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Code Documentation and Comments in the Program

Revealing the Secrets of Self-Documenting Code

Telerik Software Academy
Learning & Development
http://academy.telerik.com

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Comments and Code Documentation

The Concept of Self-Documenting Code

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What is Project Documentation?

- Consists of documents and information
  - Both inside the source-code and outside
- External documentation
  - At a higher level compared to the code
  - Problem definition, requirements, architecture, design, project plans, test plans. etc.
- Internal documentation
  - Lower-level – explains a class, method or a piece of code

Programming Style

- Main contributor to code-level documentation
  - The program structure
  - Straight-forward, easy-to-read and easily understandable code
  - Good naming approach
  - Clear layout and formatting
  - Clear abstractions
  - Minimized complexity
  - Loose coupling and strong cohesion

Bad Comments – Example

```
public static List<int> FindPrimes(int start, int end)
{
    // Create new list of integers
    List<int> primesList = new List<int>();
    // Perform a loop from start to end
    for (int num = start; num <= end; num++)
    {
        // Declare boolean variable, initially true
        bool prime = true;
        // Perform loop from 2 to sqrt(num)
        for (int div = 2; div <= Math.Sqrt(num); div++)
        {
            // Check if div divides num with no remainder
            if (num % div == 0)
            {
                // We found a divider -> the number is not prime
                prime = false;
                // Exit from the loop
                break;
            }
```

(continues on the next slide)

Bad Comments – Example (2)

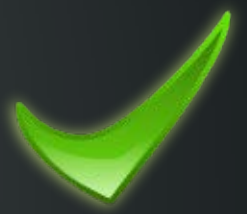
```
            // Continue with the next loop value
        }

        // Check if the number is prime
        if (prime)
        {
            // Add the number to the list of primes
            primesList.Add(num);
        }
    }

    // Return the list of primes
    return primesList;
}
```

Self-Documenting Code – Example

```
public static List<int> FindPrimes(int start, int end)
{
  List<int> primesList = new List<int>();
  for (int num = start; num <= end; num++)
  {
    bool isPrime = IsPrime(num);
    if (isPrime)
    {
      primesList.Add(num);
    }
  }
  return primesList;
}
```



Good code does not need comments. It is self-explaining.

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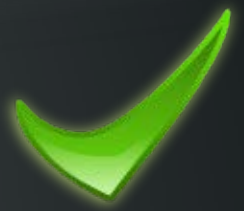
Self-Documenting Code – Example (2)

```
private static bool IsPrime(int num)
{
  bool isPrime = true;
  int maxDivider = Math.Sqrt(num);
  for (int div = 2; div <= maxDivider; div++)
  {
    if (num % div == 0)
    {
      // We found a divider -> the number is not prime
      isPrime = false;
      break;
    }
  }
  return isPrime;
}
```



Good methods have good name and are easy to read and understand.

This comment explain non-obvious details. It does not repeat the code.

Bad Programming Style – Example

```
for (i = 1; i <= num; i++)
{
    meetsCriteria[i] = true;
}
for (i = 2; i <= num / 2; i++)
{
    j = i + i;
while (j <= num)
{
        meetsCriteria[j] = false;
        j = j + i;
    }
}
for (i = 1; i <= num; i++)
{
    if (meetsCriteria[i])
    {
        Console.WriteLine(i + " meets criteria.");
    }
}
```

Uninformative variable names. Crude layout.

Good Programming Style – Example

```
for (primeCandidate = 1; primeCandidate <= num; primeCandidate++)
{
    isPrime[primeCandidate] = true;
}

for (int factor = 2; factor < (num / 2); factor++)
{
    int factorableNumber = factor + factor;
    while (factorableNumber <= num)
    {
        isPrime[factorableNumber] = false;
        factorableNumber = factorableNumber + factor;
    }
}

for (primeCandidate = 1; primeCandidate <= num; primeCandidate++)
{
    if (isPrime[primeCandidate])
    {
        Console.WriteLine(primeCandidate + " is prime.");
    }
}
```

Self-Documenting Code

- Code that relies on good programming style
  - To carry major part of the information intended for the documentation
- Self-documenting code fundamental principles

> The best documentation is the code itself.

> Make the code self-explainable and self-documenting, easy to read and understand.

> Do not document bad code, rewrite it!

Self-Documenting Code Checklist

- Classes
  - Does the class's interface present a consistent abstraction?
  - Does the class's interface make obvious how you should use the class?
  - Is the class well named, and does its name describe its purpose?
  - Can you treat the class as a black box?
  - Do you reuse instead of repeating code?

Self-Documenting Code Checklist (2)

- Methods
  - Does each routine's name describe exactly what the method does?
  - Does each method perform one well-defined task with minimal dependencies?
- Data Names
  - Are type names descriptive enough to help document data declarations?
  - Are variables used only for the purpose for which they're named?

Self-Documenting Code Checklist (3)

- Data Names
  - Does naming conventions distinguish among type names, enumerated types, named constants, local variables, class variables, and global variables?
- Others
  - Are data types simple so that they minimize complexity?
  - Are related statements grouped together?

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To Comment or Not to Comment?

"Everything the Compiler Needs to Know is in the Code!"

Effective Comments

- Effective comments do not repeat the code
  - They explain it at a higher level and reveal non-obvious details
- The best software documentation is the source code itself – keep it clean and readable!
- Self-documenting code is self-explainable and does not need comments
  - Simple design, small well named methods, strong cohesion and loose coupling, simple logic, good variable names, good formatting, …

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Effective Comments – Mistakes

- Misleading comments

```
// write out the sums 1..n for all n from 1 to num
current = 1;
previous = 0;
sum = 1;
for (int i = 0; i < num; i++)
{
   Console.WriteLine( "Sum = " + sum );
   sum = current + previous;
   previous = current;
   current = sum;
}
```

What problem does this algorithm solve?

Can you guess that sum is equal to the i^{th} Fibonacci number?

Effective Comments – Mistakes (2)

- Comments repeating the code:

```
// set product to "base"
product = base;

// loop from 2 to "num"
for ( int i = 2; i <= num; i++ )
{
   // multiply "base" by "product"
   product = product * base;
}
Console.WriteLine( "Product = " + product );
```

Obviously…

You don't say…

Effective Comments – Mistakes (3)

- Poor coding style:

```
// compute the square root of Num using
// the Newton-Raphson approximation
r = num / 2;
while (abs(r - (num/r)) > TOLERANCE)
{
   r = 0.5 * (r + (num/r) );
}
Console.WriteLine( "r = " + r );
```

- Do not comment bad code, rewrite it

Key Points for Effective Comments

- Use commenting styles that don't break down or discourage modification

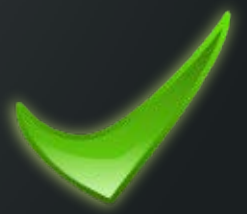
```
//  Variable              Meaning
//  --------              -------
//  xPos ..............  X coordinate position (in meters)
//  yPos ..............  Y coordinate position (in meters)
//  zPos ..............  Z coordinate position (in meters)
//  radius ............  The radius of the sphere where the
                          battle ship is located (in meters)
//  distance ..........  The distance from the start position
                          (in meters)
```

- The above comments are unmaintainable

Key Points for Effective Comments (2)

- Comment the code intent, not implementation details

```
// Scan char by char to find the command-word terminator ($)
done = false;
maxLen = inputString.Length;
i = 0;
while (!done && (i < maxLen))
{
  if (inputString[i] == '$')
  {
    done = true;
  }
  else
  {
    i++;
  }
}
```

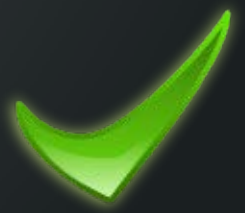


Key Points for Effective Comments (3)

- Focus your documentation efforts on the code

```
// Find the command-word terminator
foundTheTerminator = false;
maxCommandLength = inputString.Length();
testCharPosition = 0;
while (!foundTheTerminator &&
    (testCharPosition < maxCommandLength))
{
  if (inputString[testCharPosition] == COMMAND_WORD_TERMINATOR)
  {
    foundTheTerminator = true;
    terminatorPosition = testCharPosition;
  }
  else
  {
    testCharPosition = testCharPosition + 1;
  }
}
```

Better code → less comments



Key Points for Effective Comments (4)

- Focus paragraph comments on the why rather than the how

```
// Establish a new account
if (accountType == AccountType.NewAccount)
{
    …
}
```

- Use comments to prepare the reader for what is to follow
- Avoid abbreviations

Guidelines for Effective Comments (5)

- Comment anything that gets around an error or an undocumented feature
  - E.g. `// This is workaround for bug #3712`
- Justify violations of good programming style
- Don't comment tricky code – rewrite it
- Use built-in features for commenting
  - XML comments in C#
  - JavaDoc in Java, …

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General Guidelines for Higher Level Documentation

- Describe the design approach to the class
- Describe limitations, usage assumptions, and so on
- Comment the class interface (public methods / properties / events / constructors)
- Don't document implementation details in the class interface
- Describe the purpose and contents of each file
- Give the file a name related to its contents

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C# XML Documentation Comments

C# XML Documentation

- In C# you can document the code by XML tags in special comments
  - Directly in the source code
- For example:

```
/// <summary>
/// This class performs an important function.
/// </summary>
public class MyClass { }
```

- The XML doc comments are not metadata
  - Not included in the compiled assembly and not accessible through reflection

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XML Documentation Tags

- <summary>
  - A summary of the class / method / object
- <param>

```
<param name="name">description</param>
```

  - Describes one of the parameters for a method
- <returns>
  - A description of the returned value
- <remarks>
  - Additional information (remarks)

<seealso cref="TestClass.Main"/>
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XML Documentation Tags (2)

- <c> and <code>
  - Gives you a way to indicate code
- <see> and <seealso> and cref
  - Code reference

```
<seealso cref="TestClass.Main"/>
```

- <exception>

```
<exception cref="type">description</exception>
```

  - Lets you specify which exceptions can be thrown
- All tags: http://msdn.microsoft.com/en-us/library/5ast78ax.aspx

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XML Documentation Example

```
/// <summary>
/// The GetZero method. Always returns zero.
/// </summary>
/// <example>
/// This sample shows how to call the <see cref="GetZero"/> method.
/// <code>
/// class TestClass
/// {
///     static int Main()
///     {
///         return GetZero();
///     }
/// }
/// </code>
/// </example>
public static int GetZero()
{
    return 0;
}
```

C# XML Documentation

- Visual Studio will use the XML documentation for autocomplete
  - Automatically, just use XML docs
- Compiling the XML documentation:
  - Compile with /doc the to extract the XML doc into an external XML file
  - Use Sandcastle or other tool to generate CHM / PDF / HTML / other MSDN-style documentation
    - Example: http://www.ewoodruff.us/shfbdocs/

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Demo: C# XML Documentation Comments

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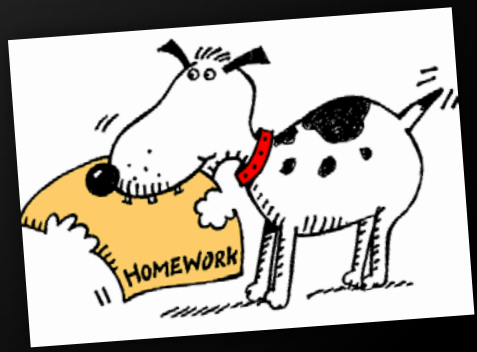
Homework

1. Open project located in 4. Code Documentation and Comments Homework.zip and:
   - Add comments where necessary
   - For each public member add documentation as C# XML Documentation Comments
   - * Play with Sandcastle / other tools and try to generate CHM book



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