COMP 3311
Database Management Systems

Lab 7

Accessing Oracle Database Using Visual Studio

Lab Objectives

- After this lab you should be able to **programmatically**
  - connect to Oracle Database from Visual Studio.
  - retrieve data from an Oracle database table and display it in a web browser.
  - update an Oracle database table through a web browser.

Prepare The Database

- **Download to the Desktop** the file Lab7Exercise.zip from the Connecting to Oracle Using Visual Studio entry of the Lab Schedule course web page and unzip it.

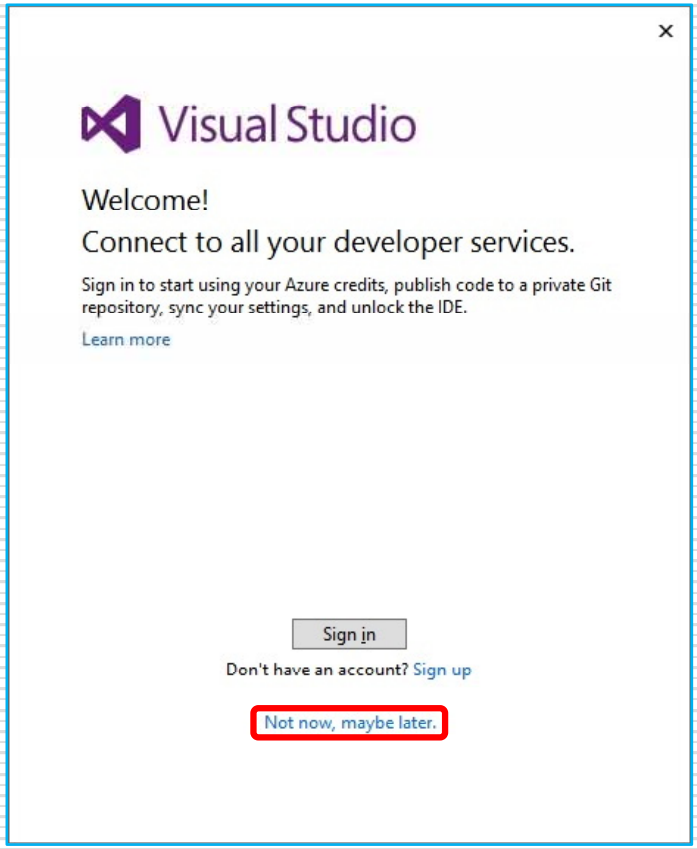
- Place your InsertMyself.sql script file inside the Lab7Exercise folder.

  Note: Your InsertMyself.sql script file should insert *only* your tuple into the Student table.
  DO NOT insert any tuples for yourself into the EnrollsIn table.

- Execute the Lab7.sql script file inside the Lab7Exercise folder in SQL Developer.

Start Visual Studio

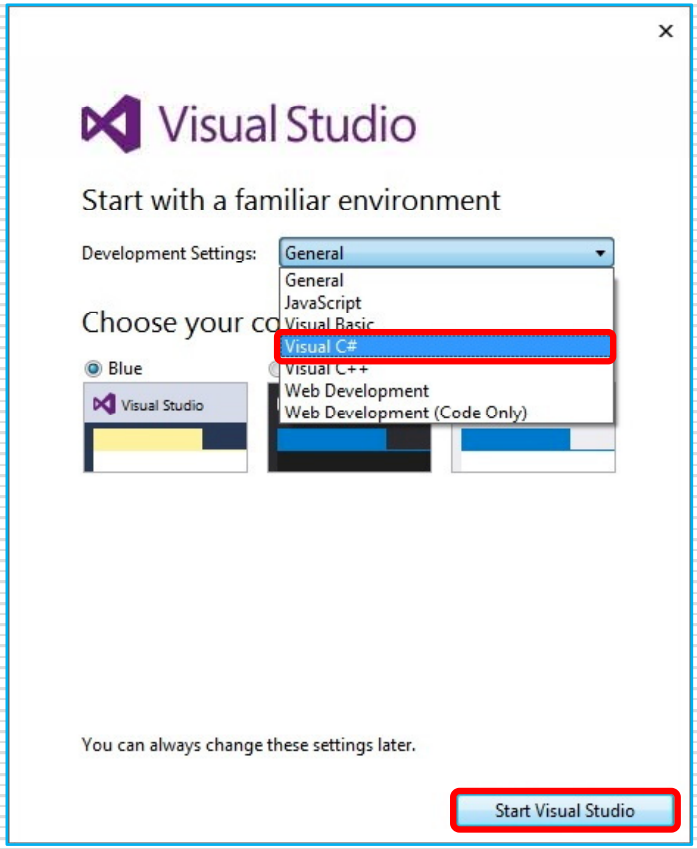
- From the Start menu, find the **Visual Studio 2015** app or search for it and double-click it.
  - **DO NOT use Visual Studio 2017!**
- In the Welcome dialog page, click the Not now, maybe later. link at the bottom of the dialog page (highlighted in red on the right).



Select the Environment

- When prompted,
  - select Visual C# as the development setting (highlighted in red on the right).

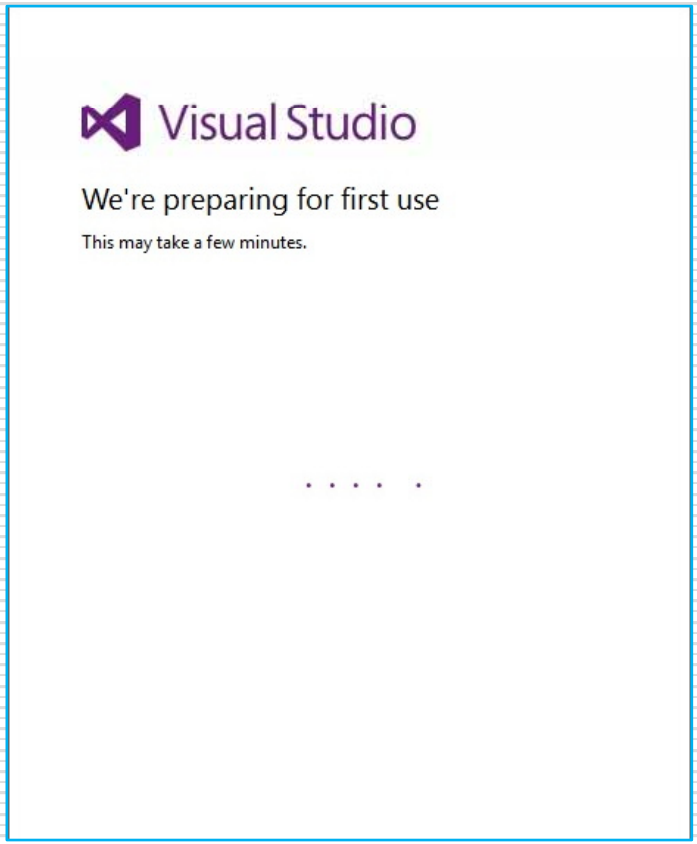
    DO NOT SELECT C++ or any other development setting!
  - click the Start Visual Studio button (highlighted in red on the right).



Be Patient

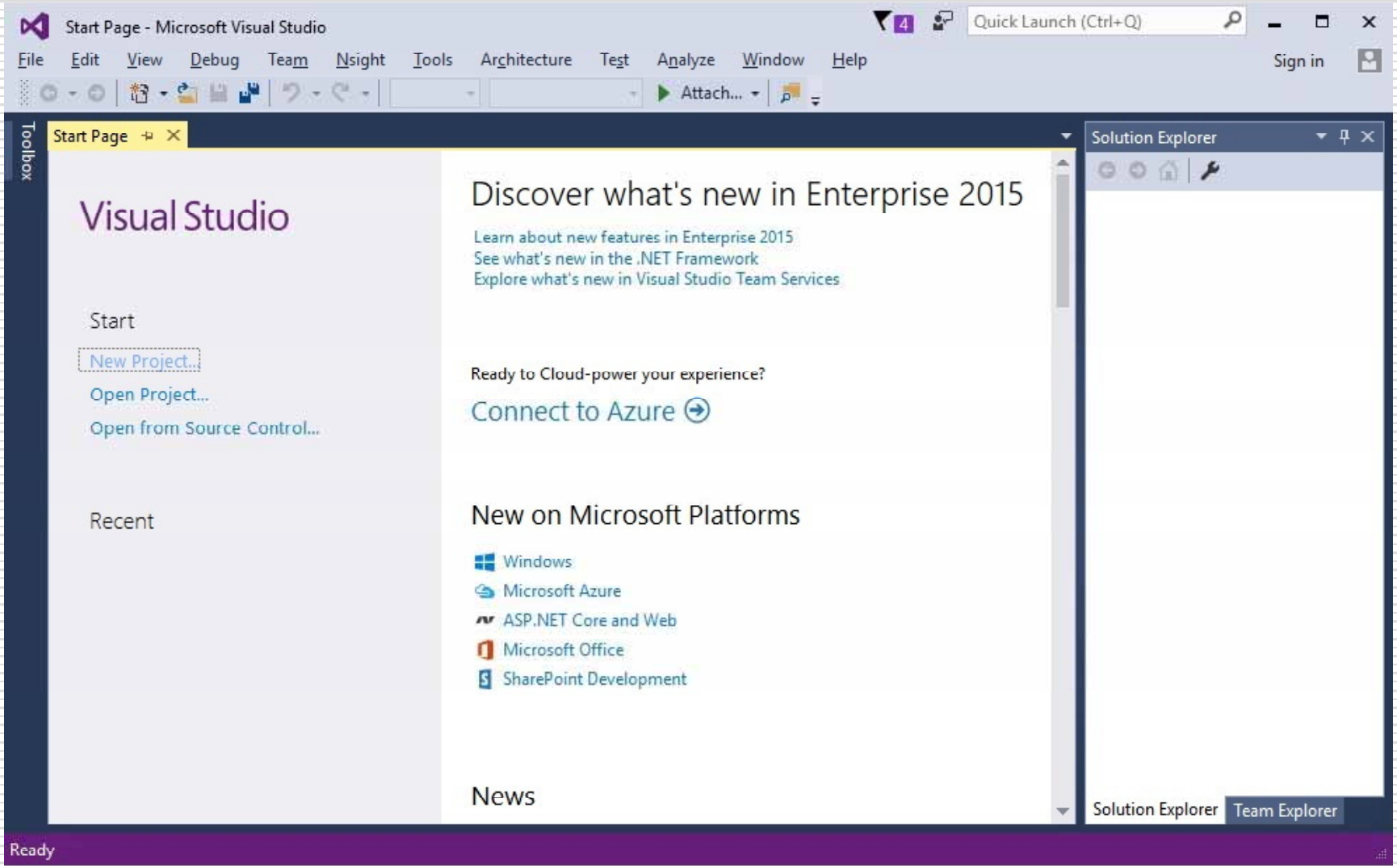
- It may take several minutes for Visual Studio to start up. We know it might be hard, but –

BE VERY PATIENT!



- The Start Page (see next slide) appears along with some of the Visual Studio windows (explained later).
- You may close the Start Page.

Visual Studio Start Page



Open The University Website

- In the File menu of Visual Studio, select Open Website… and navigate to the Lab7Exercise folder on the desktop.

IMPORTANT

DO NOT select Open Project/Solution….

- Select the UniversityWebsite folder inside the Lab7Exercise folder.
- Click the Open button.

Solution Explorer – Connect To Oracle

- The Solution Explorer allows file and resource management.
- In the Solution Explorer, double-click on the Web.config file.
- Find the line

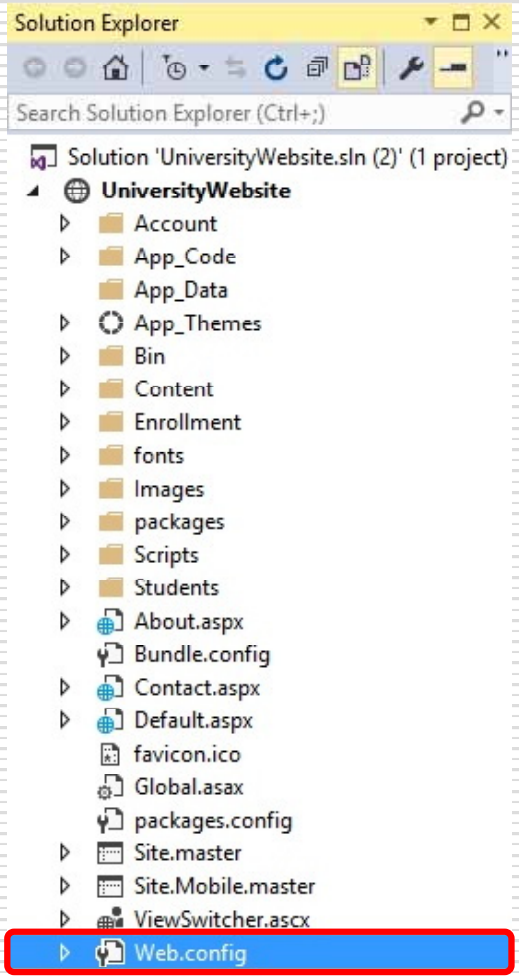
  <add name="UniversityDatabaseConnectionString ..."
- On this line, find the following:

  ID=comp3311stuXXX;Password=XXXXXXXX

  and replace

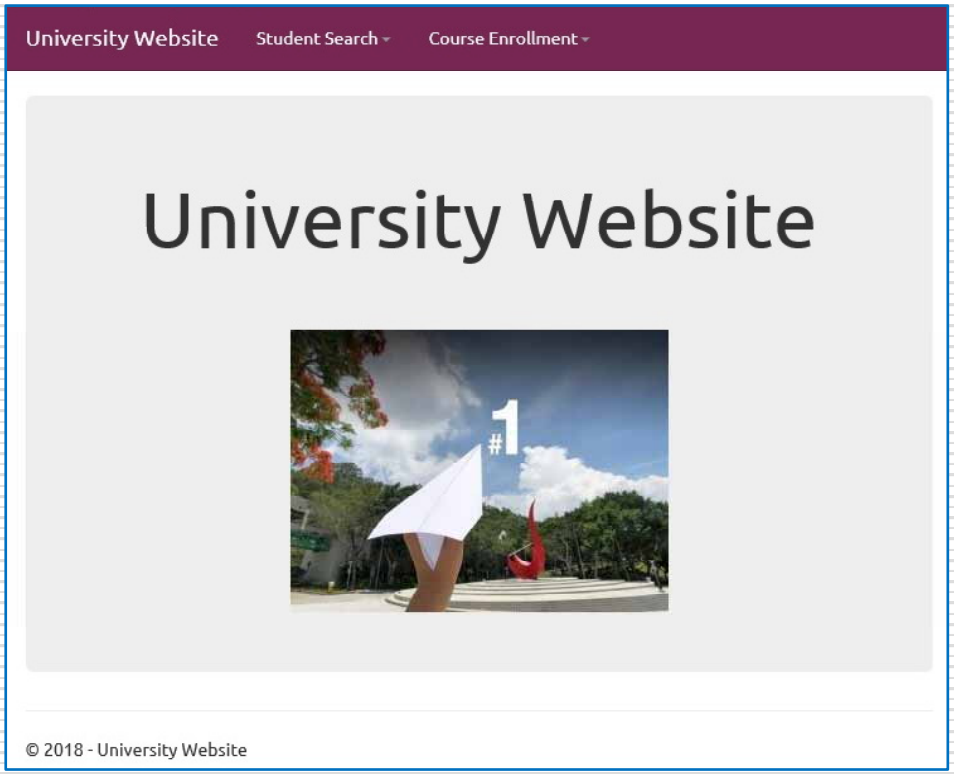
  comp3311stuXXX with your Oracle user name

  XXXXXXXX with your Oracle password
- Save and close the Web.config file.



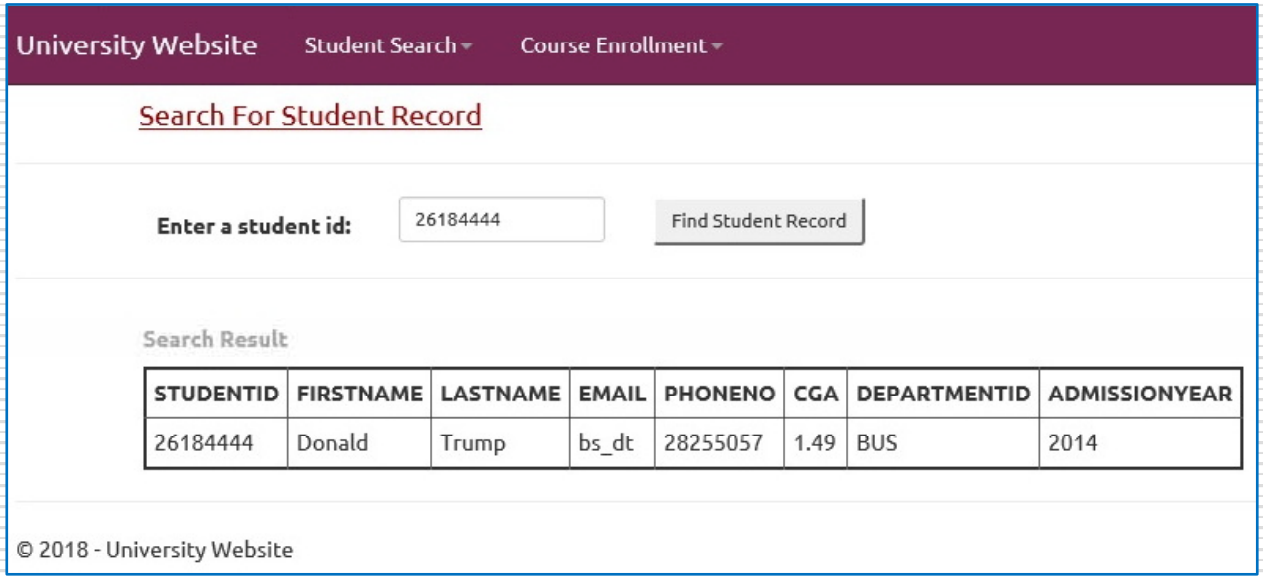
Test the Website (1)

- Select Start Debugging in the Debug menu to view the website.
- The homepage of the website, shown on the right, should be displayed.



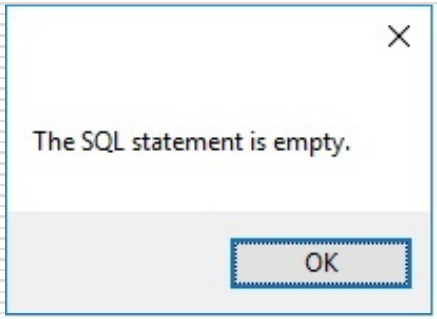
Test the Website (2)

- In the navigation bar, select Student Search → Search For A Student Record and enter a valid student id in the textbox (e.g., 26184444 or your student id).
- The record of the student should be displayed as shown below.



Test the Website (3)

- If you select any other item in the navigation bar menu and try to search, you will get the error message, shown on the right, indicating that there is no SQL statement defined to retrieve data from and/or insert data into the Oracle database.



Note: The error message may be hidden behind the browser window.

  - The required SQL statements need to be constructed as explained shortly.

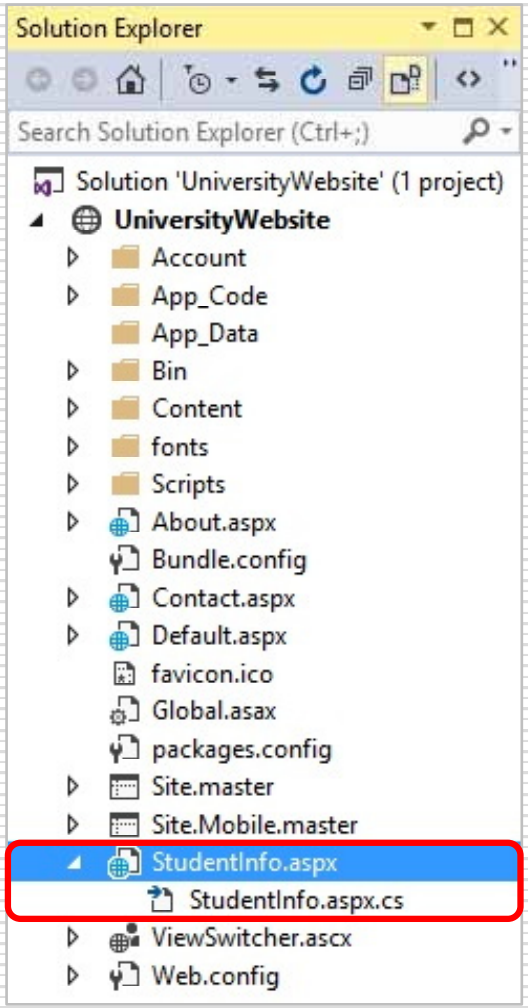
- Close the browser window.

Web Forms (1)

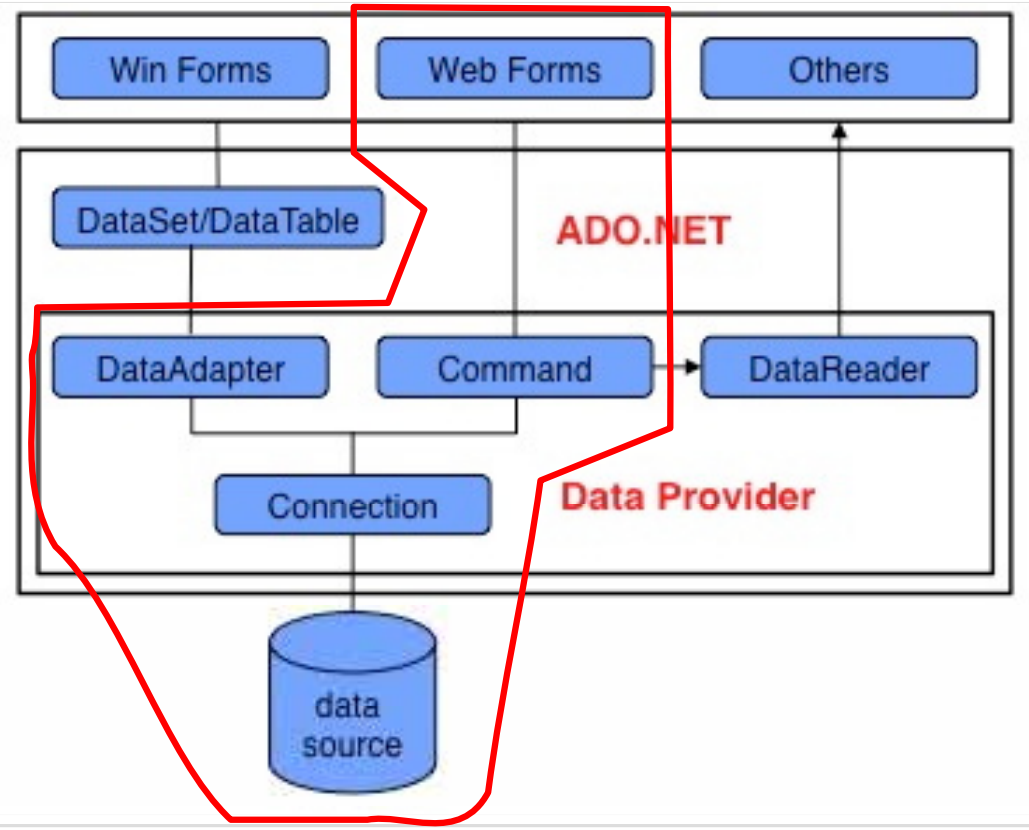
- A web form, which is rendered as a web page, provides the user interface (UI) of a website.
- Visual Studio lets you create web pages by dragging and dropping server controls onto a web form to lay out a web page.
- Properties, methods and events for server controls or for the web page can be set in order to define the web page's behavior, look and feel.
- Web forms are constructed using a combination of HTML, server controls and server code.

Web Forms (2)

- A website's web forms (with extension aspx) can be found in the Solution Explorer as shown on the right.
- Each web form also has a C# code-behind file (with extension aspx.cs) that contains the code that processes the web page (more on this later).



ASP.NET Data Access Architecture

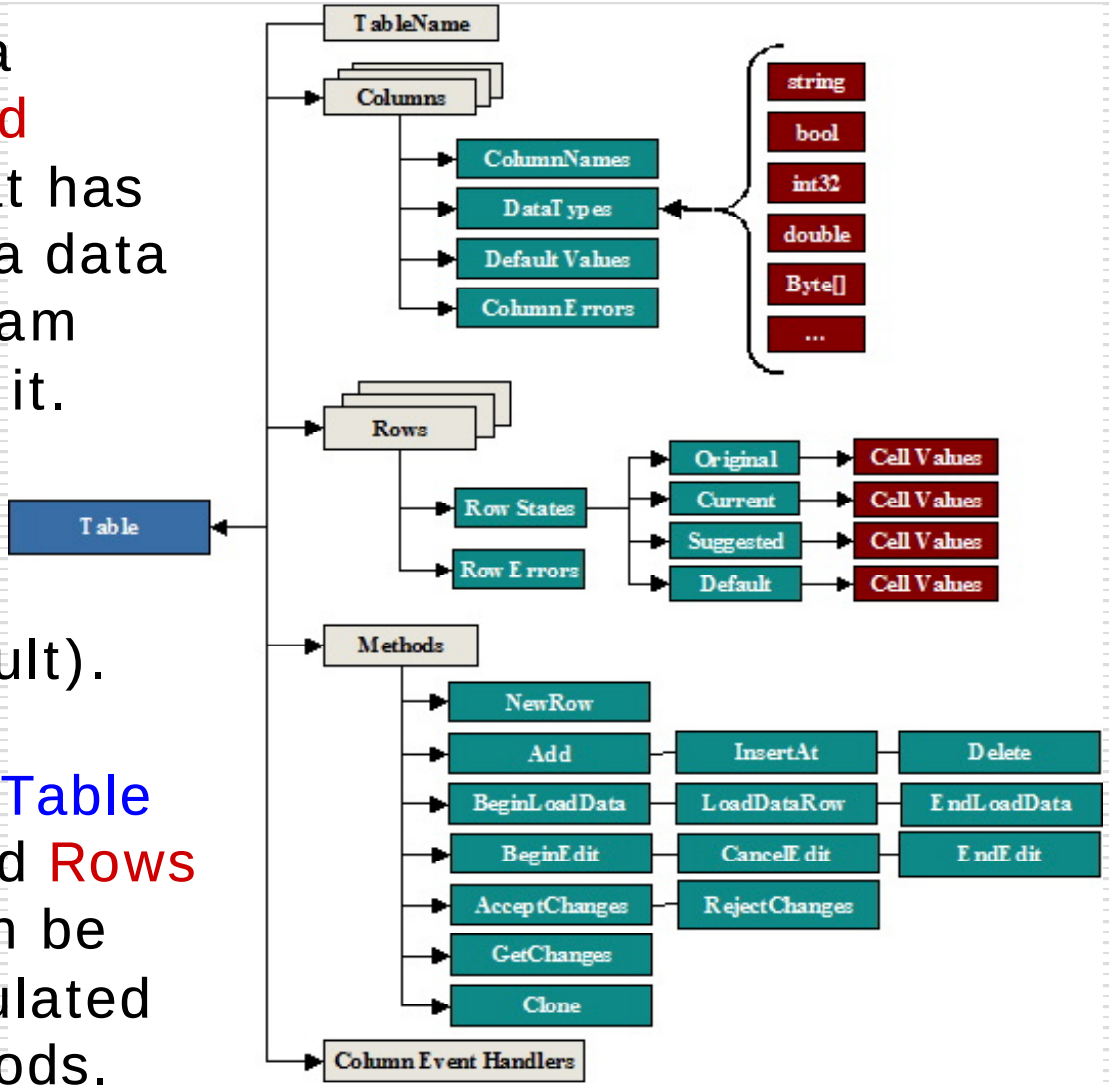


Note: The code that actually accesses Oracle Database is in the class OracleDBAccess.cs inside the App_Code folder.

DO NOT MODIFY THIS CODE!

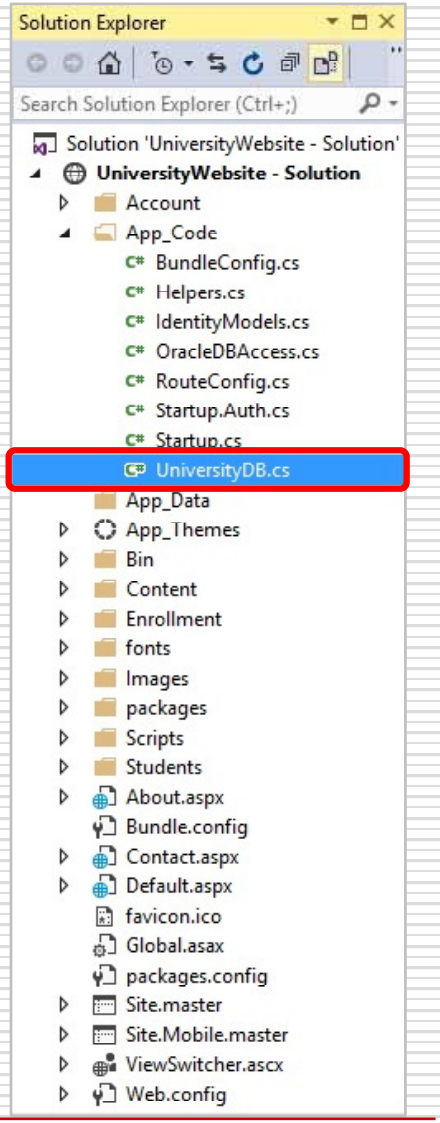
DataTable

- A DataTable is a data structure used to hold data *in memory*—that has been retrieved from a data source—where program code can manipulate it.
- A DataTable can hold at most one table (i.e., query result).
- A table within a DataTable contains Columns and Rows collections, which can be accessed and manipulated using standard methods.



UniversityDB.cs Code File (1)

- The code that constructs the required SQL statements to access the database is contained in a C# code file named UniversityDB.cs, which is located in the App_Code folder in the Solution Explorer.
- In the Solution Explorer, expand the App_Code folder.
- Double click on the file UniversityDB.cs.



UniversityDB.cs Code File (2)

- In the code file, to retrieve the student record of a student, identified by their student id, an SQL statement is constructed, as a string named sql, in which the value of the studentId parameter is used (**1** and **2**).
- Then, the string sql is passed to the procedure myOracleDBAccess.GetData, which contains the code required to access the Oracle database and the result is assigned to a DataTable (**3**), which is returned to the calling method.

```
public class UniversityDB
{
    OracleDBAccess myOracleDBAccess = new OracleDBAccess();
    private string sql;

    #region SQL statements for students
    0 references
    public DataTable GetStudentRecord(string studentId) (1)
    {
        //*****************************************************************
        // TODO 1: Used in SearchForStudent.aspx.cs                       *
        // Construct the SELECT statement to find the record (i.e., return *
        // all the attributes) of a student identified by a studentId.    *
        //*****************************************************************
    (2) sql = "select * from Student where studentId='" + studentId + "'";
    (3) return myOracleDBAccess.GetData(sql);
    }

    0 references
    public decimal StudentIdIsValid(string studentId)...

    0 references
    public DataTable GetDepartmentStudentRecords(string departmentId)...

    0 references
    public DataTable GetDepartments()...

    #endregion SQL statements for students

    SQL statements for enrolling in courses

    *** DO NOT CHANGE THE METHOD BELOW THIS LINE. IT IS NOT A TODO!!! ***!
}
```

Web Form Code-behind File

- The methods in the code file UniversityDB.cs are called from the code-behind files of the web forms as shown in the figure on the right.
- The code-behind files have comments that cross-reference the methods which they call in the UniversityDB.cs code file.

```
public partial class SearchForStudent : System.Web.UI.Page
{
    UniversityDB myUniversityDB = new UniversityDB();
    Helpers myHelpers = new Helpers();

    0 references
    protected void Page_Load(object sender, EventArgs e)...

    0 references
    protected void btnFindStudent_Click(object sender, EventArgs e)
    {
        // Reset the page.
        lblResultMessage.Visible = false;
        pnlStudentRecord.Visible = false;
        string studentId = txtStudentId.Text.Trim();

        //***************
        // Uses TODO 1 *
        //***************
        DataTable dtStudentRecord = myUniversityDB.GetStudentRecord(studentId);

        // Show the student record if the query result is not null and something was retrieved.
        if (dtStudentRecord != null)
        {
            // Display a no result message if nothing was retrieved from the database.
            if (dtStudentRecord.Rows.Count != 0)
            {
                gvStudentRecord.DataSource = dtStudentRecord;
                gvStudentRecord.DataBind();
                pnlStudentRecord.Visible = true;
            }
            else // Display a no result message.
            {
                myHelpers.ShowMessage(lblResultMessage, "No record for the student was found.");
            }
        }
        else // An SQL error occurred.
        {
            myHelpers.ShowMessage(lblResultMessage, "*** There is an error in the SQL statement
        }
    }
}
```

Complete UniversityDB.cs Code File (1)

- Most of the SQL statements that you need to complete require values that are passed as parameters of a method that is invoked from the code-behind file of a web form.
- Consider, as an example, the code on slide 19 which retrieves the record of a student with a specified student id.
- The student id value required to construct the SELECT statement is obtained from a TextBox control on the web form and passed to the method GetStudentRecord in the studentId parameter.

Complete UniversityDB.cs Code File (2)

- In the UniversityDB.cs code file, the SQL statement to retrieve the student record is then constructed and assigned to the variable sql as follows:

```
sql = "select * from Student where studentId='" + studentId + "'";
```

1. Since the type of the studentId attribute is char, it is necessary to put single quotes around the value of the studentId parameter so that the SQL statement will look like

```
select * from Student where studentId='26184444'
```

   if the value of the studentId parameter is 26184444.

2. Note that the C# string concatenation operator is +.

Complete UniversityDB.cs Code File (3)

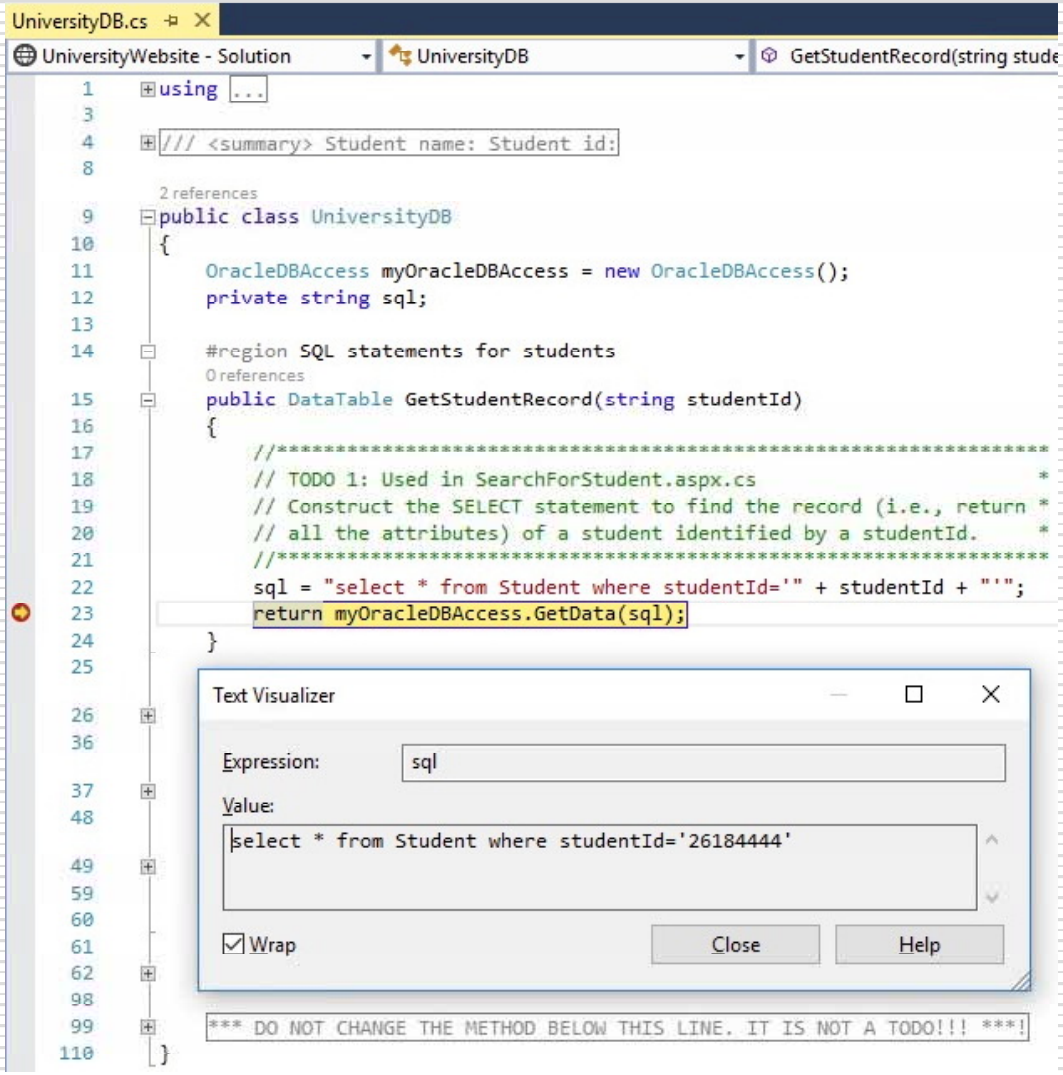
- The method parameters have been assigned names that should make it obvious what values they hold.
- You will need to use the method parameters to construct most of the SQL statements, which are marked by **TODO** comments.
- There are six additional **TODO**s (i.e., six SQL statements to construct) in the UniversityDB.cs code file.

Debugging Your SQL Statements (1)

- In the website, if your SQL statement has an error in it, then when you try to execute it, you will get a popup message indicating that an Oracle error occurred as shown on slide 12.
- The message will not indicate where in your SQL statement the error occurred, making debugging it very difficult.
- Therefore, before trying to execute an SQL statement in Visual Studio, it is highly recommended that you first "debug" it in SQL Developer using appropriate values for any variables.

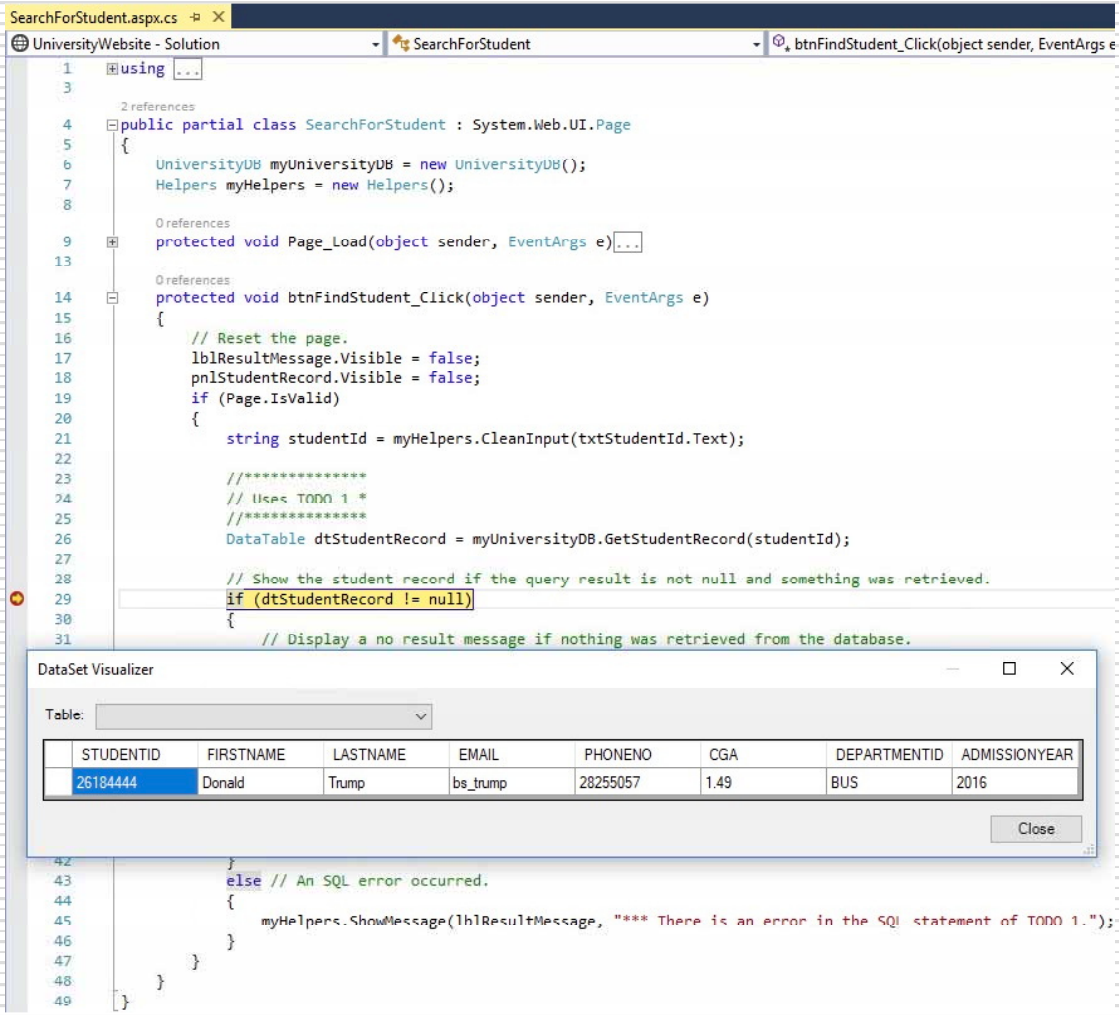
Debugging Your SQL Statements (2)

- Set a breakpoint on a code line in the UniversityDB.cs file by clicking in the left-most margin of the code editor window (right-pointing yellow arrow inside the red circle).
- Place the cursor over the sql variable in the code line.
- Select the magnifying glass icon in the popup to view your SQL statement in the Text Visualizer dialog box.



Debugging Your SQL Statements (3)

- To view the result of an SQL statement, set a breakpoint in the code-behind file where the TODO is used as shown in the figure.
- Place the cursor over the DataTable variable.
- Select the magnifying glass icon in the popup to view the DataTable contents in the Text Visualizer dialog box.



Lab Exercise

Ask for help if you need it!

IMPORTANT NOTE

You cannot access Oracle Database from the M drive using Visual Studio.

Your website folder must be on the local computer.

DO NOT modify any of the other code in the UniversityDB.cs code file or in any other files! In particular, do not modify the web forms. We cannot help you if you have changed these files. In this case the best thing to do is to start over by deleting the University Website folder and downloading it again.

Using Visual Studio on Your Computer

- A free version of Visual Studio, Visual Studio Community (Windows only) can be downloaded from

  https://www.visualstudio.com/en-us/downloads/download-visual-studio-vs.aspx

- To access Oracle Database you also need to download and install Oracle Data Access Components (ODAC) for Windows from

  http://www.oracle.com/technetwork/topics/dotnet/utilsoft-086879.html

- After installing ODAC, you need to configure the client to use TNS resolving with the following information

database server:	dbsvr1.cse.ust.hk
service name:	comp3311.cse.ust.hk
SID:	comp3311
port number:	1521

- The Oracle Database server can only be accessed within the HKUST network. To access it from outside the HKUST network, you need to use the UST VPN.

  http://itsc.ust.hk/apps/vpn/