table, and the matched records from the right table
- **RIGHT (OUTER) JOIN**: Returns all records from the right table, and the matched records from the left table
- **FULL (OUTER) JOIN**: Returns all records when there is a match in either left or right table



Variable

A variable is an object that holds a single value of a specific type e.g., integer, date, or string. We typically use variables in the following cases:

- As a loop counter to count the number of times a loop is performed.
- To hold a value to be tested by a control-of-flow statement such as WHILE.
- To store the value returned by a stored procedure or a function

Declaring a variable

To declare a variable, you use the DECLARE statement. For example, the following statement declares a variable named @model_year:

DECLARE @model_year SMALLINT;

The DECLARE statement initializes a variable by assigning it a name and a data type. The variable name must start with the @ sign. In this example, the data type of the @model_year variable is SMALLINT.

By default, when a variable is declared, its value is set to NULL.

GET is used to request data from a specified resource.

GET is one of the most common HTTP methods.

Note that the query string (name/value pairs) is sent in the URL of a GET request:

/test/demo_form.php?name1=value1&name2=value2

Some other notes on GET requests:

- GET requests can be cached
- GET requests remain in the browser history
- GET requests can be bookmarked
- GET requests should never be used when dealing with sensitive data
- GET requests have length restrictions
- GET requests are only used to request data (not modify)

POST is used to send data to a server to create/update a resource.

The data sent to the server with POST is stored in the request body of the HTTP request:

POST /test/demo_form.php HTTP/1.1
Host: w3schools.com
name1=value1&name2=value2

POST is one of the most common HTTP methods.

Some other notes on POST requests:

- POST requests are never cached
- POST requests do not remain in the browser history
- POST requests cannot be bookmarked
- POST requests have no restrictions on data length

Redirection in PHP can be done using the header() function. To setup a simple redirect, simply create an index.php file in the directory you wish to redirect from with the following content:

```
< ?php header("Location: http://www.redirect.to.url.com/"); ?>
```

Where 'http://www.redirect.to.url.com/' is the URL you wish the users to be redirected too. This can also be a file, like so:

```
<?php header("Location: anotherDirectory/anotherFile.php"); ?>
```

Files can be of any type including but not limited to HTML, python, php, cgi, perl, and compiled cgi programs.