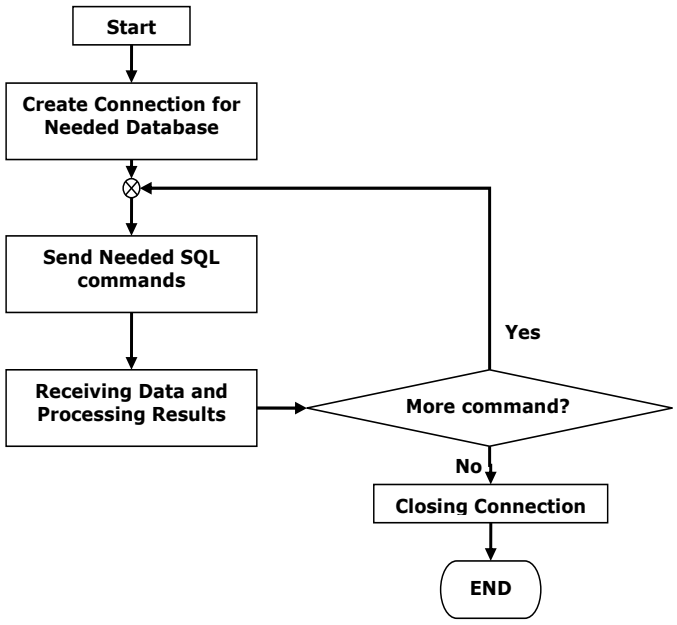
School of Information and Computer Technology
Sirindhorn International Institute of Technology
Thammasat University
ITS351 Database Programming Laboratory

Laboratory #8: Data Manupulation I

Objective: - To learn how to connect to MySQL via PHP
- To learn how to add data from PHP to MySQL

1 Connect from PHP to MySQL

A flow chart illustrating the use of PHP together with a database to make a client/server web application is shown as followed:



From the figure, we firstly have to establish a connection to the MySQL Server. After that, through the established connection, you can issue as many MySQL statements as needed to the MySQL server. In the end, the database connection is closed to free the used resource. The detail of each step in this work flow is described next.

1.1 Open a Connection

There are both procedural and object-oriented ways to connect to MySQL from PHP. In this lab, we will use the object-oriented way with *mysqli* extension. Opening a connection to MySQL is done by creating a new object of class mysqli as follows.

```php
<?php
// In some cases, 127.0.0.1 may be needed instead of localhost
$mysqli = new mysqli('localhost','user','password','dbname');
if($mysqli->connect_errno){
echo $mysqli->connect_errno.": ".$mysqli->connect_error;
}
// All subsequent queries are done through $mysqli object.
// ...
$mysqli->close();
?>
```

The constructor of mysqli takes four arguments: the host to connect to (localhost in most cases), MySQL user, MySQL password, and the databasename. Often, the connection is closed automatically at the end of script execution. So, there is no need to explicitly close it. In a rare case where it is needed, `$mysqli->close()` may be used.

The property `connect_errno` returns the last error code number from the last call to connect. If there is no error, then zero is produced. Wrapping "if" around the `connect_errno` is a common pattern when establishing a connection to MySQL. The property `connect_error` is associated with `connect_errno`, and is the string description of the last connection error.

1.2 Send Queries to MySQL

Now that we have a connection to the database, we can now send some queries. To execute an SQL command in a PHP program, we call the method `query()` on the mysqli object. The following code illustrates how an SQL CREATE statement is sent with `query()`.

```php
<?php
	$mysqli = new mysqli('localhost','user','password','dbname');
	if($mysqli->connect_errno){
		echo $mysqli->connect_errno.": ".$mysqli->connect_error;
	}

	$q='CREATE table product(p_id int unsigned not null auto_increment
primary key, p_name varchar(30), p_price int)';
	if($mysqli->query($q)){
		echo 'CREATE was successful.';
	}else{
		Echo 'CREATE failed. Error: '.$mysqli->error ;
	}
?>
```

The method `query()` of class mysqli takes a query string as its argument and returns either a `mysqli_result` object on success for a SELECT, SHOW, DESC, and EXPLAIN query, or false on failure. For a query which does not require a result set (i.e., CREATE, INSERT, UPDATE, and DELETE), the method returns true on success.

Wrapping the `query()` call with an "if" statement is a common coding pattern as it attempts to query and performs the failure checking in one go. In the case of a failure, the property `$mysqli->error` will return the last error message associated with the latest query.

After the code is successfully executed, we would have a new table "product" in the database. The table has the following structure.

```
+---------+------------------+------+-----+---------+----------------+
| Field   | Type             | Null | Key | Default | Extra          |
+---------+------------------+------+-----+---------+----------------+
| p_id    | int(10) unsigned | NO   | PRI | NULL    | auto_increment |
| p_name  |varchar(30)       | YES  |     | NULL    |                |
| p_price | int(11)          | YES  |     | NULL    |                |
+---------+------------------+------+-----+---------+----------------+
```

It is simple to make a slight modification of the previous code to insert some rows to this table. Here is a code snippet which inserts four rows into the Product table we just created. We assume that `$mysqli` has already been created.

```php
<?php
$recs=array(
      array('Pencil',10),array('Eraser',5),
      array('Mouse',600),array('Printer',4000)
);
foreach($recs as $r){
      $q="INSERT INTO product(p_name, p_price) VALUES('$r[0]', $r[1])";
      if(!$mysqli->query($q)){
            echo "INSERT failed. Error: ".$mysqli->error ;
            break;
      }
}
?>
```

In this example, we have the data in an array, where each element in this array is another array representing a row. The for loop just iterates through each element, constructs an insert query, and executes with `$mysqli->query()` as before. After the code is executed, the "Product" table looks like:

```
+------+--------------------+---------+
| p_id | p_name             | p_price |
+------+--------------------+---------+
|    1 | Pencil             |      10 |
|    2 | Eraser             |       5 |
|    3 | Mouse              |     600 |
|    4 | Printer            |    4000 |
+------+--------------------+---------+
```

1.3 Retrieve Result Sets from MySQL

In the case that the query is of type SELECT, SHOW, DESC, or EXPLAIN, `query()` will return a `mysqli_result` object on success, and return false on failure. Since in PHP anything that is not null or not 0 is considered true, wrapping an "if" statement around the call of `query()` will still work.

Here is a demonstration of how to retrieve a result set after executing "show tables" to list all tables in the database.

```php
<?php
      if($result=$mysqli->query('show tables')){
            while($row=$result->fetch_array()){
                  echo$row[0].'<br>';
            }
            $result->free();
      }else{
            echo "Retrieval failed";
      }
?>
```

To understand the code above, it helps to recall that putting `show tables` in a command-line client would produce (assuming database name is "its331" and there are seven tables):

```
+------------------+
| Tables_in_its331 |
+------------------+
| Course           |
| Product          |
| Register         |
| Section          |
| Student          |
| employee_data    |
| employee_per     |
+------------------+
```

In the code above, `$result` contains the `mysqli_result` object. A `mysqli_result` object should be imagined to contain the result which would be returned in a command-line client. In this case, `mysqli_result` object would contain the table above. Internally the `mysqli_result` object has its own pointer which points to one row of the result set at a time. Each call to `$result->fetch_array()` returns the row as an array and moves the pointer to the next row. The array is indexed in such a way that 0 will give the value of the first column, 1 will give the value of the second column, and so on. In the code above, since we have only one column (index 0), we simply get the values and print them out. In the last call to `fetch_array` a null value will be produced, and thus causes the loop to end. After the while loop, `$result->free()` is called to free the buffered result.

1.4 Display Result Sets in a Table

Continuing from the example of "product" table, let us try to retrieve some data and display it in an HTML table. The following code displays products and their prices which are greater than 100.

```
<?php
      $q="select p_name, p_price from product where p_price> 100; ";
      if($result=$mysqli->query($q)){
            echo '<table border="1">';
            echo '<tr><th>Name</th><th>Price</th></tr>';
            while($row=$result->fetch_array()){
                  echo "<tr>";
                  echo "<td>".$row['p_name']."</td>";
                  echo "<td>".$row['p_price']."</td>";
                  echo "</tr>";
            }
            Echo '</table>';
            $result->free();
      }else{
            Echo "Retrieval failed: ".$mysqli->error ;
      }
?>
```

The structure of the code is almost identical to the previous example except that we now print the result in an HTML table. In the previous example, `$row` is accessed by a numeric index. In fact, the method `fetch_array()` also allows the values in each row to be accessed by their column names as the keys in the returned associative array. In this particular example, `$row['p_name']` would give the same value as `$row[0]`. Notice that `$mysqli->error` also works for a SELECT query, and will give an error message on a failure.

After the code is executed, the following table is obtained.

Name	Price
Mouse	600
Printer	4000

1.5 Get the Number of Rows

There are many circumstances where, besides the actual result set, the number of rows in the result set is needed. The class `mysqli_result` has a property `num_rows` for this purpose. The following code demonstrates how to use it. We assume `$mysqli` has already been constructed.

```
<?php
	$q="select p_id from product where p_name like 'P%'; ";
	if($result=$mysqli->query($q)){
		$count=$result->num_rows;
		Echo "There are $count products starting with P.";
		$result->free();
	}else{
		Echo "Query failed: ".$mysqli->error ;
	}
?>
```

In this example, we try to find the number of product names which start with 'P'. The number can be obtained by referring to `$result->num_rows`.

There is another way to get only the number of rows. That is to query "`select count(*) from Product where p_name like 'P%'` ", and use `fetch_array()` to get the count value. If only the count is needed, then one may issue an SQL COUNT statement. However, if the actual result set is also needed, we recommend the first way which is to use `$result->num_rows` to get the count. In this way, both the result set and the count can be obtained.

1.6 Get the Number of Columns

Often, the number of columns is known in advance when the query is constructed. However, in the case that the query is dynamically constructed (i.e., columns to query depend on a user input), or the query has "*" for all columns, the number of columns may be unknown. The class `mysqli_result` has a property `field_count` for this purpose.

```
<?php
	$q="select * from Product limit 1;";
	if($result=$mysqli->query($q)){
		$count=$result->field_count;
		Echo "There are $count columns.";
		$result->free();
	}else{
		Echo "Query failed: ".$mysqli->error ;
	}
?>
```

In this example, we try to find the number of columns (fields) in the "Product" table. On a success, "There are 3 columns" will be printed out.

1.7 Seek a Row in the Result Set

The object `mysqli_result` containing the result set works by maintaining an internal pointer which points to the current row. Rows in the set are retrieved by moving this pointer (by calling `$result->fetch_array()`) sequentially from the beginning to the end. However, in

some cases, we may be interested in only a particular row in the result set. This is when the method `data_seek()` of class `mysqli_result` comes in handy. For example, we want to find the product which has the third lowest price.

```
<?php
      $q='select p_name, p_price from product order by p_price limit 3;';
      if($result=$mysqli->query($q)){
            // Seek to the third row (row index starts from 0)
            $result->data_seek(2);
            $row=$result->fetch_array();
            Echo $row['p_name']." has the third lowest price which is
".$row['p_price'];
            $result->free();
      }else{
            Echo "Query failed: ".$mysqli->error;
      }
?>
```

In this example, we query the products and order them by their prices in ascending order. To get the product having the third lowest price, we move the internal pointer of `$result` to index 2 by using `$result->data_seek(2)`. So, the next fetch by `$result->fetch_array()` will give the result of the third row. After executed, the output of this code is "Mouse has the third lowest price which is 600".

1.8 Properly Escape Query Strings

When inserting a new record, it is very common to construct an INSERT statement by concatenating the values input by the user. However, it is sometimes problematic when those values contain characters used in MySQL syntax. Here is an example which will produce a MySQL syntax error.

```
<?php
      $r=array("Idiot's Guide Book",1200);
      $q="INSERT INTO product(p_name, p_price) VALUES('$r[0]', $r[1])";
      if(!$mysqli->query($q)){
            echo "INSERT failed. Error: ".$mysqli->error ;
      }
?>
```

In the code above, we attempt to insert a new product called "Idiot's Guide Book" into the Product table. On the surface, the code looks fine. However, when executed, there will be a MySQL syntax error produced. The reason is that the value "Idiot's Guide Book" contains a single-quote which renders `$q` as

"`INSERT INTO product(p_name, p_price) VALUES('Idiot's Guide Book', 1200)`".

As can be seen, the single-quote in the value accidentally becomes a single-quote closing the string in the MySQL query.

To solve this problem, we can use the method `$mysqli->real_escape_string()` which will properly escape MySQL special characters.

```php
<?php
	$r=array("Idiot's Guide Book",1200);
	$q="INSERT INTO product(p_name, p_price)
VALUES('".$mysqli->real_escape_string($r[0])."', $r[1])";
	if(!$mysqli->query($q)){
		echo "INSERT failed. Error: ".$mysqli->error ;
	}
?>
```

This time, $q will be

"INSERT INTO product(p_name, p_price) VALUES('Idiot\'s Guide Book', 1200)"

(note the backslash in front of the single-quote). The added backslash signals the MySQL that the following character is an actual value, not part of the syntax. With this code, the insertion is successful, and the Product table's records become

p_id	p_name	p_price
1	Pencil	10
2	Eraser	5
3	Mouse	600
4	Printer	4000
5	Idiot's Guide Book	1200

2 Short Reference

In this section, we give a summary of selected commonly used methods and properties of `mysqli` and `mysqli_result` classes. Properties are denoted with a $. For full detail, see http://www.php.net/manual/en/book.mysqli.php

2.1 mysqli Class

- `mysqli::$affected_rows` — Gets the number of affected rows in a previous MySQL operation
- `mysqli::$client_info`— Returns the MySQL client version as a string
- `mysqli::$client_version` — Get MySQL client info
- `mysqli::close` — Closes a previously opened database connection
- `mysqli::$connect_errno` — Returns the error code from last connect call
- `mysqli::$connect_error` — Returns a string description of the last connect error
- `mysqli::$errno` — Returns the error code for the most recent function call
- `mysqli::$error` — Returns a string description of the last error
- `mysqli::$field_count` — Returns the number of columns for the most recent query
- `mysqli::get_client_info` — Returns the MySQL client version as a string
- `mysqli::$host_info` — Returns a string representing the type of connection used
- `mysqli::$server_info` — Returns the version of the MySQL server
- `mysqli::$server_version` — Returns the version of the MySQL server as an integer
- `mysqli::get_warnings` — Get result of SHOW WARNINGS
- `mysqli::$info` — Retrieves information about the most recently executed query
- **`mysqli::$insert_id`** — Returns the auto generated id used in the last query
- `mysqli::query` — Performs a query on the database
- `mysqli::real_escape_string` — Escapes special characters in a string for use in an SQL statement, taking into account the current charset of the connection
- `mysqli::select_db` — Selects the default database for database queries
- `mysqli::$thread_id` — Returns the thread ID for the current connection

- `mysqli::kill` — Asks the server to kill a MySQL thread

2.2 mysqli_result Class

- `mysqli_result::$current_field` — Get current field offset of a result pointer
- `mysqli_result::data_seek` — Adjusts the result pointer to an arbitary row in the result
- `mysqli_result::fetch_all` — Fetches all result rows as an associative array, a numeric array, or both
- `mysqli_result::fetch_array` — Fetch a result row as an associative, a numeric array, or both
- `mysqli_result::fetch_assoc`— Fetch a result row as an associative array
- **`mysqli_result::fetch_field_direct`** — Fetch meta-data for a single field
- `mysqli_result::fetch_fields` — Returns an array of objects representing the fields in a result set
- **`mysqli_result::fetch_object`** — Returns the current row of a result set as an object
- `mysqli_result::$field_count` — Get the number of fields in a result
- `mysqli_result::free` — Frees the memory associated with a result
- `mysqli_result::$num_rows` — Gets the number of rows in a result

Worksheet

1. Create database named "STAFF" and create two tables along with the specified fields. The following tables show the structure of STAFF database. Note that all fields, except primary key, must be set to allow NULL values.

USERGROUP Table

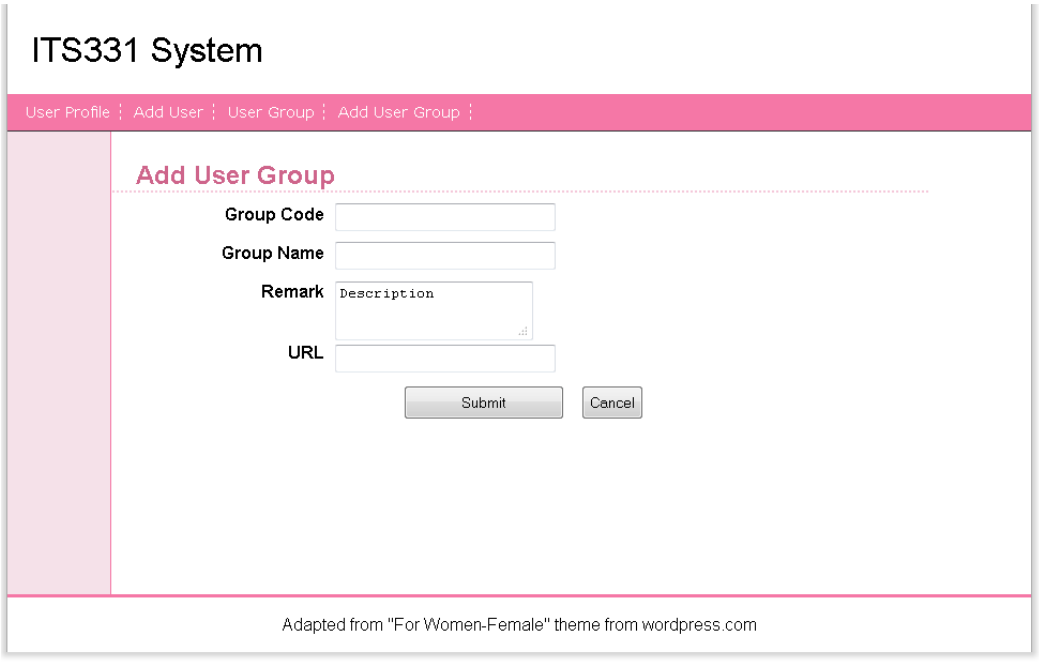
Field	Type	Length Values	Extra	Primary Key
USERGROUP_ID	INT		Auto_increment	Yes
USERGROUP_CODE	VARCHAR	50		
USERGROUP_NAME	VARCHAR	50		
USERGROUP_REMARK	VARCHAR	255		
USERGROUP_URL	VARCHAR	50		

USER Table

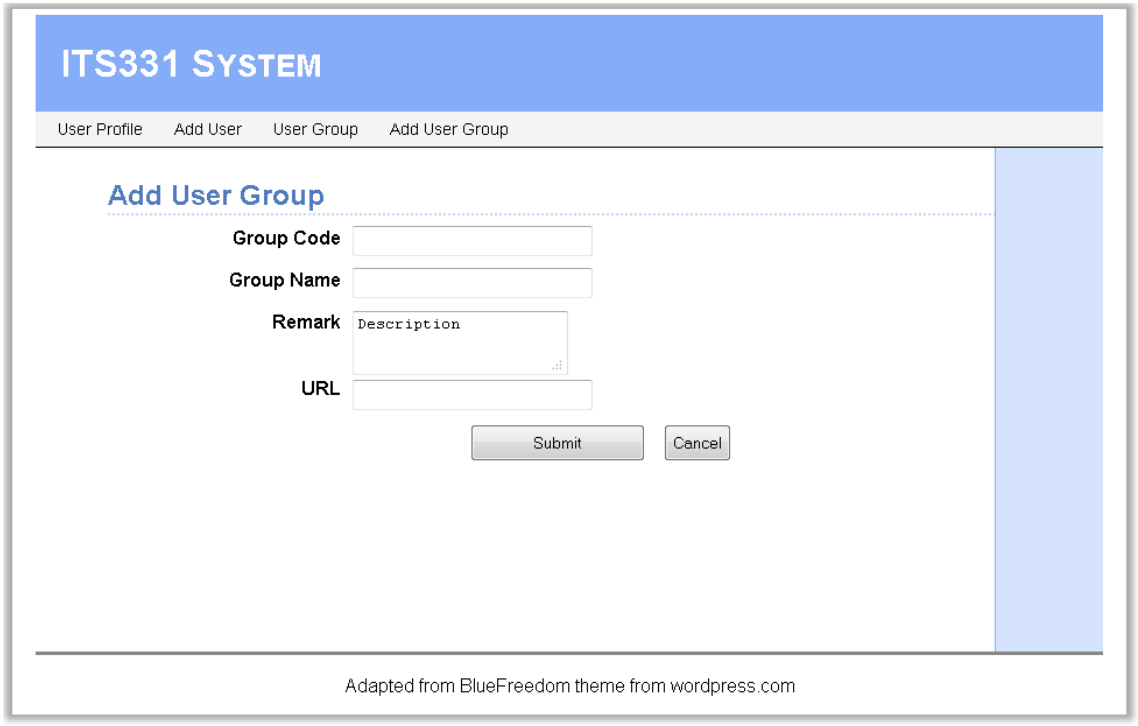
Field	Type	Length Values	Extra	Primary Key
USER_ID	INT		Auto_increment	Yes
USER_TITLE	VARCHAR	25		
USER_FNAME	VARCHAR	50		
USER_LNAME	VARCHAR	50		
USER_GENDER	VARCHAR	25		
USER_EMAIL	VARCHAR	50		
USER_NAME	VARCHAR	25		
USER_PASSWD	VARCHAR	25		
USER_GROUPID	INT			
DISABLE	INT			

2. Complete add_group.html so that data input in add_group.html is inserted into the USERGROUP table in the database. To check inserting data, go to PHPMyadmin, retrieve data in "USERGROUP" Table in "STAFF" database.

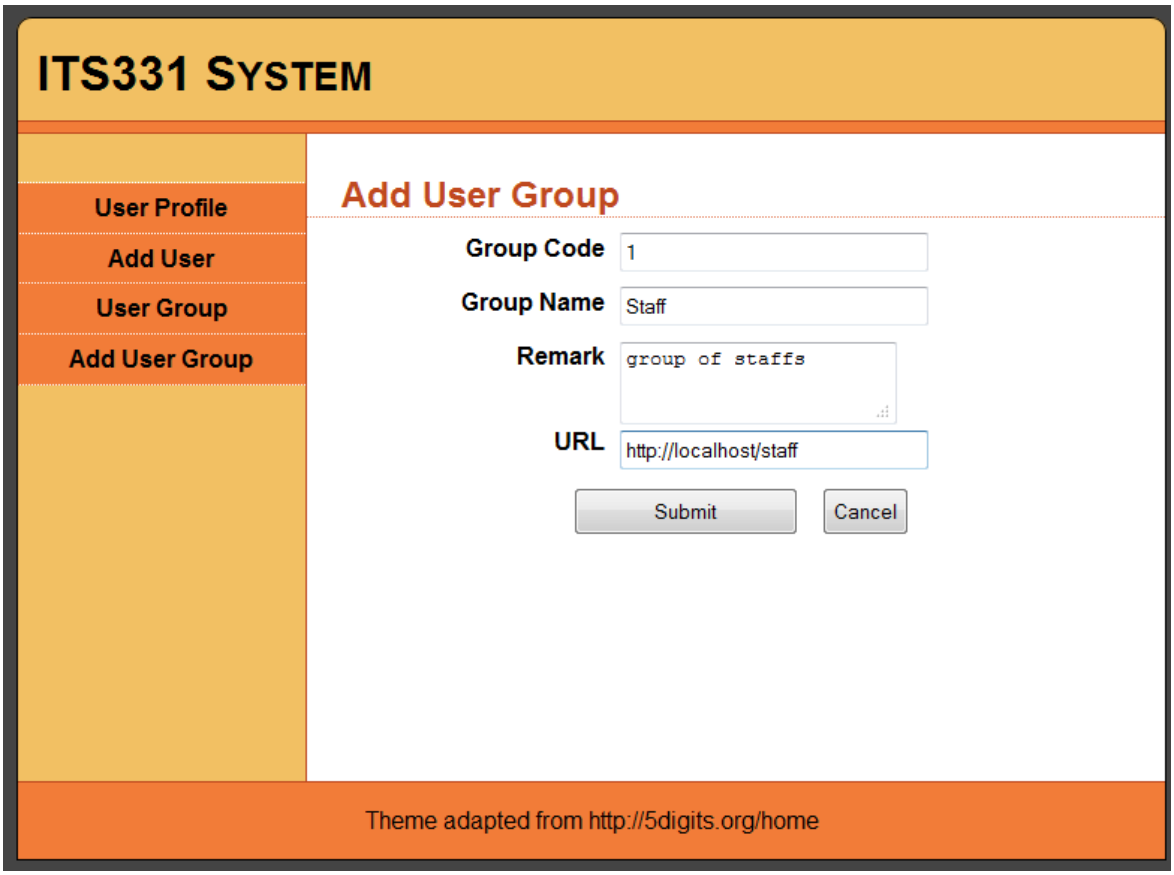
add_group.html (worksheet 1)



add_group.html (worksheet 2)



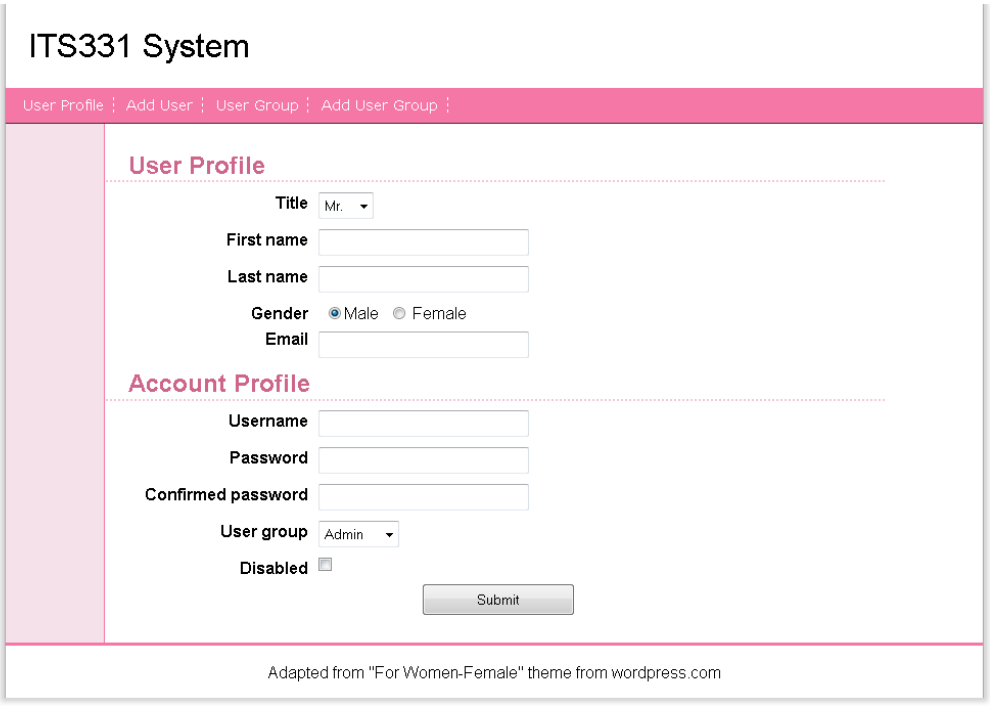
add_group.html (worksheet 3)



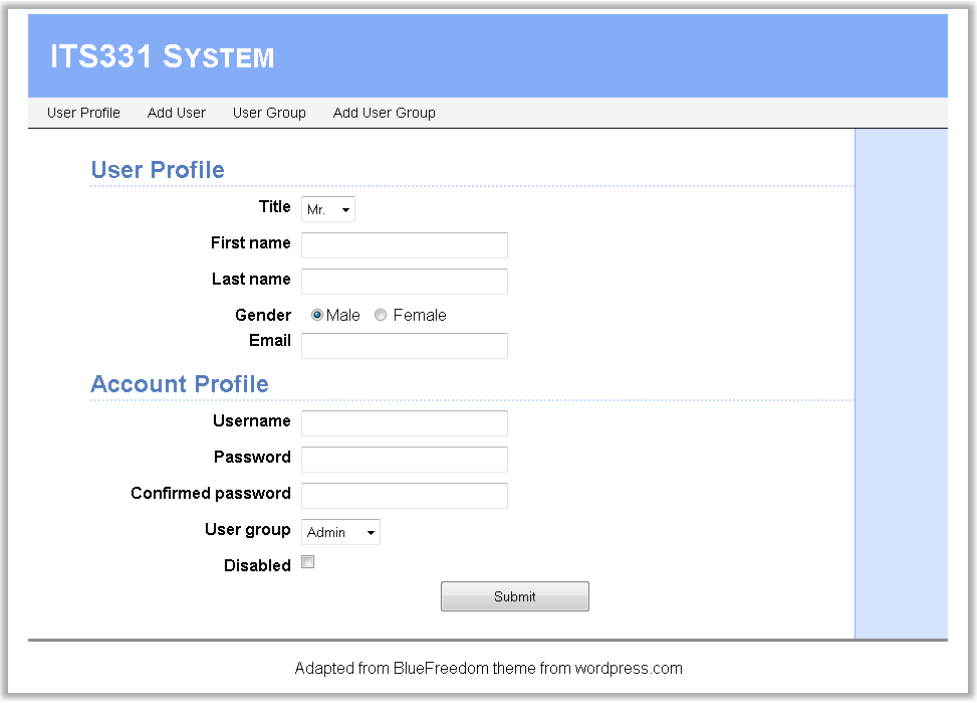
Exercise

Complete add_user.php (page with form to add new users) so that data input in add_user.html is inserted into the USER table in the database. To check inserting data, go to PHPMyadmin, retrieve data in "USER" Table in "STAFF" database.

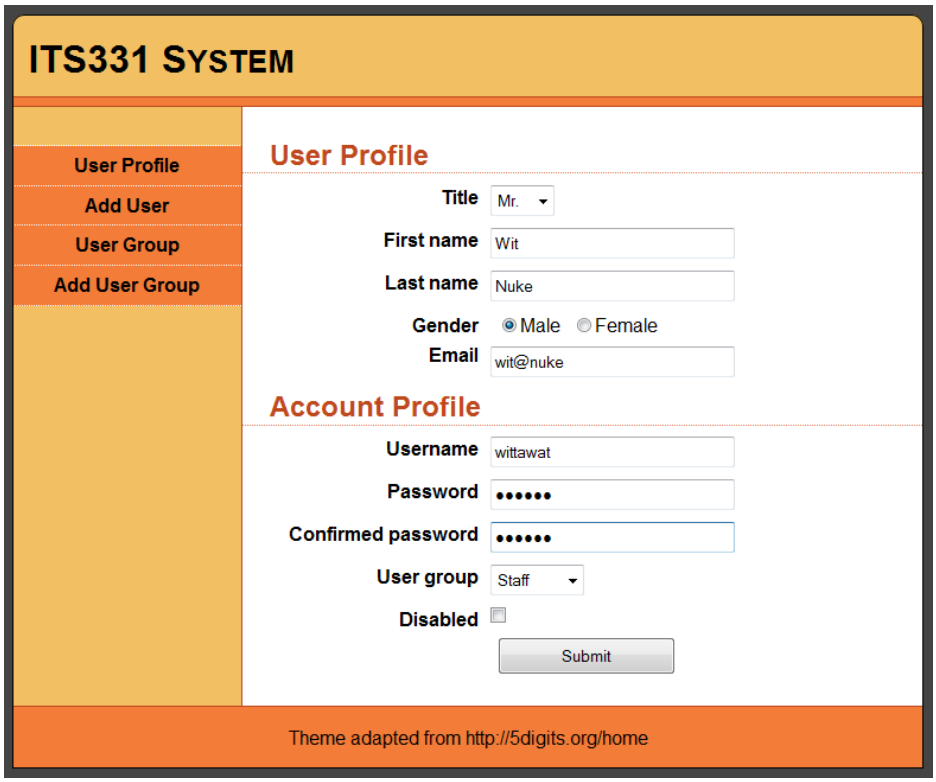
add_user.php (worksheet 1)



add_user.php (worksheet 2)



add_user.php (worksheet 3)



The choice names in the combo box for "User Group" must be the actual data in the table USERGROUP (i.e., "USERGROUP_NAME" column in USERGROUP table). However, the choice values must be from "USERGROUP_ID" column.

Recall that the choices of a combo box are created with an <option> tag. In this case, the following code may be used to make the combo box.

```
<select name="usergroup">
<?php
	$mysqli = new mysqli('localhost','…','…','STAFF');
	$q='select USERGROUP_ID, USERGROUP_NAME from USERGROUP;';
	if($result=$mysqli->query($q)){
		while($row=$result->fetch_array()){
			echo '<option value="'.$row[0].'">'.$row[1].'</option>';
		}
	}else{
		echo 'Query error: '.$mysqli->error;
	}
?>
</select>
```