BEST CODING PRACTICES FOR OOP IN C#

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MYTH VS REALITY

What people think programming means

Programmers
spend their time writing code

What programming actually means

Programmers
- Write code
- **Read code**
- Delete code

CLEAN CODE

Why should we use it and why don't we use it enough?

WHAT IS CLEAN CODE ?

„Any fool can write code
that a computer can understand.

Good programmers write code
that humans can understand”

(Martin Fowler)

CLEAN CODE – WHY?

The way a software developer writes code
is his business card.

RESOURCES

1. Clean Code - A Handbook of Agile Software Craftsmanship (Robert C. Martin)
2. Code Complete: A Practical Handbook of Software Construction (Steve McConnell)
3. The Pragmatic Programmer (Andrew Hunt, David Thomas)
4. https://app.pluralsight.com/library/courses/writing-clean-code-humans/
5. Start projects - https://github.com/nadiacomanici/git-PeakIT-002-CleanCode

WHY IT'S IMPORTANT TO WRITE CLEAN CODE?

- Code is easier to read and understand
  - By you
  - By others
  - After months or years

- Code is easier to change
  - Less possible bugs from misunderstanding code
  - Easier maintainance

- Easier to integrate new team members

WHY DON'T WE WRITE CLEAN CODE?

BEGINNER,
NOT ENOUGH EXPERIENCE,

HURRY,
DEADLINES,
PRESSURE

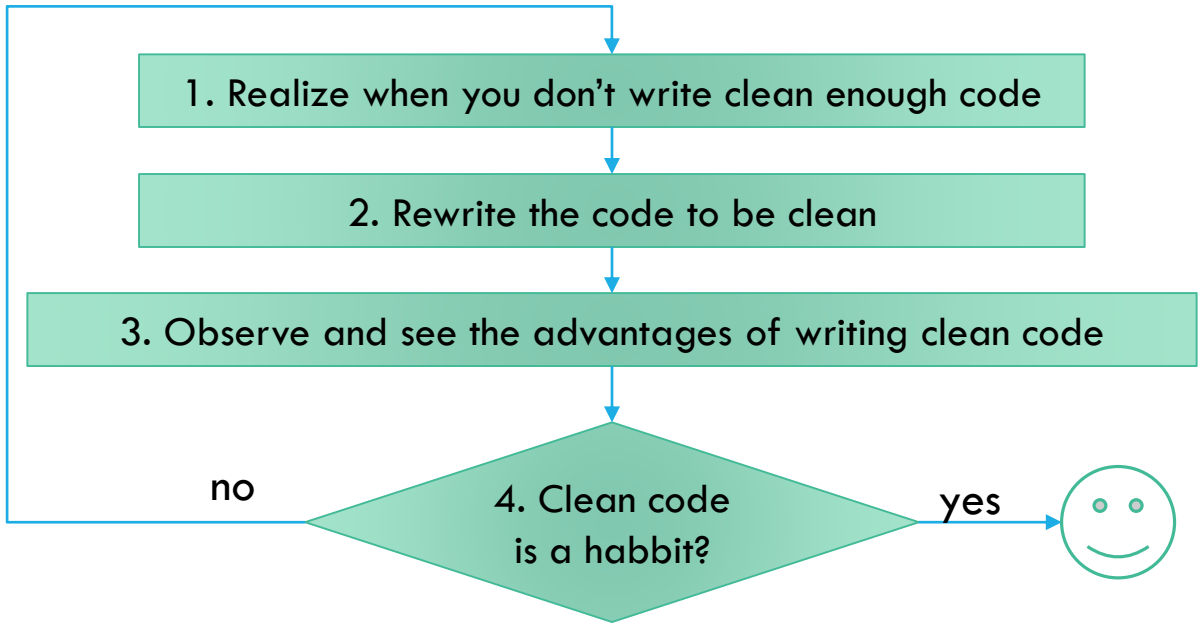
TEST CODE,
FREQUENT CHANGES
NO LONG-TERM VISION

LAZYNESS,
INDIFERENCE,
UNPROFESSIONALISM

LATER = NEVER

HOW DO WE LEARN TO WRITE CLEAN CODE?

It's not enough to know how clean code looks like: It's like tasting food – we can say if it's good or not, but that doesn't mean we know how to prepare it to be good.



CODE IMPROVEMENT TECHNIQUES

- ✓ Read code and compare clean code with dirty code
- ✓ Verbalize code
- ✓ Code Review
- ✓ Pair Programming
- ✓ Feedback
- ✓ Try to unit test it

SELF DOCUMENTING CODE

- Ideally, code should be written as a book and should be easily read as a book
  - Should easily answer „What did the author want to say here?" = INTENT

- Well written code is self documented code
  - Express intent clear
  - Abstractization = shows only the important aspects and hides/ignores unnecesairy details
  - Good formatting for readability
  - Favour good code over comments

CODING STANDARDS

CODING STANDARDS

- A coding standard is a set of recommendations about how to write code and what are the naming and organizing conventions of code.

- Each programming language has its own coding standard, usually recommended by the authors of the language
  - Microsoft recommendations: https://msdn.microsoft.com/en-us/library/ff926074.aspx

- Coding standards can change in time and depend on the language
  - Hungarian notation is obsolete

CODING STANDARDS FOR TEAMS

Each team should adopt a standard that best fits their needs and is appropriate to the programming language they use

Why?

- ✓ Better code quality
- ✓ Faster development and maintainance
- ✓ Easier and faster integration for new team members
- ✓ Easier to work on someone else's piece of code
- ✓ Same writing style for the entire team – proof of professionalism
  - Tools: ReSharper, FxCop, Sonar etc.

CAMEL CASE

- C# uses Camel Case for naming variables, methods, classes etc. and Microsoft recommends the same coding standards for developers that use C#
- Camel Case means that every different word in a name should start with the first letter capitalized. This makes reading easier for the brain, because the words are easier to identify and separate inside the long sequence of letters

Casing type	Upper Camel Case	Lower Camel Case
Used for naming	- Classes, Interfaces, Structs - Methods - Properties - Public Fields	- Private/protected fields - Local variables

Examples	`public void GetStudentById(int id)`
	`public class Student`
	`public string FirstName {get; private set;}`
		`private List<Student> students;`
		`string nextIndex;`

COMMENTS

COMMENTS

Comments should optimize reading and understanding code, but should not compensate for bad code.

WHEN TO USE COMMENTS

- They have to be useful and written only when they are needed because the code itself is not enough to understand
- Up to date and reflecting what the code does
- Brief and explicative
- Clear, not misleading
- Visual Studio – Task List (todo, hack, undone)

WHEN NOT TO USE COMMENTS

- Comments should not compensate for bad code. You should just rewrite that code
- Redundant – not DRY
- Zombie code
- Too much text that can be easily understood from code

WHERE TO PLACE COMMENTS?

- Always before the code block
- Indented at the same level as the code
- Space after // or /*

Good

```
// list must contain exactly 3 elements
bool isValid = (cases.size() == 3);
```

Evil

```
bool isValid = (cases.size() == 3);//list must contain 3 elements
```

COMMENTS – ENCAPSULATION

- Easier to read and understand
- Each class should be responsable for it's own internal logic
- Encapsulation - Don't expose more then needed

Evil

```
// checks if the employee is eligible to get extra vacation days
if ((employee.Flags == WorkSchedule.FullTime) && employee.YearsOfExperience > 10)
```

Good

```
if (employee.IsEligibleForExtraVacationDays)
```

COMMENTS – USELESS

- Funny or apology, but useless
  - Don't answer „what did the author want to say?"

Evil

```
// if you made it this far without having a nervous breakdown
// congratulations! Go get yourself a beer!

// Magic. Do not touch

// When I wrote this, only God and I understood what I was doing.
// Now, only God knows

// Bug #1234

// Sorry, this crashes and I don't know why

// Here starts the hack - See John
```

COMMENTS – REDUNDANT

- Comments that state the same as the line of code itself
- Methods that have good names, don't need description that is actually the same as the method name (DRY)

Evil

```
// returns true
return true;

/// <summary>
/// Counts the females
/// </summary>
/// <returns></returns>
public int CountFemales()
```

COMMENTS – MISLEADING

- Compensates bad code
- Does not reflect reality

Evil

```
public int GetRandomNumber()
{
   // chosen by rolling die
   return 4;
}
```

COMMENTS – ZOMBIE CODE

- Unused code should not be commented – but removed
- You have the code under source control
- Makes reading more difficult and distracts attention from the active code
  - Clutters reading code with “noise code”
  - Search results might return zombie code as well
- Creates ambiguity – was the code commented by mistake?

COMMENTS – USEFUL

Good

```
string searchString = "test";
foreach (Patient patient in this.patient)
{
   // the same string
   if (patient.Name.CompareTo(searchString) == 0)
   {
      return patient;
   }
}
```

Good

```
// Pattern explanation:
//  - "^(?:[\w]\:|\\)" -- Begin with x:\ or \\
//  - "[a-z_\-\s0-9\.]" -- valid characters are a-z| 0-9|-|.|_
//  - "(txt|gif|pdf|doc|docx|xls|xlsx)" -- Valid extension
// Matches:
//  \\192.168.0.1\folder\file.pdf
//  c:\my folder\abc abc.docx
// Non-Matches:
//  \\192.168.0.1\folder\\file.pdf
//  c:\my folder\another_folder\ab*c.v2.docx
//  file.xls
string filePattern = @"^(?:[\w]\:|\\)(\\[a-z_\-\s0-
9\.]+)+\.(txt|gif|pdf|doc|docx|xls|xlsx)$";
```

BRACES - BLOCKS OF CODE

- The blocks of code in C# are marked with curly braces { and }
- The braces should be each on a separate line, without any other command/comment
- The braces should be specified even if there is only 1 instruction in that code block

Evil

```
public Student GetStudentById(int id) {
    return students.SingleOrDefault(s => s.Id == id);
}
```

```
if (x > 0)
    Console.WriteLine("Positive");
else Console.WriteLine("Negative or zero");
```

Good

```
public Student GetStudentById(int id)
{
    return students.SingleOrDefault(s => s.Id == id);
}
```

```
if (x > 0)
{
    Console.WriteLine("Positive");
}
else
{
    Console.WriteLine("Negative or zero");
}
```

BRACES - CONDITIONS

- Specify the condition between round paranthesis ()

Evil

```
if x > 0
{
    Console.WriteLine("Positive");
}
```

Good

```
if (x > 0)
{
    Console.WriteLine("Positive");
}
```

GOOD NAMES

The names you give to classes, variables, methods etc. are essential for understanding code. Even if it takes some time to „baptize” properly a variable, this will eventually save time in the future because it will be easier to understand what the variable is/does, just by taking a glance at it.

Let’s suppose you get a pet. What name would you give him?

- Dog1
- myDog
- d

Each name should represent what the variable/method/class does.

MEANINGFUL NAMES

Give good names instead of using comments to compensate for the bad code

Evil

```
// elapsed time in days
int d;
```

Good

```
int daysSinceModification;
int fileAgeInDays;
```

MEANINGFUL NAMES - DEMO

Give good names to understand easier the code

Evil

```
public double Compute(List<int> a)
{
    double x = 0;
    int y = 0;
    foreach (int nr in a)
    {
        x += nr;
        y++;
    }
    if (y == 0)
    {
        return 0;
    }
    else
    {
        return x / y;
    }
}
```

Good

```
public double ComputeAverage(List<int> numbers)
{
    double sum = 0;
    int howManyNumbers = 0;

    foreach (int number in numbers)
    {
        sum += number;
        howManyNumbers++;
    }

    if (howManyNumbers == 0)
    {
        return 0;
    }
    else
    {
        return sum / howManyNumbers;
    }
}
```

Good

```
public double ComputeAverage(List<int> numbers)
{
    return numbers.Count == 0 ? 0 : numbers.Average();
}
```

BAD NAMES

- If the objects represent different things, then their names should reflect the difference
  - Don't add prefixes like: the, my, a
  - Don't add numeric suffixes

Evil

```
string theString;
string myString;
string aString;

string string1;
string string2;
string string3;
```

- Avoid too general names or prefixes

Evil

Utility
Common
...Manager
...Processor
...Info
...Data

BAD NAMES – REDUNDANCIES

- Avoid redundant prefixes/suffixes

Evil

```
string stringName;
decimal moneyAmount;
```

Good

```
string name;
decimal money;
```

GOOD NAMES – PREFIXES & SUFFIXES

- Avoid prefixes/suffixes that don't help you make clear differences

Evil

```
class StudentInfo
class StudentData
```

Good

```
class StudentMedicalData
class StudentSchoolData
```

Evil

```
List<Account> theList
List<Account> aList
```

Good

```
List<Account> usedAccounts
List<Account> newAccounts
```

GOOD NAMES - SYMMETRY

- Use symmetrical naming for opposing states or prefixes

Evil
on/disable
quick/slow
lock/open
slow/max

Good
on/off enable/disable
fast/slow
lock/unlock close/open
min/max

GOOD NAMES

- Avoid very similar names: itemInList/itemsInList
- Don't use lower „L" and „O" for naming variables
- Be consistent when giving names (use GetList all the times, not GetList sometimes and other times RetrieveList)
- Don't be a cheapskate with names – give variable names longer than a letter, because each variable has a significance
- You can use „i" and „j" for iterating through a list, but it the iterator spreads over a few tens of lines, maybe it would be better to rename the „i" and „j" so that you don't have to scroll back and see what each does.

VERBALIZING CODE

- Avoid names that cannot be pronounced.
- Avoid abbreviations
- It will be very difficult to explain to someone else what it does

Evil

```
class DtaRcrd102
{
   private DateTime genymdhms;
   private DateTime modymdhms;
   private String pszqint = "102";
}
```

Good

```
class Customer
{
  private DateTime generationTimestamp;
  private DateTime modificationTimestamp;
  private String recordId = "102";
}
```

GOOD NAMES IN C#

- Avoid names that have underscore separators between the words
- Exception: the event handlers, that are generated automatically have *controlName_eventName*

Evil

```
int next_Index;
void get_student_by_id(int id)
```

Good

```
int nextIndex;
void GetStudentById(int id)

void btnSave_Click(object sender, RoutedEventArgs e)
```

CLASSES

WHAT IS A CLASS?

- A class is the pattern (template) that defines a type of objects and an instance (object) is one element created using that pattern (template)
- A class contains:
  - State = fields/properties = nouns
  - Behaviour = methods = verbs

CLASSES VS OBJECTS

A class

- The gingerbread cutter is the pattern for a gingerbread man.
- It defines the common elements for all gingerbread men:
  - 1 head, 1 mouth, 2 eyes
  - 2 hands, 2 feet, 2 buttons
- But you can't eat it

Objects (instances) of a class

- Each gingerbread man is created using that cutter and all gingerbread men have the same elements defined by the pattern:
  - 1 head, 1 mouth, 2 eyes
  - 2 hands, 2 feet, 2 buttons
- They can have some different properties
  - Coloring
  - Taste

CLASS NAMES

- NOUNS at Singular
- As specific as possible
- Upper Camel Case
- Same for structs

Evil

```
class Students
class student
class ReadStudents
```

Good

```
class Student
class StudentsFileReader
```

EXTRACTING CLASSES FROM TEXT - EXAMPLE

- A university has two types of persons: students and teachers.
- Each person has a first name, a last name and a birthdate.
- Each student has an identifier and some marks
- The application should display for each student the average of the marks, it he has a scholarship, if he is legally an adult and if he can vote.
- The application should allow to sort the students by last name or average mark
- In a similar manner, each teacher has a scientific title and can publish research papers

IDENTIFYING **STATE** AND BEHAVIOUR

- A **university** has two types of **persons: students** and **teachers.**
- Each **person** has a **first name,** a **last name** and a **birthdate.**
- Each **student** has an **identifier** and some **marks**
- The **application** should display for each **student** the **average** of the **marks,** it he has a scholarship, if he is legally an adult and if he can vote.
- The **application** should allow to sort the **students** by **last name** or **average mark**
- In a similar manner, each **teacher** has a **scientific title** and can publish **research papers**

CLASSES AFTER ANALYSIS

University

Students

Teachers

*AddStudent()

*AddTeacher()

Person

- **FirstName**
- **LastName**
- **BirthDate**
- ***Age**

Application

- DisplayStudents()
- SortStudentsByLastName()
- SortStudentsByAverageMark()

Student is a Person

- **Id**
- **Marks**
- **AverageMark**
- *HasScolarship*
- *IsLegallyAdult*
- *CanVote*
- ***FirstName**
- ***LastName**
- ***BirthDate**

Teacher is a Person

- **ScientificTitle**
- **ResearchPapers**
- ***FirstName**
- ***LastName**
- ***BirthDate**

ENTITIES AND FILES

- Each class/struct/interface/enum should be in a separate file
- The file should have the same name as the class/struct/interface/enum
- The namespace should match the containing folder and should be updated if you move a file from a folder to another

INTERFACE NAMES

- NOUNS at Singular, prefixed with „I”
- As specific as possible
- Upper Camel Case

Evil

```
interface Students
interface iReadStudents
interface iStudent
```

Good

```
interface IStudent
interface IStudentsFileReader
```

METHODS

METHOD NAMES

- Have to contain VERBS
- Each method should do one thing and one thing only
- Method names should reflect what the method does
- Method names should be descriptive, so that whoever looks at the name, understands what the method does without having to look at the implementation
- Ask yourself (or a colleague or a rubber duck)
  - What does this method do?
  - Does it do a single thing?
    - Watch out for words like: AND, OR, IF
    - If it does more, then you should split it
  - Is it in the right place?

METHOD – SHOULD I SPLIT IT?

1. Does it fit on your screen?
   - Small methods that can be reused
   - Ideally not over 20 lines. Never over 100 lines
   - Simpler functions can be longer. Complex functions should be shorter
2. Do you use comments or white spaces to separate code inside a method?
   - You should split the code into smaller methods
3. Is this method or part of it similar to another method?
   - Avoid Duplication - Don't reinvent the wheel, just reuse it
4. Does it have a lot of indentation?
   - Cyclomatic complexity = there are many distinct paths through a method
   - Difficult to read and test, more possible bugs

METHOD PARAMETERS

- Minimize parameters
  - 0-2 parameters – Rule of 7
  - Group them in a struct/class

Evil

```
private void SendEmail(string username, string password, string email, string message)
{
    // send email
}
```

Good

```
private void SendEmail(User user, string message)
{
    // send email
}
```

METHODS – DO THEY DO TOO MUCH?

- Avoid flag arguments
  - Method does more than one thing

Evil

```
private void SaveUser(User user, bool sendEmail)
{
    // save user

    if (sendEmail)
    {
        // send email
    }
}
```

Good

```
private void SaveUser(User user)
{
    // save user
}

private void SendEmail(User user)
{
    // send email
}
```

STRATEGIES FOR METHODS - DEMO

- Return early
  - If you know that certain conditions are not valid, return as fast as possible

- Fail fast – Guard clauses
  - Guard clauses – conditions at the begining of the method that assure you have all needed data before continuing
  - Guards reduce complexity and indentation
  - Guards state from the begining of the code the conditions that have to be met for the data to be valid

- Variables should have minimum lifespan
  - Declare variables only when they are needed, not from the begining of the method

STRATEGIES FOR METHODS

Evil

```
private void btnAddNumbers_Click(object sender, RoutedEventArgs e)
{
    try
    {
        int firstNumber;
        int secondNumber;
        int sum;

        if (string.IsNullOrEmpty(txtFirstNumber.Text) == false)
        {
            firstNumber = int.Parse(txtFirstNumber.Text);
            if (string.IsNullOrEmpty(txtSecondNumber.Text) == false)
            {
                secondNumber = int.Parse(txtSecondNumber.Text);
                sum = firstNumber + secondNumber;
                textBlockSum.Text = sum.ToString();
            }
            else
            {
                throw new Exception("You must specify a value for the input numbers");
            }
        }
        else
        {
            throw new Exception("You must specify a value for the input numbers");
        }
    }
    catch (Exception ex)
    {
        MessageBox.Show(ex.Message, "An error has occured", MessageBoxButton.OK, MessageBoxImage.Error);
    }
}
```

Good

```
private bool AreInputFieldsMissing()
{
    return (string.IsNullOrEmpty(txtFirstNumber.Text) == false
        || string.IsNullOrEmpty(txtSecondNumber.Text) == false);
}

private int ComputeSum()
{
    int firstNumber = int.Parse(txtFirstNumber.Text);
    int secondNumber = int.Parse(txtSecondNumber.Text);
    return firstNumber + secondNumber;
}

private void btnAddNumbers_Click(object sender, RoutedEventArgs e)
{
    try
    {
        if (AreInputFieldsMissing())
        {
            throw new Exception("You must specify a value for the input numbers");
        }

        var sum = ComputeSum();
        textBlockSum.Text = sum.ToString();
    }
    catch (Exception ex)
    {
        MessageBox.Show(ex.Message, "An error has occured", MessageBoxButton.OK,
MessageBoxImage.Error);
    }
}
```

AVOID CODE DUPLICATION - DEMO

- DRY Principle = Don't repeat yourself
- Avoid code duplication
  - Whenever you are tempted to copy-paste code, think if it would not be better to extract a method and use it in multiple places
  - See the common pattern for similar code and extract a method with different parameters for the differences
- Disadvantages of duplication:
  - More code to maintain
  - If you forget to change in all places -> Inconsistencies -> Bugs

CODE DUPLICATION

Evil

```
public int CountFemales()
{
    int count = 0;
    foreach (var person in this.persons)
    {
        if (person.Gender == Gender.Female)
        {
            count++;
        }
    }
    return count;
}

public int CountMales()
{
    int count = 0;
    foreach (var person in this.persons)
    {
        if (person.Gender == Gender.Male)
        {
            count++;
        }
    }
    return count;
}
```

Good

```
private int CountByGender(Gender gender)
{
    int count = 0;
    foreach (var person in this.persons)
    {
        if (person.Gender == gender)
        {
            count++;
        }
    }
    return count;
}

public int CountFemales()
{
    return CountByGender(Gender.Female);
}

public int CountMales()
{
    return CountByGender(Gender.Male);
}
```

Better

```
private int CountByGender(Gender gender)
{
    return persons.Count(p => p.Gender == gender);
}

public int CountFemales()
{
    return CountByGender(Gender.Female);
}

public int CountMales()
{
    return CountByGender(Gender.Male);
}
```

FIELD NAMES

- Fields represent any type of variables inside a class
- You should make the fields private or protected and make a getter/setter for it if it needs to be visible from outside the class
- According to the access modifier, the casing should be:
  - public/internal → UpperCamelCase
  - private/protected → lowerCamelCase

Evil

```
public class StudentList
{
    private List<Student> l;
    private int _next_Id;
}
```

Good

```
public class RegistrationBook
{
   private int nextId;
   private List<Person> persons;
}

public class Person
{
   private int id;
}
```

STATIC FIELDS

- The static fields belong to the class, not to the instances
  - Static fields are shared between all instances of a class
- You don't need an instance to access a static field
- If you want to use them from outside the class, you should prefix the static field name with the class name

Good

```
public class Person
{
    public static int MinimumAgeForVoting = 18;

    //....
}

Console.WriteLine(Person.MinimumAgeForVoting);
```

CONSTANT FIELDS

- A constant is a variable that has a known value at compile time and doesn't change its value during runtime.
- The constant fields belong to the class, not to the instances
  - constant fields are shared between all instances of a class
  - there is no need to use the "static" keyword when defining them
- Constants are used similar to static fields, by prefixing with the class name

Good

```
public class Person
{
    public const int MinimumAgeForId = 14;

    //....
}

Console.WriteLine(Person.MinimumAgeForId);
```

READONLY FIELDS

- A readonly field is a variable that doesn't have a known value at compile time. The value is set at runtime and doesn't change its value during the lifetime of the application.
  - You should assign it when you define it or in the constructor
- The readonly fields belong to the instances, not to the class
  - You need a instance to access it and can have different values for each instance

Good

```
public class Person
{
    public readonly int MinimumAgeForRetirement;
    // ...
    private Gender gender;

    public Person(string firstName, string lastName, Gender gender)
    {
        this.MinimumAgeForRetirement = (gender == Gender.Male) ? 65 : 63;
    }
}
```

PROPERTY NAMES

- A property is a member that allows:
  - accessing/modifying a field
  - or computing a value
- A property must have at least a get or a set, each with different access modifiers
- Properties are called similar to fields (without parenthesis, like methods)

Good

```
public class Person
{
    public int Id
    {
        get
        {
            return this.id;
        }
    }

    public string FirstName { get; private set; }
    public string LastName { get; private set; }

    public string FullName
    {
        get
        {
            return $"{FirstName} {LastName}";
        }
    }
}
```

PROPERTY/FIELDS VISIBILITY

- When creating a field, make it private.
- When you create a property, make
  - The setter private
  - The getter internal
- Change them to something more visible only when needed

Evil

```
public class Student
{
    public string FirstName {get; set;}
}
```

Good

```
public class Student
{
    public string FirstName {get; private set;}
}
```

BOOLEAN METHOD/PROPERTY NAMES

- Should sound like it is asking a true/false question
- Use “Is/Are/Can/Has” for a property that returns a boolean value

Evil

```
bool valid
bool start
bool open
public bool Voted
public bool GetIdCardValid()
public bool Adult
```

Good

```
bool isValid
bool hasStarted
bool isOpen
public bool CanVote
public bool HasIdCard()
public bool IsLegallyAdult
```

COMPARE BOOLEAN

- Assign and compare implicitly

Evil

```
if (age > retirementAge)
{
    isRetired = true;
}
else
{
    isRetired = false;
}
```

Good

```
bool isRetired = (age > retirementAge);
```

- Fewer lines
- More human readable
- Less duplication
- No need to initialize before condition

Evil

```
if (isRetired == true)
```

Good

```
if (isRetired)
```

USE POSITIVE CONDITIONALS

- It is difficult to understand double negation

Evil

```
if (!isNotValid)
```

Good

```
if (isValid)
```

TERNARY OPERATOR

- Avoid using multiple ternaries in the same condition, it will be difficult to understand

Evil

```
if (gender == Gender.Female)
{
    retirementAge = 61;
}
else
{
    retirementAge = 65;
}
```

Good

```
int retirementAge = (gender == Gender.Female) ? 61 : 65;
```

- Fewer lines
- More human readable
- Less duplication
- No need to initialize before condition

USE ENUMS INSTEAD OF STRINGS/MAGIC NUMBERS - DEMO

Evil

```
public void LogUser(User user)
{
    if (user.Role == "manager")
    {
        GiveAdminRights();
    }
    else
    {
        if (user.Role == "employee")
        {
            GiveEditRights();
        }
        else
        {
            GiveReadOnlyRights();
        }
    }
}
```

Good

```
public enum UserRoles
{
    Manager,
    Employee
}

public void LogUser(User user)
{
    if (user.Role == UserRoles.Manager)
    {
        GiveAdminRights();
    }
    else
    {
        if (user.Role == UserRoles.Employee)
        {
            GiveEditRights();
        }
        else
        {
            GiveReadOnlyRights();
        }
    }
}
```

Good

```
public enum Roles
{
    Manager,
    Employee
}

public void LogUser(User user)
{
    switch (user.Role)
    {
        case UserRoles.Manager:
            GiveAdminRights();
            break;
        case UserRoles.Employee:
            GiveEditRights();
            break;
        default:
            GiveReadOnlyRights();
            break;
    }
}
```

COMPLEX CONDITIONS & ENUMS - DEMO

- Use enums instead of magic numbers
- Simplify the understanding of complex conditions by

1. Intermediate variables
2. Encapsulate in function

Evil

```
public void PlayVideo(string fileName)
{
    string fileExtension = Path.GetExtension(fileName);

    if ((fileExtension == ".mp4" || fileExtension == ".avi")
        && (CurrentState != 2 || CurrentState == 3))
    {
        LoadVideo(fileName);
        Play();
    }
}
```

Good

```
private bool IsExtensionValid(string fileName)
{
    string fileExtension = Path.GetExtension(fileName);
    return (fileExtension == ".mp4" || fileExtension == ".avi");
}

private bool CanPlayNewVideo()
{
    return (CurrentState != PlayerStates.Playing || CurrentState == PlayerStates.Paused);
}

public void PlayVideo(string fileName)
{
    if (IsExtensionValid(fileName) && CanPlayNewVideo())
    {
        LoadVideo(fileName);
        Play();
    }
}
```

POLYMORFISM OVER ENUMS

Evil

```
public enum AttendanceTypes
{
    Daily,
    Weekend,
    Evening
}

public class Student
{
    public AttendanceTypes AttendanceType { get; private set; }

    public int GetMinimumCreditPointsToPromote()
    {
        int minCreditPoints = 0;
        switch (this.AttendanceType)
        {
            case AttendanceTypes.Daily:
                // compute and return credits for daily courses
                minCreditPoints = 100;
                break;

            case AttendanceTypes.Evening:
                // compute and return credits for evening courses
                minCreditPoints = 50;
                break;

            case AttendanceTypes.Weekend:
                // compute and return credits for weekend courses
                minCreditPoints = 35;
                break;
        }
        return minCreditPoints;
    }
}
```

Good

```
public class DailyStudent : Student
{
    public override int GetMinimumCreditPointsToPromote()
    {
        // compute and return credits for daily courses
        return 100;
    }
}

public class EveningStudent : Student
{
    public override int GetMinimumCreditPointsToPromote()
    {
        // compute and return credits for evening courses
        return 50;
    }
}

public class WeekendStudent : Student
{
    public override int GetMinimumCreditPointsToPromote()
    {
        // compute and return credits for weekend courses
        return 35;
    }
}

public abstract class Student
{
     public abstract int GetMinimumCreditPointsToPromote();
}
```

THE POWER OF ENUMS

- Strongly type check, typos can easily generate bugs
- You can use intellisense
- You have a finite and known list of all possible values
- If you use strings and change in one place, but not all places, you will get inconsistencies (bug)
- Switch should always have a default clause

CONSTANTS INSTEAD OF MAGIC NUMBERS

- Magic numbers are hardcoded values whose value are not obvious for someone looking the first time at the code
- They can generate bugs because:
  - Someone that doesn't know what the value represents, can change it incorrectly
  - If it is used in multiple places and the dev forgets to replace it in all the places, there will be bugs

Evil

```
return (DateTime.Now - DateOfBirth).TotalDays / 365.2425;
```

Good

```
double daysInAYear = 365.2425
return (DateTime.Now - DateOfBirth).TotalDays / daysInAYear;
```

CONSTANTS INSTEAD OF MAGIC NUMBERS

- If it is used in multiple places and the developer forgets to replace it in all the places, there will be bugs

Evil

```
public class Person
{
    public bool CanVote
    {
        get
        {
            return Age > 18;
        }
    }

    public bool IsLegallyAdult
    {
        get
        {
            return Age > 21; //18;
        }
    }
}
```

Good

```
public class Person
{
    public static int MinimumAgeForVoting = 18;

    public bool CanVote
    {
        get
        {
            return Age > MinimumAgeForVoting;
        }
    }

    public bool IsLegallyAdult
    {
        get
        {
            return Age > MinimumAgeForVoting;
        }
    }
}
```

REMOVE HARDCODED VALUES

- Instead of hardcoding values in the code, you might use values from the database or a configuration file
- This way, if something changes, you don't have to rebuild and install the application, just update the database – dynamic logic

Evil

```
if (yearsOfExperience > 20)
{
    return 28;
}
else if (yearsOfExperience > 10)
{
    return 23;
}
else
{
    return 21;
}
```

Id	MinYearsOfExperience	DaysOffPerYear
1	0	21
2	10	23
3	20	28

Good

```
GetDaysOffPerYear()
```

EXCEPTII

EXCEPTIONS BEST PRACTICES

- Exceptions have to be treated. Don't swallow / ignore exceptions
- If you cannot treat an exception at a level, let it go up in the call stack to a higher level for treatment
- Types of exceptions:
  1. Unrecoverable
     - The application cannot continue correctly
     - Null reference, file not found, access denied
  2. Recoverable
     - Can have temporary issues and if you try again, succeed. Have a limit for retrials
     - Retry connection, try different file, wait and try again
  3. Ignorable
     - Logging click

QUESTIONS

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FEEDBACK

http://bit.ly/peak-it-2019-feedback