

Coding Standard

Common programming rules.

Goals

Efficiently develop code and applications with the following qualities :

- **Robust** : runs without crash and protects the data from being lost or corrupted.
- **Secure** : protects the data from being stolen or hacked.
- **Ergonomic** : does exactly what the user needs and can be used in an productive and intuitive manner.
- **Efficient** : minimizes processing times to maximize the user productivity.
- **Maintainable** : is easy to fix and enhance by any programmer in the team.
- **Extensible** : is easy to extend with new features by reusing existing components.
- **Consistent** : looks like it has been designed and implemented by a single developer.

Specificity

This coding standard favors readability over compactness, by :

- Forbidding the use of cryptic acronyms, abbreviations, prefixes and suffixes;
- Using different letter cases for classes, class members and local variables;
- Including the class name in the attribute and variable names.

Rules

- Develop the application and its components with simple, robust and efficient code which will be easy to understand, extend and debug by any programmer in the team.
- Develop any piece of code so that it's :
 - easy to understand just by itself;
 - impossible to guess who has actually worked on it.
- Use **American English** for all the code, including comments.

```
InitializeColor();  
MoveForward();
```

- Use the **meter** as the default distance unit.
- Use the **second** as the default time unit.
- Use **four spaces** instead of tabulations, to make the code independent of the editor settings.
- Choose **short meaningful identifiers** for class, attribute, method, constant and variable names, to prevent ambiguity and cognitive load.
- Use **standard prefixes** :

- First, Last, Post
- Prior, Next
- Sub, Super, Base
- Initial, Final
- Old, New
- Backward, Forward
- Left, Right
- Back, Front
- Bottom, Top
- Minimum, Maximum
- Lower, Higher, Upper
- Horizontal, Vertical
- Local, Global
- Use **standard suffixes** :
 - Index, Count
 - Array, List, Map, Dictionary
- Use **standard verbs** :
 - Initialize, Update, Finalize
 - Create, Release, Destroy
 - Build, Apply
 - Clear, Fill
 - Reset, Set, Get, Find
 - Is, Has
 - Add, Remove
 - AddFirst, RemoveFirst
 - AddLast, RemoveLast
 - Start, Stop
 - Begin, End
 - Enter, Exit
 - Open, Close
 - Read, Write
 - Load, Save
 - Pause, Resume
 - Lock, Unlock
 - Attach, Detach
 - Enable, Disable
 - Select, Deselect
 - Activate, Deactivate
 - Increment, Decrement
 - Increase, Decrease
 - Compress, Decompress
 - Connect, Disconnect
 - Send, Receive
 - Grant, Revoke
- Name your **types** (classes, structures, enumerations, etc) in **UPPER_CASE**, without articles.

```

class TANK_SHELL
{
    VECTOR_3
        PositionVector;
    QUATERNION
        RotationQuaternion;

    ...
}

```

- Name your **type members** (methods, attributes, constants, etc) in **PascalCase**, without articles.

```

ShootShell(
    Muzzle.PositionVector,
    Muzzle.RotationQuaternion
);

```

- Name your **local variables** and **method parameters** in **snake_case**, without articles.

```

void ShootShell(
    VECTOR_3 shell_position_vector,
    QUATERNION shell_rotation_quaternion
)
{
    TANK_SHELL
        shot_tank_shell;

    ...

    shot_tank_shell
        = new TANK_SHELL(
            shell_position_vector,
            shell_rotation_quaternion
        );

    ...
}

```

- Don't use abbreviations or single-letter variables.

```

TANK FindTank(
    int tank_identifier,
    int first_tank_index,
    int post_tank_index
)
{
    int
        tank_index;

    for ( tank_index = first_tank_index;

```

```

        tank_index < post_tank_index;    // no i, j, n, etc
        ++tank_index )
    {
        if ( TankArray[ tank_index ].Identifier == tank_identifier )
        {
            return TankArray[ tank_index ];
        }
    }

    return null;
}

```

- Avoid acronyms, and capitalize them in member names.

```

DATABASE_URL
    DatabaseUrl;

```

- If a variable name collides with a predefined identifier, simply add a trailing underscore.

```

CLASS
    class_;

class_ = new CLASS;

```

- Use a noun or noun phrase for classes, constants, attributes and variable names.
- Include the meaningful part of the class name in attribute and variable names.

```

Dictionary<PLAYER, string>
    ActivePlayerDictionary;
List<ENEMY>
    CloseEnemyList;
TANK[]
    EnemyTankArray;
VECTOR_3
    InitialShellPositionVector,
    TankVelocityVector;

void ShootShell(
)
{
    SHELL
        last_shot_shell,
        shot_shell;

    ...
}

```

- Start method names with a verb in the imperative mood (Set, Get, Find, ...).
- Start boolean inquiry names with a verb in the indicative mood (Is, Has, Can, ...).

- Declare the method parameters in the same order as in the method name.

```
bool FindPlayerIndexByName(  
    ref int player_index,  
    string player_name  
)  
{  
    ...  
}
```

- Use a positive affirmation for boolean variable and attribute names.

```
if ( game_is_paused )  
{  
    ...  
}
```

- If an attribute name starts like its owner class name, omit the common prefix.

```
class TANK  
{  
    TANK_SHELL[]  
        ShellArray;  
    bool  
        IsDamaged;  
  
    void ShootShell(  
        TANK_SHELL tank_shell  
    )  
    {  
        ...  
    }  
}
```

- Align matching braces.

```
bool CanShoot(  
    )  
{  
    return ShotShellCount < MaximumShellCount;  
}  
  
// ~~~~  
  
void ShootShell(  
    VECTOR_3 initial_velocity_vector  
    )  
{  
    ...  
}
```

- Use braces for single statement blocks.

```
if ( LoadedAmmunitionCount > 0 )
{
    ShootBullet();
}
else if ( CarriedAmmunitionCount > 0 )
{
    ReloadWeapon();
}
else
{
    NoAmmunitionSound.Play();
}
```

- Declare each attribute, variable and method parameter name on separate line.

```
int
    tank_count,
    tank_index;
```

- Try to declare all local variables at the start of the method, to improve the algorithm readability.
- Group local variables of the same type, and sort the declarations by ascending types (lowercase, then PascalCase, then UPPER_CASE) and variable names, so that the declaration of a variable can be located at a glance.

```
int
    shell_count,
    shell_index,
    tank_count,
    tank_index;
string
    player_name,
    target_name;
CharacterController
    character_controller;
NavMeshAgent
    navigation_mesh_agent;
TANK
    enemy_tank;
TANK[]
    enemy_tank_array;
```

- Split complex statements and expressions on several lines if they contain boolean operators or if they become too wide.
- When splitting an expression on several lines, start the next lines with an operator and align it with the start of its left operand (or else indent it by 4 spaces).

```

if ( ( tower.GetDistance(
    tower_target,
    weapon_type
)
    > tower.MaximumShootingDistance )
    || ( tank_distance > maximum distance
        && tank_health > 0.5 ) )
{
    ...
}

```

- Put the scalar or constant multiplier after the multiplicand expression.

```

average_value = ( first_value + second_value ) * 0.5f;

```

- Add exactly one space :
 - after ([,
 - before)]
 - after if while for foreach return ...
 - around operators
- Add exactly one empty line :
 - around standard comments;
 - after the local variable declarations;
 - after the method preconditions;
 - between if while for foreach do return and the prior statement;
 - between } and the next statement.
- Use standard file extensions.
 - C# : cs
 - C : c, h
 - C++ : cpp, hpp
 - Javascript : js
 - HTML : html
 - CSS : css
- Declare one class per source code file.
- Use the class name in lowercase as file name.

```

tank_shell.cpp
tank_shell.hpp

```

- Use the class name in uppercase as Unity file name.

```

TANK_SHELL.cs

```

- Group the class elements by category, declared in the same predefined order :

- Imports.
 - Types.
 - Constants.
 - Attributes.
 - Constructors.
 - Destructor.
 - Operators.
 - Inquiries : methods which don't change the class attributes.
 - Operations : methods which change the class attributes.
- Within a category, declare :
 - the called methods before the calling methods, preferably in the order they will be called, so that the class code can be immediately understood by a single sequential read.
 - the static members after the non-static members.
 - Import exactly what each file needs to be compiled independently, and nothing more.
 - Sort the imports by ascending names.
 - Delimitate the code sections with standard comments.

```
// -- IMPORTS

...

// -- TYPES

class NAME
{
    // -- CONSTANTS

    ...

    // -- ATTRIBUTES

    ...

    // -- CONSTRUCTORS

    ...

    // -- DESTRUCTOR

    ...

    // -- OPERATORS

    ...

    // -- INQUIRIES

    ...
```



```
// -- OPERATIONS

...

}
```

- Don't use standard comments for empty sections.
- Align multiple lines comments with the surrounding statements, start them with an uppercase character and end them with a period.

```
/*
    A long explanation which must be written
    on several lines.
*/

...
```

- Align single line comments with the surrounding statements, start them with an uppercase character and end them with a period.

```
// A short explanation which can be written on a single line.

...
```

- Put end of line comments exactly four spaces after the statement, and start them with lowercase character.

```
DoSomethingWeird();    // a short explanation
```

- Begin C++ header files with `#pragma once`.

```
#pragma once

// -- IMPORTS

#include "tank.hpp"
#include "tank_shell.hpp"
...
```

- Name the unit test class by simply adding a `_TEST` suffix to the class name.

Guidelines

- Whenever possible :
 - Use only public attributes and methods.
 - Don't use getters/setters.
 - Use virtual methods only where needed.

- Avoid delegates.
- Design before you program, to avoid losing precious time in developing the wrong solution to the wrong problem, by quickly writing :
 - a short text or UI flow explaining how to use the application, to optimize the application interface before implementing it;
 - a short text explaining what the application components will do, to optimize the application architecture before implementing it;
 - a short text or test code explaining how to use the application components, to optimize their external interface before implementing it.
- Develop programs gradually, one feature at a time, using simple and efficient code.
- Don't overengineer your code, choose simple modular designs which can easily be extended.
- Immediately refactor components when their modularity or reusability needs to be improved.
- Instead of adding comments to explain the code intent, refactor the code to make it easy to understand by :
 - choosing better method and parameter names;
 - using local variables to store intermediate results;
 - splitting putting the code of a lengthy method into smaller methods called in sequence.
- Make the application resilient to external conditions (network failures, missing or corrupted files, etc).
- Check invalid method parameters with assertions only in the debug build.

Version

1.0

Author

Eric Pelzer (ecstatic.coder@gmail.com).

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