Outline

Understanding the Basics of Databases

- Working with MySQL Databases
- Managing Databases and their Tables
- Managing Tables and their Records

Accessing Databases with PHP

- Creating and Deleting Databases and Tables
- Selecting, Creating, Updating, and Deleting Records
- Handling errors

Accessing Databases with PHP

- There are three main options when considering connecting to a MySQL database server using PHP:
  - PHP's mysql Extension
  - PHP's mysqli Extension
  - PHP Data Objects (PDO)

We will use mysqli

- The mysqli extension features a dual interface, supporting both procedural (functions) and object-oriented interfaces.
- These notes and examples use the procedural interface.

  http://www.php.net/manual/en/book.mysqli.php

Hint: Separate file for your login info

Example

```
<?php
	$host = "mysql.ict.swin.edu.au";
	$user = "s1234567";
	$pwd  = “password";
	$sql_db  = " s1234567_db";
?>
```

Can edit the host when goes to production server

Your student id

Don’t use your Mercury password

ITS has created a predefined database for you

SWIN BUR NE SWINBURNE UNIVERSITY OF TECHNOLOGY

Template 1 – for SQL* queries

* Create and drop tables

* Insert update and delete records

```
<?php
	require_once "settings.php";
	$conn = @mysqli_connect ($host,$user,$pwd,$sql_db);
	if ($conn) {

		$query = "replace with a valid MySQL query";
		$result = mysqli_query ($conn, $query);
		if ($result) { …}
		else {…}

		mysqli_close ($conn);
	} else		echo "<p>Unable to connect to the db.</p>";
?>
```

Step 1: Connect to the database

Step 2: Create your SQL query

Step 3: Execute your SQL query

Step 4: Did it work?

Step 5: Close connection

SWIN BUR NE SWINBURNE UNIVERSITY OF TECHNOLOGY

Connecting to MySQL

- Open a connection to a MySQL database server with the `mysqli_connect()` function
- The `mysqli_connect()` function returns a ***positive integer*** if it connects to the database successfully or `false` if it does not
- Assign the return value from the `mysqli_connect()` function to a variable that you can use to access the database in your script
- Example

```
$yourconn= mysqli_connect("mysql.ict.swin.edu.au",
   " s1234567", "yourMySQLpassword", "s1234567_db"]);
```

Connecting to MySQL (continued)

- The syntax for the `mysqli_connect()` function is:

```
 $connection = mysqli_connect("host"[,
"user", "password", "database"])
```

  – The ***host*** argument specifies the host name where your MySQL database server is installed
    e.g. `mysql.ict.swin.edu.au`
  – The ***user*** and ***password*** arguments specify a MySQL account name and password
    e.g. `s1234567 yourMySQLpassword`
  – The ***database*** argument specifies a database
    e.g. `s1234567_db`

Connecting and Selecting

- The **`mysqli_connect`** also allows one to connect and select the database in one step.

```
$dbConnect = mysqli_connect(
  "mysql.ict.swin.edu.au", "s1234567",
  "ddmmyy", "s1234567_db");
```

YourMySQLpassword

Selecting a Database

We can connect() and select_db() in separate steps

- The statement for selecting a database with the MySQL Monitor is **`use`** ***`database`***
- The function for selecting a database with PHP is **`mysqli_select_db(`*`connection, database`*`)`**
- The function returns a value of **`true`** if it successfully selects a database or **`false`** if it does not

Executing SQL Statements

The **`mysqli_query()`** function returns one of three values:

- For SQL statements that *do not* return results (**`CREATE DATABASE`** and **`CREATE TABLE`** statements) they return a value of `true` if the statement executes successfully
- For SQL statements that *do* return results (**`SELECT`** and **`SHOW`** statements) they return a ***result pointer*** that represents the query results
  - A **result pointer** is a special type of variable that refers to the currently selected row in a resultset
- For SQL statements that fail, **`mysqli_query()`** function returns a value of `false`, regardless of whether they return results

Cleaning Up

- When you are finished working with query results retrieved with the `mysqli_query()` function, use the `mysqli_free_result()` function to close the resultset
- To close the resultset, pass to the `mysqli_free_result()` function the variable containing the result pointer from the `mysqli_query()` function

  e.g. `mysqli_free_result(`**`$queryResult`**`);`

Closing Connection

- Close a connection to a MySQL database server with the `mysqli_close()` function
  - `mysqli_close($dbconnect);`

Outline

Understanding the Basics of Databases

- Working with MySQL Databases
- Managing Databases and their Tables
- Managing Tables and their Records

Accessing Databases with PHP

- **Creating and Deleting Databases and Tables**
- Selecting, Creating, Updating, and Deleting Records
- Handling errors

Creating Tables

- The `CREATE TABLE` statement specifies the table and column names and the data type for each column
- The syntax for the `CREATE TABLE` statement is:

```
CREATE TABLE table_name
   (column_name TYPE, ...);
```

- Execute the `USE` statement to select a database before executing the `CREATE TABLE` statement

Creating and Deleting Tables (continued)

```
...
$sqlString = "CREATE TABLE car(
  model      VARCHAR(30),
  make       VARCHAR(25),
  price      INT,
  manufactured   DATE)";

$queryResult = @mysqli_query($dbConnect, $sqlString)
...
```

Use INT if you do not want to store any decimal figures

Creating Tables (continued)

Type	Range	Storage
BOOL	-128 to 127 with 0 considered false	1 byte
INT or INTEGER	-2147483648 to -2147483647	4 bytes
FLOAT	-3.402823466E+38 to -1.175494351E-38, 0, and 1.175494351E+38 to 3.402823466E+38	8 bytes
DOUBLE	-1.7976931348623157E+308 to -2.2250738585072014E+308, 0, and 2.2250738585072014E+308 to 1.7976931348623157E+308	8 bytes
DATE	'1000-01-01' to '9999-12-31'	Varies
TIME	'-838:59:59' to '838:59:59'	Varies
CHAR(n)	Fixed length string between 0 to 255 characters	Number of bytes specified by n
VARCHAR(n)	Variable length string between 0 to 65,535 characters	Varies according to the number of bytes specified by n

Common MySQL field data types

Deleting Tables

- The `DROP TABLE` statement removes all data and the table definition
- The syntax for the `DROP TABLE` statement is:

```
DROP TABLE table_name;
```

Outline

Understanding the Basics of Databases

- Working with MySQL Databases
- Managing Databases and their Tables
- Managing Tables and their Records

Accessing Databases with PHP

- Creating and Deleting Databases and Tables
- **Selecting, Creating, Updating, and Deleting Records**
- Handling errors

Structured Query Language (SQL)

Common SQL keywords

Keyword	Description
INSERT	Inserts a new row into a table
UPDATE	Update field value in a record
DELETE	Deletes a row from the table
SELECT	Retrieve records from table(s)
INTO	Specifies the table into which to insert the record(s)
FROM	Specifies the table(s) from which to retrieve or delete record(s)
WHERE	Specifies the condition that must be met
ORDER BY	Sorts the records retrieved (does not affect the table)

e.g. `SELECT * FROM employees`

See also:
http://swinbrain.ict.swin.edu.au/wiki/SQL_Commands_Introduction

Adding Records

- Use the `INSERT` statement to add individual records to a table
- The syntax for the `INSERT` statement is:
  INSERT INTO *table_name* VALUES(*value1*, *value2*, ...);
- The values entered in the `VALUES` list must be in the same order in which you defined the table fields
- Specify `NULL` in any fields for which you do not have a value
- Add multiple records, use the `LOAD DATA` statement
  LOAD DATA LOCAL INFILE 'file_path_name' INTO TABLE table_name;

SWINBURNE UNIVERSITY OF TECHNOLOGY

Adding Records with INSERT

- Use the **INSERT** and **VALUES** keywords with the **mysqli_query()** function

```
INSERT INTO table_name
          VALUES(value1, value2, ...);
```

- The values entered in the **VALUES** list must be in the same order that defined in the table fields
- Specify **NULL** in any fields that do not have a value e.g. for **AUTO_INCREMENT** field

SWINBURNE UNIVERSITY OF TECHNOLOGY

Adding record with INSERT: PHP example

```
<?php
    require_once "settings.php";
    $conn = @mysqli_connect ($host,$user,$pwd,$sql_db);
    if ($conn) {
        $query = "INSERT INTO
                `tutors`  (`userid`, `username`,`password`, `datejoined`)
                        VALUES (1,'Alex','8376',curdate())";;
        $result = mysqli_query ($conn, $query);
        if ($result)  { echo "<p>Insert operation successful.</p>";}
        else { echo "<p>Insert operation unsuccessful.</p>";  }
        mysqli_close ($conn);
    } else echo "<p>Unable to connect to the db.</p>";
?>
```

Field names and values must be in the same order

Table name

Updating Records

- To update records in a table, use the `UPDATE` statement
- The syntax for the `UPDATE` statement is:

```
UPDATE table_name
SET column_name=value
WHERE condition;
```

  - The `UPDATE` keyword specifies the name of the table to update
  - The `SET` keyword specifies the value to assign to the fields in the records that match the condition in the `WHERE` keyword

UPDATE record in PHP example

```
<?php
    require_once "settings.php";
    $conn = @mysqli_connect ($host,$user,$pwd,$sql_db);
    if ($conn) {
        $query = "UPDATE `tutors`
                      SET `password`='1234'
                      WHERE userid = 1";
        $result = mysqli_query ($conn, $query);
        if ($result) {echo "<p>Update operation successful.</p>";}
        else { echo "<p>Update operation unsuccessful.</p>"; }
        mysqli_close ($conn);
    } else echo "<p>Unable to connect to the db.</p>";
?>
```

Deleting Records

- Use the `DELETE` statement to delete records in a table
- The syntax for the `DELETE` statement is:

```
DELETE FROM table_name
WHERE condition;
```

- The `DELETE` statement deletes all records that match the condition
- To delete all the records in a table, leave off the `WHERE` keyword

Delete record in PHP example

```
<?php
    require_once "settings.php";
    $conn = @mysqli_connect ($host,$user,$pwd,$sql_db);
    if ($conn) {
        $query = "DELETE FROM `tutors` WHERE userid = 1";
        $result = mysqli_query ($conn, $query);
        if ($result)  { echo "<p>Deleted"
                    .mysqli_affected_rows($dbConnect) . " record(s).</p>"; }
        else { echo "<p>Insert operation unsuccessful.</p>";  }
        mysqli_close ($conn);
    } else echo "<p>Unable to connect to the db.</p>";
?>
```

Deleting Records

To Delete records from a table:

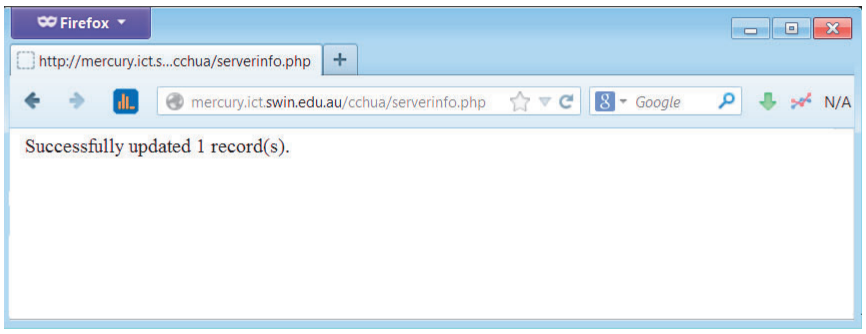
- Use the **`DELETE`** and **`WHERE`** keywords with the **`mysqli_query()`** function
- The **`WHERE`** keyword determines which records to delete in the table
- *Be careful*, if no **`WHERE`** keyword, *all records are deleted !!*

Using the **`mysqli_affected_rows()`** Function

- With queries that modify tables but do not return results (**`INSERT`**, **`UPDATE`**, and **`DELETE`** queries), use the **`mysqli_affected_rows()`** function to determine the *number of affected rows* by the query

```
$sqlString = "UPDATE car SET price=4500
     WHERE make='Fender' AND model='DG7'";
$queryResult = @mysqli_query($dbConnect, $sqlString);
if ($queryResult){
  echo "<p>Successfully updated "
  . mysqli_affected_rows($dbConnect) . "record(s).</p>";
}
```

Using the **`mysqli_affected_rows()`** Function



```
Successfully updated 1 record(s).
```

Output of `mysqli_affected_rows($con)` function for an `UPDATE` query

Selecting and Retrieving Records

- Use the SELECT statement to retrieve records from a table:

```
SELECT criteria FROM table_name;
```

- Use the asterisk (*) wildcard with the SELECT statement to retrieve all fields from a table
- To return multiple fields, separate field names with a comma

```
mysql> SELECT model, quantity FROM inventory;
```

Retrieving Records – Sorting

- Use the ORDER BY keyword with the SELECT statement to perform an alphanumeric sort of the results returned from a query

```
mysql> SELECT make, model FROM inventory
     -> ORDER BY make, model;
```

- To perform a reverse sort, add the DESC keyword after the name of the field by which you want to perform the sort

```
mysql> SELECT make, model FROM inventory
     -> ORDER BY make DESC, model;
```

Retrieving Records – Filter

- The **criteria** portion of the SELECT statement determines which fields to retrieve from a table
- You can also specify which records to return by using the WHERE keyword

```
mysql> SELECT * FROM inventory
     -> WHERE make='Martin';
```

- Use the keywords AND and OR to specify more detailed conditions about the records you want to return

```
mysql> SELECT * FROM inventory
     -> WHERE make='Washburn' AND price<400;
```

Selecting Records in PHP

To select from a table:

- Use the **SELECT** and **WHERE** keywords with the mysqli_query() function
- The WHERE keyword determines which records to select in the table
- if no WHERE keyword, all records are selected

Selecting Records (continued)

Be careful when constructing query:

```
$make = "Holden";

$sqlString = "SELECT model, quantity FROM
    $dbTable WHERE model = '$make'";
```

Field name not in 'quotes'

Variable name must be in 'quotes' if string

Template 2 – for SQL SELECT queries

```
<?php
   require_once "settings.php";
   $conn = @mysqli_connect ($host,$user,$pwd,$sql_db);
   if ($conn) {
      $query = "replace with a MySQL SELECT query";
      $result = mysqli_query ($conn, $query);
      if ($result) {
      $record = mysqli_fetch_assoc ($result);
         if ($record) {
            echo "<p>At least 1 record was retrieved.</p>";
         } else echo "<p>No records retrieved.</p>";
      } else      echo "<p>MySQL operation unsuccessful.</p>";
      mysqli_close ($conn);
   } else  echo "<p>Unable to connect to the db.</p>";
?>
```

Checks if query successful

Check if any records exist

Note: we haven't done anything with the records yet

Selecting Records (continued)

Function	Description
mysqli_data_seek($result, position)	Moves the result pointer to a specific row in the result set
mysqli_fetch_array($result, mysqli_assoc | mysqli_num | mysqli_both)	Returns the fields in the current row of the result set into an associative array, indexed array or both, and moves the result pointer to the next row
mysqli_fetch_assoc($result)	Returns the fields in the current row of the result set into an associative array, and moves the result pointer to the next row
mysqli_fetch_row($result)	Returns the fields in the current row of the result set into an indexed array, and moves the result pointer to the next row
mysqli_fetch_lengths($result)	Returns the field lengths for the current row in a result set into an indexed array

Common PHP functions for accessing database results

Selecting Records (continued)

- The difference between **`mysqli_fetch_assoc()`** and **`mysqli_fetch_row()`** is that instead of returning the fields into an *indexed array*, **`mysqli_fetch_assoc()`** function returns the fields into an *associate array* and uses each *field name* as the *array key*

Selecting Records (continued)

Retrieving Records into an Associative Array

- The `mysqli_fetch_assoc()` function returns the fields in the current row of a result set into an associative array and moves the result pointer to the next row

```
echo "<table border='1'>";
echo "<tr><th>Make</th><th>Model</th>
  <th>Price</th><th>Yr of Manufacture</th></tr>";
$row = mysqli_fetch_assoc($queryResult);
while ($row) {
        echo "<tr><td>{$row['make']}</td>";
        echo "<td>{$row['model']}</td>";
        echo "<td>{$row['price']}</td>";
        echo "<td>{$row['yom']}</td></tr>";
        $row = mysqli_fetch_assoc($queryResult);
}
echo "</table>";
```

Selecting Records (continued)

Retrieving Records into an Indexed Array

- The `mysqli_fetch_row()` function returns the fields in the current row of a result set into an indexed array and moves the result pointer to the next row

```
echo "<table border='1'>";
echo "<tr><th>Make</th><th>Model</th>
  <th>Price</th><th>Yr of Manufacture</th></tr>";
$row = mysqli_fetch_row($queryResult);
while ($row) {
        echo "<tr><td>{$row[0]}</td>";
        echo "<td>{$row[1]}</td>";
        echo "<td>{$row[2]}</td>";
        echo "<td>{$row[3]}</td></tr>";
        $row = mysqli_fetch_row($queryResult);
}
echo "</table>";
```

Selecting Records (continued)

- Assignment and combination can also be combined to reduce the size of the code

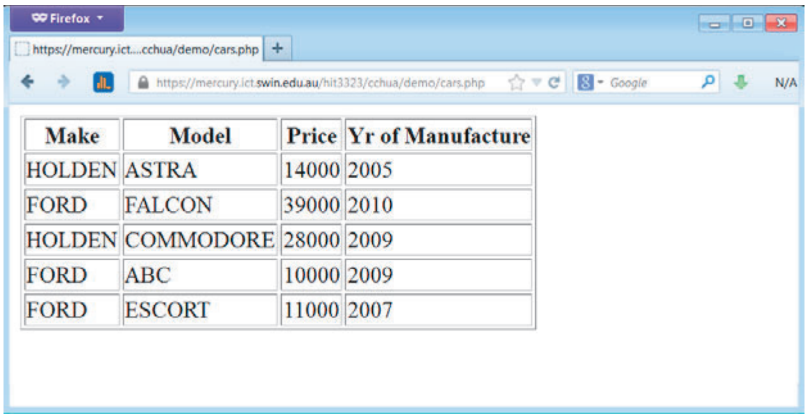
```
echo "<table border='1'>";
echo "<tr><th>Make</th><th>Model</th>
  <th>Price</th><th>Yr of Manufacture</th></tr>";

while ($row = mysqli_fetch_assoc($queryResult)) {
      echo "<tr><td>{$row['make']}</td>";
      echo "<td>{$row['model']}</td>";
      echo "<td>{$row['price']}</td>";
      echo "<td>{$row['yom']}</td></tr>";

}
echo "</table>";
```

This is an assignment expression, not a comparison

Selecting Records (continued)



Make	Model	Price	Yr of Manufacture
HOLDEN	ASTRA	14000	2005
FORD	FALCON	39000	2010
HOLDEN	COMMODORE	28000	2009
FORD	ABC	10000	2009
FORD	ESCORT	11000	2007

Output of the inventory table in a Web browser

Selecting Records (continued)

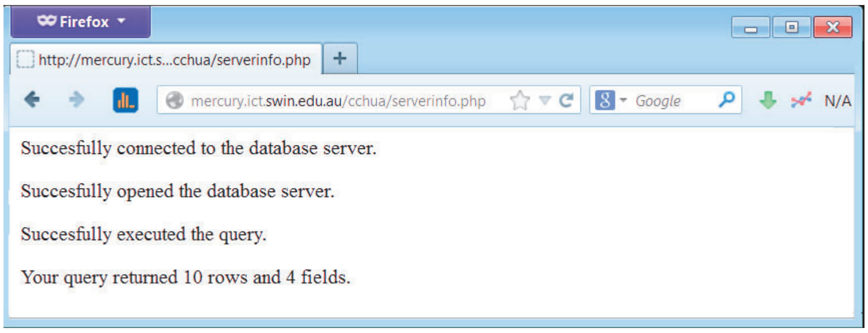
Accessing Query Result Information for queries that return result sets:

•The `mysqli_num_rows()` function returns the number of rows in a query result

•The `mysqli_num_fields()` function returns the number of fields in a query result

•Both functions accept a database result variable,
eg.a query result, as an argument

Selecting Records (continued)


Firefox
http://mercury.ict.s...cchua/serverinfo.php
mercury.ict.swin.edu.au/cchua/serverinfo.php
Google
N/A

```
Succesfully connected to the database server.

Succesfully opened the database server.

Succesfully executed the query.

Your query returned 10 rows and 4 fields.
```

Output of the number of rows and fields returned from a query

Outline

Understanding the Basics of Databases

- Working with MySQL Databases
- Managing Databases and their Tables
- Managing Tables and their Records

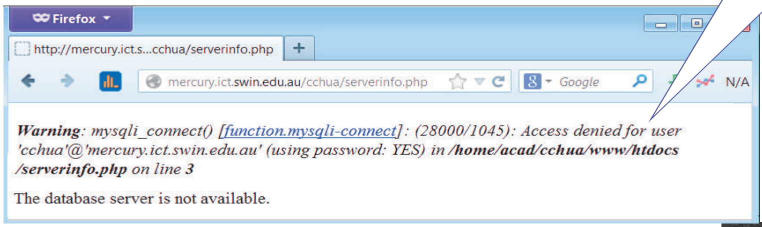
Accessing Databases with PHP

- Creating and Deleting Databases and Tables
- Selecting, Creating, Updating, and Deleting Records
- **Handling errors**

Handling MySQL Errors

- Reasons for not connecting to a database server include:
  - The database server is not running
  - Insufficient privileges to access the data
  - Invalid username and/or password
- e.g. `if (!$dbConnect) ...`

We do not want users to see any database error messages !


Firefox
http://mercury.ict.s...cchua/serverinfo.php
mercury.ict.swin.edu.au/cchua/serverinfo.php
Google
N/A

```
Warning: mysqli_connect() [function.mysqli-connect]: (28000/1045): Access denied for user
'cchua'@'mercury.ict.swin.edu.au' (using password: YES) in /home/acad/cchua/www/htdocs
/serverinfo.php on line 3
The database server is not available.
```

Database connection error message

Handling MySQL Errors

Suppressing Errors with the Error Control Operator

- Writing code that anticipates and handles potential problems is often called **bulletproofing**
- Bulletproofing techniques include:
  - Checking submitted form data
    e.g. `if (isset($_GET['height']) ...`
  - Using the **error control operator (@)** to suppress error messages
    e.g. `$dbConnect = @mysqli_connect(...);`
    `if (!$dbConnect) ...`

Handling MySQL Errors

Terminating Script Execution

- **die()** and **exit()** terminate script execution
- **die()** version is usually used when attempting to access a data source
- Both functions accept a single string argument
- Invoke the **die()** and **exit()** as separate statements or by appending either function to an expression with the **or** operator

Note: When script is terminated, an *incomplete* html page is sent to the client. This is useful for error diagnostics, but *poor in a production application.*

Handling MySQL Errors (continued)

```
$dbConnect = @mysqli_connect(("mysql.ict.swin.edu.au",
   "s1234567", "ddmmyy")
    or die("<p>The database server is not available.</p>");
// the above is one statement: connected OK or die
echo "<p>Successfully connected to the database server.</p>";

@mysqli_select_db($dbConnect, "s1234567_db")
     or die("<p>The database is not available.</p>");
echo "<p>Successfully opened the database.</p>";
// additional statements that access the database server
mysqli_close($dbConnect);
```

No `if` required here

Handling MySQL Errors (continued)

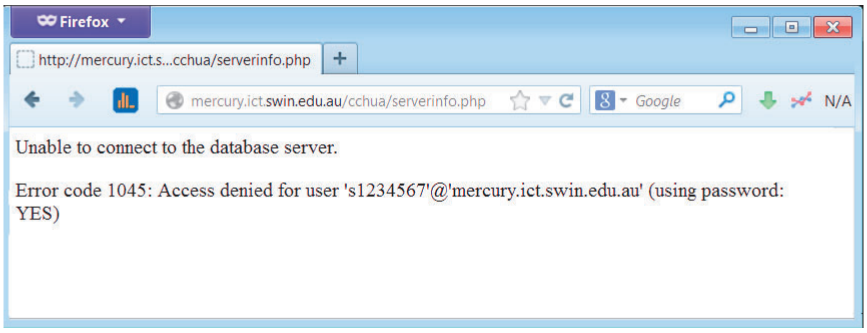
MySQL error reporting functions

Function	Description
mysqli_connect_errno()	Returns the error code from the last database connection attempt, 0 if no error
mysqli_connect_error()	Returns the error message from the last database connection attempt, empty string if no error
mysqli_errno(connection)	Returns the error code from the last MySQL function call attempted, 0 if no error
mysqli_error(connection)	Returns the error message from the last MySQL function call attempted, empty string if no error
mysqli_sqlstate(connection)	Returns a string of five character error code from the last MySQL operation, '00000' if no error

Handling MySQL Errors (continued)

```
$user = $_GET['username'];
$password = $_GET['password'];
$dbConnect = @mysqli_connect("mysql.ict.swin.edu.au", $user,
   $password)
   or die("<p>Unable to connect to the database server.</p>"
      . "<p>Error code " . mysqli_connect_errno()
      . ": " . mysqli_connect_error() . "</p>");
echo "<p>Successfully connected to the database server.</p>";
@mysqli_select_db($dbConnect, "s1234567_db")
     or die("<p>The database is not available.</p>");
echo "<p>Successfully opened the database.</p>";
// additional statements that access the database
mysqli_close($dbConnect);
```

Handling MySQL Errors (continued)


Firefox
http://mercury.ict.s...cchua/serverinfo.php
mercury.ict.swin.edu.au/cchua/serverinfo.php
Google
N/A

Unable to connect to the database server.

Error code 1045: Access denied for user 's1234567'@'mercury.ict.swin.edu.au' (using password: YES)

Error number and message generated by an invalid username and/or password

Reminder: Checking Data Entry

- ***Never trust the user! Never!***
  - **Always** check that input values are of the ***type*** you expect
  - If possible, test that a text value is **within** a **set** of values
  - If showing the content gathered from users, **remove** anything that shouldn't be there, and **encode** everything else to make sure that nothing is **inserted** into your code! (HTML, JS, CSS or other!)
  - If using information from users as part of a database **query**, **escape** all (string) values, always surround values with **quotes** and log/test whatever you can.