TEXAS TECH UNIVERSITY
HEALTH SCIENCES CENTER™
EL PASO

TTUHSC El Paso

Programming Languages Coding Standards Best Practices

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Prepared for:

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Health Sciences Center

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1. Introduction

1.1 Purpose

The purpose of this document is to provide coding style standards for the development of source code written in C#. Adhering to a coding style standard is an industry proven best-practice for making team development more efficient and application maintenance more cost-effective. While not comprehensive, these guidelines represent the minimum level of standardization expected in the source code of projects within TTUHSC El Paso.

1.2 Scope

This document provides guidance on the architecture, formatting, commenting, naming, and programming style of C# source code and is applicable to component libraries, web sites, web services, and client – server applications.

2. Technologies and Architecture

2.1 Programming Languages and project specifications

As part of the TTUHSC El Paso programming standarization the following languages and technologies are defined as primary components to work with when developing new projects:

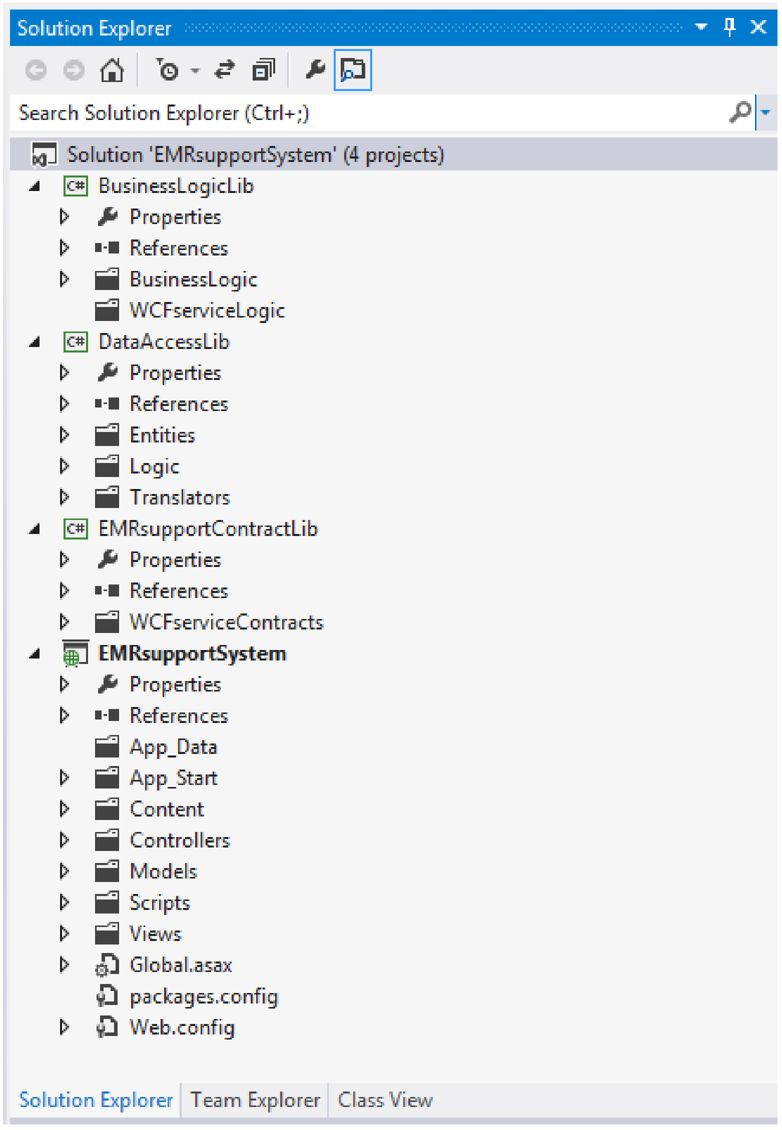
A) Visual Studio Professional 2012 Framework 4.5.
B) Web applications: ASP.NET with MVC4.
C) Front End: ASP.Net, CSS, Javascript, and Bootstrap templates to build responsive web pages (automatic adjustment when using wide screens, tablets or smart phones).
D) Back End: C# (only in very specific cases we will use VB.Net).
E) API: WCF (Windows Communication Fundation).
F) DBMS: MS SQL Server 2012 (Database, SP, UDF, Database Mail, Jobs) and Oracle 11g for very specific cases.
G) Authentication: CAS authentication method and RoleProvider for granular permissions, the only exepction is to use eRaider authentication when the application was built in ASP classic.
H) Repository: our current version controller is Git, for further information review the document Source Control Policies Installation and User Guide.pdf.
I) When creating a new project the naming of the solution, database, and repository should match.

2.2 Applications Architecture

The applications shall have at least the following 3 layers in the solution:

A) Presentation Layer (Views, Models and Controllers).
B) Business Logic Layer (Functions or methods with business logic)
C) Data Access Layer (Data entities, DB connections, Entity framework)

The applications might have more layers depending on the application needs, and the layers supporting either front-end or back-end will be Class Libraries.



```
Solution 'EMRsupportSystem' (4 projects)
  BusinessLogicLib
    Properties
    References
    BusinessLogic
    WCFserviceLogic
  DataAccessLib
    Properties
    References
    Entities
    Logic
    Translators
  EMRsupportContractLib
    Properties
    References
    WCFserviceContracts
  EMRsupportSystem
    Properties
    References
    App_Data
    App_Start
    Content
    Controllers
    Models
    Scripts
    Views
    Global.asax
    packages.config
    Web.config
```

Fig 1.0 Solution Architecture example.

3. Programming

3.1 Namespaces

Namespaces represent the logical packaging of component layers and subsystems. The declaration template for namespaces will be: Company.Product.Library.SubsystemName (or subfolder).

Examples:

```
TTUHSC.CIS.DataAccess.Translators
TTUHSC.RMS.BusinessLogic
```

Guidelines:

- Use plural namespace names if it is semantically appropriate. For example, use System.Collections rather than System.Collection. Exceptions to this rule are brand names and abbreviations. For example, use System.IO rather than System.IOs.
- Use Pascal casing when naming namespaces.

3.2 Classes & Structures

Classes and structures represent the 'Nouns' of a system. As such, they should be declared using the following template: Noun + *Qualifier(s).* Classes and structures should declared with qualifiers that reflect their derivation from a base class whenever possible.

Examples:

```
CustomerForm : Form
CustomerCollection : CollectionBase
```

Guidelines:

- Use Pascal casing when naming classes and structures.
- Classes and structures should be broken up distinct #regions as described in the class layout guidelines.
- All public classes and their methods should be documented using the Intellisense triple slash '///' comments built into Visual Studio.Net. Use this comment style to document the purpose of the class and its methods.
- Default values for fields should be assigned on the line where the field is declared. These values are assigned at runtime just before the constructor is called. This keeps code for default values in one place, especially when a class contains multiple constructors.

3.3 Interfaces

Interfaces express behavior contracts that derived classes must implement. Interface names should use Nouns, Noun Phrases, or Adjectives that clearly express the behavior that they declare.

Examples:

```
IComponent
IFormattable
ITaxableProduct
```

Guidelines:

- Prefix interface names with the letter 'I'.
- Use Pascal casing when naming interfaces.

3.4 Constants

Constants and static read-only variables should be declared using the following template: *Adjective(s)* + Noun + *Qualifier(s)*

Example:

```
public const int DefaultValue = 25;
public static readonly string DefaultDatabaseName = "Membership";
```

Guidelines:

- Use Pascal casing when naming constants and static read only variables.
- Prefer the use of static readonly over const for public constants whenever possible. Constants declared using const are substituted into the code accessing them at compile time. Using static readonly variables ensures that constant values are accessed at runtime. This is safer and less prone to breakage, especially when accessing a constant value from a different assembly.

3.5 Enumerations

Enumerations should be declared using the following template: *Adjective(s)* + Noun + *Qualifier(s)*

Example:

```
/// <summary>
/// Enumerates the ways a customer may purchase goods.
/// </summary>
[Flags]
public enum PurchaseMethod
{
    All          = ~0,
    None         =  0,
    Cash         =  1,
    Check        =  2,
    CreditCard   =  4,
    DebitCard    =  8,
    Voucher      = 16,
}
```

Guidelines:

- Use Pascal casing when naming enumerations.
- Use the [Flags] attribute only to indicate that the enumeration can be treated as a bit field; that is, a set of flags.

3.6 Variables, Fields & Parameters

Variables, fields, and parameters should be declared using the following template: *Adjective(s)* + Noun + *Qualifier(s)*

Examples:

```
int    lowestCommonDenominator = 10;
float  firstRedBallPrice       = 25.0f;
```

Guidelines:

- Use Camel casing when naming variables, fields, and parameters.
- Define variables as close as possible to the first line of code where they are used.
- Assign initial values whenever possible. The .NET runtime defaults all unassigned variables to 0 or null automatically, but assigning them proper values will alleviate unnecessary checks for proper assignment elsewhere in code.
- Avoid meaningless names like i, j, k, and temp. Take the time to describe what the object really is (e.g. use index instead of i; use swapInt instead of tempInt).
- Use a positive connotation for boolean variable names (e.g. isOpen as opposed to notOpen).

3.7 Properties

Properties should be declared using the following template: *Adjective(s)* + Noun + *Qualifier(s)*

Examples:

```
public TotalPrice
{
    get
    {
        return this.totalPrice;
    }
    set
    {
        // Set value and fire changed event if new value is different
        if( !object.Equals( value, this.totalPrice )
        {
            this.totalPrice = value;
            this.OnTotalPriceChanged();
        }
    }
}
```

Guidelines:

- Use the common prefixes for inspection properties (properties that return query information about an object).
- When there is a property setter that sets another property:
    - If the code in the other property sets a private member field in the same class, the field should be set directly, without calling the property setter for that field.
    - If a property setter sets a private field that would normally be set via another property setter, the originating setter is responsible for firing any events the other setter would normally fire (e.g. Changed events).
    - If a value that needs to be set that does NOT correspond to a private field, then an appropriate property setter or method should be called to set the value.

3.8 Methods

Methods should be named using the following format: Verb + *Adjective(s)* + Noun + *Qualifier(s)*

Example:

```
private Ball FindRedCansByPrice(
     float price,
     ref int canListToPopulate,
     out int numberOfCansFound )
```

Guidelines:

- Parameters should be grouped by their mutability (from least to most mutable) as shown in the example above.
- If at all possible, avoid exiting methods from their middles. A well written method should only exit from one point: at its end.
- Avoid large methods. As a method's body approaches 20 to 30 lines of code, look for blocks that could be split into their own methods and possibly shared by other methods.
- If you find yourself using the same block of code more than once, it's a good candidate for a separate method.
- Group like methods within a class together into a region and order them by frequency of use (i.e. more frequently called methods should be near the top of their regions.

3.9 Event Handlers

Event handlers should be declared using the following format: ObjectName_EventName

Example:

```
private HelpButton_Click( object sender, EventArgs e )
```

3.10 Error Handling

Use exceptions only for exceptional cases, not for routine program flow. Exceptions have significant performance overhead.

Guidelines:

- Pass a descriptive string into the constructor when throwing an exception.
- Use grammatically correct error messages, including ending punctuation. Each sentence in the description string of an exception should end in a period.
- If a property or method throws an exception in some cases, document this in the comments for the method. Include which exception is thrown and what causes it to be thrown.
    - Example: Comment for Order.TotalCost property might read "Gets or sets the total cost of an Order. If the TotalCost property is set when the cost should be calculated, an InvalidOperationException is thrown."
- Use the following exceptions if appropriate:
    - ArgumentException (and ArgumentNull, ArgumentOutOfRange, IndexOutOfRange): Used when checking for valid input parameters to method.

- InvalidOperationException: Used when a method call is invalid for the current state of an object.

  Example: TotalCost cannot be set if the cost should be calculated. If the property is set and it fails this rule, an InvalidOperationException is thrown.

- NotSupportedException: Used when a method call is invalid for the class.

  Example: Quantity, a virtual read/write property, is overridden by a derived class. In the derived class, the property is read-only. If the property is set, a NotSupportedException is thrown.

- NotImplementedException: Used when a method is not implemented for the current class.

  Example: An interface method is stubbed in and not yet implemented. This method should throw a NotImplementedException.

○ Derive your own exception classes for a programmatic scenarios. All new derived exceptions should be based upon the core Exception class.

Example: DeletedByAnotherUserException : Exception. Thrown to indicate a record being modified has been deleted by another user.

○ Rethrow caught exceptions correctly.

The following example throws an exception caught and rethrown incorrectly:

```
catch( Exception ex )
{
     LogManager.Publish( ex );
     throw ex;    // INCORRECT – we lose the call stack of the exception
}
```

We log all unhandled exceptions in our applications, but may sometimes throw them again to let the higher level systems determine how to proceed. The problem comes in with the throw – it works much better to do this:

```
catch( Exception ex )
{
     LogManager.Publish( ex );
     throw;    // CORRECT - rethrows the exception we just caught
}
```

Notice the absence of an argument to the throw statement in the second variation.

The difference between these two variations is subtle but important. With the first example, the higher level caller isn't going to get all the information about the original error. The call stack in the exception is replaced with a new call stack that originates at the "`throw ex`" statement – which is not what we want to record. The second example is the only one that actually re-throws the original exception, preserving the stack trace where the original error occurred.

4. Formatting

4.1 Class Layout

Classes should be organized into regions within an application using a layout determined by the best practices. These may be based on accessibility, type, or functionality.

Example:

```
// Class layout based on accessibility
class Purchasing
{
        #region Main

        #region Public

        #region Internal

        #region Protected

        #region Private

        #region Extern

        #region Designer Generated Code
}
```

Guidelines:

- Use the same layout consistently in all classes in an application.
- Omit regions if their associated class elements are not needed.
- The Designer Generated Code region created by Visual Studio's Visual Designer should never be modified by hand. It should contain only code generated by the designer.

4.2 Indicating Scope

Indicate scope when accessing all static and non-static class members. This provides a crystal clear indication of the intended use of the member. VisualStudio.NET intellisense is automatically invoked when using this practice, providing a list of all available class members. This helps prevent unnecessary typing and reduces the risk of typographic errors.

Example:

```
string connectionString = DataAccess.DefaultConnectionString;
float amount = this.CurrentAmount;
this.discountedAmount = this.CalculateDiscountedAmount( amount,
this.PurchaseMethod );
```

Guidelines:

- Include the `this` keyword before all member fields, properties and methods.
- Include the name of the class before all static fields, constants, fields, and methods.

4.3 Indentation & Braces

Statements should be indented (using tabs) into blocks that show relative scope of execution. A consistent tab size should be used for all indentation in an application. Braces, when necessary, should be placed directly below and aligned with the statement that begins a new scope of execution. Visual Studio.NET includes a keyboard short-cut that will automatically apply this format to a selected block of code.

Example:

```
float CalculateDiscountedAmount( float amount, PurchaseMethod purchaseMethod )
{
   // Calculate the discount based on the purchase method
   float discount = 0.0f;
   switch( purchaseMethod )
   {
      case PurchaseMethod.Cash:
         // Calculate the cash discount
         discount = this.CalculateCashDiscount( amount );
         Trace.Writeline( "Cash discount of {0} applied.", discount );
         break;

      case PurchaseMethod.CreditCard:
         // Calculate the credit card discount
         discount = this.CalculateCreditCardDiscount( amount );
         Trace.WriteLine( "Credit card discount of {0} applied.", discount );
         break;

      default:
         // No discount applied for other purchase methods
         Trace.WriteLine( "No discount applied." );
         break;
   }

   // Compute the discounted amount, making sure not to give money away
   float discountedAmount = amount - discount;
   if( discountedAmount < 0.0f )
   {
      discountedAmount = 0.0f;
   }
   LogManager.Publish( discountedAmount.ToString() );

   // Return the discounted amount
   return discountedAmount;
}
```

4.4 White space

Liberal use of white space is highly encouraged. This provides enhanced readability and is extremely helpful during debugging and code reviews. The indentation example above shows an example of the appropriate level of white space.

Guidelines:

- Blank lines should be used to separate logical blocks of code in much the way a writer separates prose using headings and paragraphs. Note the clean separation between logical sections in the previous code example via the leading comments and the blank lines immediately following.
- Single spaces should be used to separate logical elements within individual statements. This can be seen clearly in the CalculateDiscountedAmount and `switch` statements in the preceding example. Note the spaces immediately after opening '('s and before closing ')'s.

4.5 Long lines of code

Comments and statements that extend beyond 80 columns in a single line can be broken up and indented for readability. Care should be taken to ensure readability and proper representation of the scope of the information in the broken lines. When passing large numbers of parameters, it is acceptable to group related parameters on the same line.

Example:

```
string Win32FunctionWrapper(
    int    arg1,
    string arg2,
    bool   arg3 )
{
    // Perform a PInvoke call to a win32 function,
    // providing default values for obscure parameters,
    // to hide the complexity from the caller
    if( Win32.InternalSystemCall(
        null,
        arg1, arg2,
        Win32.GlobalExceptionHandler,
        0, arg3,
        null )
    {
         return “Win32 system call succeeded.”;
    }
    else
    {
         return “Win32 system call failed.”;
    }
}
```

Guidelines:

- When breaking parameter lists into multiple lines, indent each additional line one tab further than the starting line that is being continued.
- Group similar parameters on the same line when appropriate.
- When breaking comments into multiple lines, match the indentation level of the code that is being commented upon.
- Consider embedding large string constants in resources and retrieving them dynamically using the .NET `ResourceManager` class.

5. Commenting

5.1 Intellisense Comments

Use triple slash '///' comments for documenting the public interface of each class. This will allow Visual Studio.Net to pick up the method's information for Intellisense. These comments are required before each public, internal, and protected class member and optional for private members.

5.2 End-Of-Line Comments

Use End-Of-Line comments only with variable and member field declarations. Use them to document the purpose of the variable being declared.

Example:

```
private string name = string.Empty; // Name of control (defaults to blank)
```

5.3 Single Line Comments

Use single line comments above each block of code relating to a particular task within a method that performs a significant operation or when a significant condition is reached. Comments should always begin with two slashes, followed by a space.

Example:

```
// Compute total price including all taxes
float stateSalesTax = this.CalculateStateSalesTax( amount, Customer.State );
float citySalesTax  = this.CalculateCitySalesTax( amount, Customer.City );
float localSalesTax = this.CalculateLocalSalesTax( amount, Customer.Zipcode );
float totalPrice    = amount + stateSalesTax + citySalesTax + localSalesTax;
Console.WriteLine( “Total Price: {0}”, totalPrice );
```

5.4 // TODO: Comments

Use the `// TODO:` comment to mark a section of code that needs further work before release. Source code should be searched for these comments before each release build.

5.5 C-Style Comments

Use c-style `/*…*/` comments only for temporarily blocking out large sections of code during development and debugging. Code should not be checked in with these sections commented out. If the code is no longer necessary, delete it. Leverage your source control tools to view changes and deletions from previous versions of the code. If code must be checked in with large sections commented out, include a `// TODO:` comment above the block commented out describing why it was checked in that way.

6. Capitalization

6.1 Capitalization

Follow the standard set by the .NET framework team by using only three capitalization styles: **Pascal**, **Camel**, and **Upper** casing.

Examples:

Identifier Type	Capitalization Style	Example(s)
Abbreviations	Upper	ID, REF
Namespaces	Pascal	AppDomain, System.IO
Classes & Structs	Pascal	AppView
Constants & Enums	Pascal	TextStyles
Interfaces	Pascal	IEditableObject
Enum values	Pascal	TextStyles.BoldText
Property	Pascal	BackColor
Variables, and Attributes	Pascal (public) Camel (private, protected, local)	WindowSize windowWidth, windowHeight

Methods	Pascal (public, private, protected)
	Camel (parameters)
		ToString()
		SetFilter(string filterValue)

Local Variables	Camel	recordCount

Guidelines:

- In **Pascal** casing, the first letter of an identifier is capitalized as well as the first letter of each concatenated word. This style is used for all public identifiers within a class library, including namespaces, classes and structures, properties, and methods.
- In **Camel** casing, the first letter of an identifier is lowercase but the first letter of each concatenated word is capitalized. This style is used for private and protected identifiers within the class library, parameters passed to methods, and local variables within a method.
- **Upper** casing is used only for abbreviated identifiers and acronyms of four letters or less.

7. C# Golden Rules

The following guidelines are applicable to all aspects of C# development:

- Make code as simple and readable as possible. Assume that someone else will be reading your code.
- Prefer small cohesive classes and methods to large monolithic ones.
- Use a separate file for each class, struct, interface, enumeration, and delegate with the exception of those nested within another class.
- Write the comments first. When writing a new method, write the comments for each step the method will perform before coding a single statement. These comments will become the headings for each block of code that gets implemented.
- Use liberal, meaningful comments within each class, method, and block of code to document the purpose of the code.
- Mark incomplete code with // TODO: comments. When working with many classes at once, it can be very easy to lose a train of thought.
- **Never hard code** "magic" values into code (strings or numbers). Instead, define constants, static read-only variables, and enumerations or read the values from configuration or resource files.
- Prefer while and foreach over other available looping constructs when applicable. They are logically simpler and easier to code and debug.
- Use the StringBuilder class and it's Append(), AppendFormat(), and ToString() methods instead of the string concatenation operator (+=) for much more efficient use of memory.
- Be sure Dispose() gets called on IDisposable objects that you create locally within a method. This is most commonly done in the finally clause of a try block. It's done automatically when a using statement is used.
- Never present debug information to yourself or the end user via the UI (e.g. MessageBox). Use tracing and logging facilities to output debug information.
- Gaps and exceptions to these guidelines should be discussed and resolved with your application architect.
- Follow the style of existing code. Strive to maintain consistency within the code base of an application. If further guidance is needed, look to these guidelines and the .NET framework for clarification and examples.

8 Database Standards

8.1 General Rules for all database objects

- Try to limit the name to 30 characters (shorter is better).
- Avoid using underscores even if the system allows it, only special cases are allowed.
- Try to avoid numbers – and limit the use of underscores to meet standards for constraints.
- Limit the use of abbreviations (can lead to misinterpretation of names).
- Limit the use of acronyms (some acronyms have more than one meaning e.g. "ASP").
- Make the name readable.
- Avoid using spaces in names even if the system allows it.
- Ensure the name is unique and does not exist as a reserved keyword.

8.2 Tables

1) Names should use PascalCase (AuditTransaction).
2) Use singular or a collective name or, less ideally, a plural form. For example (in order of preference) staff and employees.
3) Do not prefix with tbl or any other such descriptive prefix or Hungarian notation.
4) Never give a table the same name as one of its columns and vice versa.

8.3 Columns

1) Always use the singular name.
2) Where possible avoid simply using id as the primary identifier for the table.
3) Do not add a column with the same name as its table and vice versa.
4) All column names should use PascalCase to distinguish them from SQL keywords (camelCase).
5) Don't use prefixes.
6) Field names should contain only letters and numbers. No special characters, underscores or spaces should be used.

8.4 Views

1) While it is pointless to prefix tables, it can be helpful for views. Prefix your views with "vw", is a helpful reminder that you're dealing with a view, and not a table.
2) Give a meaningful name to the view. For example, joining the "Customer" and "StateAndProvince" table to create a view of Customers and their respective geographical data should be given a name like "vwCustomerStateAndProvince".
3) Names should use PascalCase after the prefix.

8.5 Stored Procedures

1) The name must contain and start with a verb (Get, Create, Save, Insert, Update, Delete, Validate, etc.)
2) Do not prefix with sp_ or any other such descriptive prefix or Hungarian notation.
3) Names should use camelCase (getCustomerInformation).
4) SQL reserved words should be written in UPPER Case (SELECT, FROM, WHERE, etc)

8.6 Functions

1) Prefix the name with “fn” as a helpful reminder that you're dealing with a function, and not a stored procedure.
2) Names should use camelCase (fnGetOpenDate).
3) Functions should be named as a verb, because they will always return a value.
4) SQL reserved words should be written in UPPER Case (SELECT, FROM, WHERE, etc)

8.7 Variables

1) Variable names should be meaningful and natural.
2) Variable names should describe its purpose and not exceed 30 characters in length.
3) All variables must begin with the “@” symbol. Do NOT user “@@” to prefix a variable as this signifies a SQL Server system global variable and will affect performance.
4) All variables should be written in camelCase, e.g. “@firstName” or “@city” or “@siteId”.
5) Variable names should contain only letters and numbers. No special characters or spaces should be used.

8.8 DB Coding Conventions

1) SQL statements should be arranged in an easy to read manner, refer to the following example:

```
SELECT
        dui.DealUnitInvoiceID,
        dui.UnitInventoryID,
        ui.UnitID,
        ui.StockNumber [Stock Number],
        ut.UnitType AS [Unit Type],
        COALESCE(mk.Description, '') Make,
        COALESCE(ml.Description, '') Model,
        DATEPART(YEAR,u.ProductionYear) [Year],
        ut.UnitTypeID,
        mt.Description AS MeterType,
        ui.MeterReading,
        ui.ECMReading,
        '$' + LTRIM(CONVERT(nvarchar(18),CONVERT(decimal(18, 2),dui.Price)))
        Price,
        '$' + LTRIM(CONVERT(nvarchar(18),CONVERT(decimal(18, 2),dui.Cost)))
        Cost,
        dui.IsTradeIn,
        COALESCE(u.Vin,'') Vin,
        COALESCE(u.SerialNumber,'') SerialNumber,
        ui.AvailabilityStatusID,
        ui.SellingStatusID,
        ui.IsNew,
        ui.UnitPurchaseOrderID,
        ui.BaseCost,
        dui.DealPacketInvoiceID
FROM
        dbo.DealUnitInvoice dui
        INNER JOIN dbo.UnitInventory ui
        ON dui.UnitInventoryID = ui.UnitInventoryID
        INNER JOIN dbo.Unit u ON
        ON ui.UnitID = u.UnitID
        LEFT JOIN dbo.MeterType mt
        ON u.MeterTypeID = mt.MeterTypeID
        LEFT JOIN dbo.UnitType ut
        ON ui.UnitTypeID = ut.UnitTypeID
        AND ut.InActive = 0
        LEFT JOIN dbo.Make mk
        ON u.MakeID = mk.MakeID
        AND mk.Inactive = 0
        LEFT JOIN dbo.Model ml
        ON u.ModelID = ml.ModelID
        AND ml.InActive = 0
WHERE
        ut.ui.IsNew  = 1
```

Note how the tables are aliased and joins are clearly laid out in an organized manner.

2) When developing a stored procedure consider the following example to use TRY – CATCH and BEGIN – END blocks as well as the identation:

```
CREATE PROCEDURE DoStuff
@var1 int
AS
SET NOCOUNT ON

BEGIN TRY
        BEGIN TRAN
                DELETE FROM MyTable
                WHERE Col1 = @var1
                INSERT INTO MyOtherTable(Col1)
                SELECT @var1
        COMMIT TRANSACTION
END TRY
GO

BEGIN CATCH
         SELECT
         ERROR_NUMBER() as ErrorNumber,
         ERROR_MESSAGE() as ErrorMessage
         -- Test XACT_STATE for 1 or -1.
         -- XACT_STATE = 0 means there is no transaction and
         -- a commit or rollback operation would generate an error.

         -- Test whether the transaction is uncommittable.
         IF (XACT_STATE()) = -1
         BEGIN
                 PRINT
                 N'The transaction is in an uncommittable state. ' +
                 'Rolling back transaction.'
                 ROLLBACK TRAN
         END
         -- Test whether the transaction is active and valid.
         IF (XACT_STATE()) = 1
         BEGIN
                 PRINT
                 N'The transaction is committable. ' +
                 'Committing transaction.'
                 COMMIT TRAN
         END
END CATCH
```

3) **Code Commenting** : Important code blocks within stored procedures and user defined functions should be commented. Brief functionality descriptions should be included where important or complicated processing is taking place.

4) **Code Headers**: Stored procedures, triggers and user-defined functions should have a code header. The header can be created using the comment syntax above. This header should give a brief description of the functionality of the procedure as well as any special execution instructions. Also contained in this header there should be a brief definition of any parameters used. Refer to the example below. You may also include an execution example of the function or procedure in the header as well.

```
CREATE PROCEDURE [dbo].[validateConcurrency]
@TableName varchar(255),
@ID int,
@LastUpdate datetime,
@IsValid bit OUTPUT
AS
/*******************************************************
This procedure validates the concurrency of a record update by taking
the LastUpdate date passed in and checking it against the current
LastUpdate date of the record. If they do NOT match the record is not
updated because someone has updated the record out from under
the user.
--------------------------------
Parameter Definition:
--------------------------------
@TableName = Table to be validated.
@ID = Record ID of the current record to be validated.
@LastUpdate = The Last Update Date passed by app to compare with
current date value for the record.
@IsValid = Returns the following back to the calling app.
1 = Record is valid. No concurrancy issues.
0 = Record is NOT concurrent.
*******************************************************/
```