04834580 Software Engineering (Honor Track) 2024-25

# Code Style & Documentation

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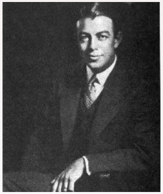
## Naming Things

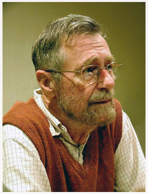
*There are only two hard things in Computer Science: cache invalidation and naming things. — Phil Karlton*

## Linguistic Determinism



According to Benjamin Lee Whorf, **thoughts** are determined by the specific grammar and **vocabulary** of the language in which ideas are expressed.

## Separation of Concerns



According to Edsger W. Dijkstra, “the separation of concerns”, even if not perfectly possible, is yet the only available technique for effective ordering of one’s **thoughts**.

## Program Abstraction as Linguistic Construct

*The function (including its name) can capture our mental chunking, or abstraction, of the problem. [1]*

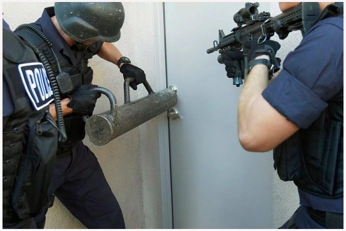
```python
def process_string_explicit(s):
    while s and s[0] == ' ':
        s = s[1:]
    while s and s[-1] == ' ':
        s = s[:-1]

    if len(s) > 2:
        start = 1
        end = len(s) - 1
        middle = s[start:end]
        middle_upcased = middle.upper()
        s = s[0] + middle_upcased + s[-1]

    return s
```

```python
def process_string_trim(s):
    s = s.strip()

    if len(s) > 2:
        start = 1
        end = len(s) - 1
        middle = s[start:end]
        middle_upcased = middle.upper()
        s = s[0] + middle_upcased + s[-1]

    return s
```

The boundaries of procedural abstraction are determined by the meaning of “strip”.

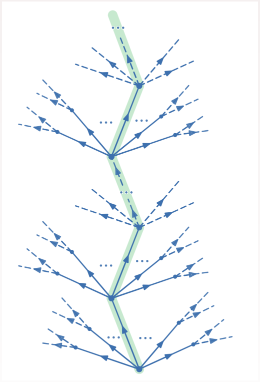
## Good Name Example: Brute Force

A general problem-solving technique that consists of systematically checking all possible candidates for whether or not each candidate satisfies the problem's statement.



## Good Name Example: Tree

**Tree** is hierarchically organized data structure, where from the **root** item the other items **branch** out into nodes and **leaves**. A collection of trees is often called a **forest**.



## Linguistic Antipatterns [2]

### Definition

Linguistic Antipatterns (LAs) in software systems are recurring poor practices in the naming, documentation, and choice of identifiers in the implementation of an entity, thus possibly impairing program understanding.

## Antipatterns: Fallacious Method Name

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### Definition

Creating conflicting methods or functions regarding their functionality and naming.

```
def getFoos() -> Foo:
    ...
    foo: Foo = ...
    return foo

def isGoo() -> str:
    ...
    return 'yes'

def setValue(self, value) -> Any:
    ...
    return new_value
```

```
def getFoos() -> list[Foo]:
    ...
    foos: list[Foo] = ...
    return foos

def isGoo() -> bool:
    ...
    return True

def setValue(self, value) -> None:
    ...
```

## Antipatterns: Binary Operator in Name

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**Definition**

Method or function names that have binary operators like AND and OR are possible violators of the single responsibility principle.

```python
def render_and_save():
    # render logic
    ...
    # save logic
    ...
```

## Other Issues with Names

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```
// "a" could mean anything
const a = 5

// "Paginatable" is a broken English
const isPaginatable = a > 10

// Hard to read
const onItmClk = () => {}

// Does not reflect expected result
const isEnabled = itemCount > 3
return <Button disabled={!isEnabled} />

// Units are unclear
int fileSize

// Redundant meta-data
String valueString
```

```
// Better
const postCount = 5

// Better
const hasPagination = postCount > 10

// Better
const onItemClick = () => {}

// Better
const isDisabled = itemCount <= 3
return <Button disabled={isDisabled} />

// Better
int fileSizeGb

// Better
String value
```

## Code Style

**Definition**

Is a set of rules or guidelines used when writing the source code for a computer program.

- Reduce the number of choices a developer has to make.
- Makes code more readable and predictable.

## Role of Indentation

```
if(x < y) {
    x= y;
    y= 0;
   } else {
    x= 0;
     y= y/2;
}
```

```
if (x < y) {
    x = y;
    y = 0;
} else {
    x = 0;
    y = y / 2;
}
```

Poorly formatted code distracts attention, takes longer to read.

## Readability: Blank Lines

```
// Eliminate whitespace from the beginning of t.
while (t.length() != 0 && isWhitespace(t.charAt(0))) {
    t= t.substring(1);
}

// If t is empty, print an error message and return.
if (t.length() == 0) {
    ...
    return false;
}

if (containsCapitals(t)) {
    ...
}
```

Use blank lines to separate logical parts of your algorithm.

## Readability: Order of Branches

```
if (condition) {
    ...
    30 lines of code
    ...
} else single-statement
```

```
if (!condition) {
    single-statement
} else {
    ...
    30 lines of code
    ...
}
```

Put the shorter of the then-part and else-part first.

## Documentation

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### Definition

Written text or illustration that accompanies computer software or is embedded in the source code.

Two main categories:

- System documentation.
- User documentation.

## Self-Documenting Code

Not descriptive:

```
List<Triple<Integer,Integer,Integer>> p = f();
```

More descriptive:

```
List<Point3D> path = findShortestPath();
```

Using good names, types and abstractions make code self-documenting.

## Tests Serve as Documentation

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```java
@Test
public void testWrapNull() {
    assertEquals("", wrapper.wrap(null, 10));
}
@Test
public void testOverTheLimitShouldWrapAtSecondWord() {
    assertEquals("word word\nword",
                 wrapper.wrap("word word word", 5));
}
@Test
public void testLongerThanLimitShouldNotWrap() {
    assertEquals("word word", wrapper.wrap("word word", 6));
}
```

## Comments as Documentation

Useless comments (antipattern):

```
/* set age to 32 */
int age = 32;
```

Useful comments:

```
function addSetEntry(set, value) {
    /* Don't return `set.add` because it's not chainable in IE 11. */
    set.add(value);
    return set;
}
```

## Documenting Methods

```
class InputStreamReader {
    int read(char[] cbuf, int offset, int len) throws IOException
    ...
}
```

Important aspects of method documentation:

- How to call the method.
- What the results are.
- What the effects are.

## Documenting Methods

```
class InputStreamReader {
    int read(char[] cbuf, int offset, int len) throws IOException
    ...
}
```

How to call the method:

Arguments cbuf is non-null, `offset` is non-negative, `len` is non-negative, `offset` + `len` is at most `cbuf.length`

Input state the receiver is open

## Documenting Methods

```
class InputStreamReader {
    int read(char[] cbuf, int offset, int len) throws IOException
    ...
}
```

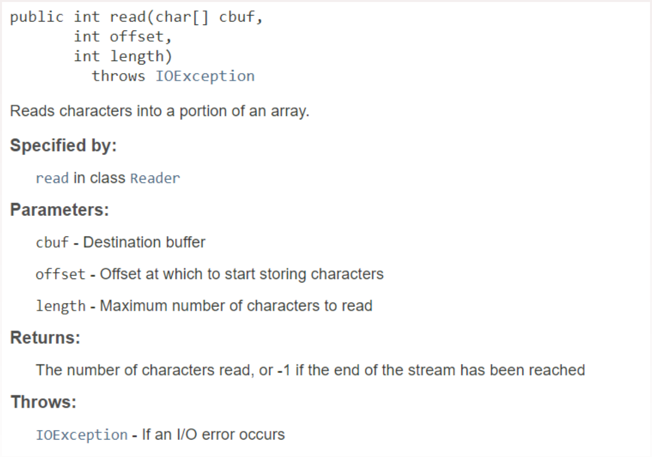
What the results are:

- The method returns -1 if the end of the stream has been reached before any characters are read.
- Otherwise, the result is between 0 and `len`, and indicates how many characters have been read from the stream.

## JavaDoc

```java
/**
 * This method reads up to <code>length</code> characters from the stream into
 * the specified array starting at index <code>offset</code> into the
 * array.
 *
 * @param buf The character array to receive the data read
 * @param offset The offset into the array to start storing characters
 * @param length The requested number of characters to read.
 *
 * @return The actual number of characters read, or -1 if end of stream.
 *
 * @exception IOException If an error occurs
 */
public int read(char[] buf, int offset, int length) throws IOException
```

## JavaDoc



```
public int read(char[] cbuf,
       int offset,
       int length)
         throws IOException
```

Reads characters into a portion of an array.

**Specified by:**

`read` in class `Reader`

**Parameters:**

`cbuf` - Destination buffer

`offset` - Offset at which to start storing characters

`length` - Maximum number of characters to read

**Returns:**

The number of characters read, or -1 if the end of the stream has been reached

**Throws:**

`IOException` - If an I/O error occurs

## JavaDoc Format

**Description:** A clear and concise textual explanation of the class, method, or field. Intended to help developers understand its purpose and usage.
**Block Tags:** Metadata annotations that provide specific details about the class or method. Common tags include:

- `@author`: Specifies the author(s) of the code.
- `@version`: Describes the version of the code.
- `@param`: Documents method parameters.
- `@return`: Explains the return value of a method.
- `@exception` (`@throws`): Details the exceptions thrown by a method.
- `@see`: Provides references to related resources (classes, methods, etc.).
- `@since`: Indicates when a specific feature was introduced.
- `@serial`: Used to document serializable fields or methods.
- `@deprecated`: Marks elements that are outdated and suggest alternatives.

## JavaDoc Best Practices

Useless JavaDoc (antipattern):

```
/**
 * Sets the tool tip text.
 *
 * @param text  the text of the tool tip
 */
public void setToolTipText(String text) {
```

Useful JavaDoc:

```
/**
 * Registers the text to display in a tool tip.   The text
 * displays when the cursor lingers over the component.
 *
 * @param text  the string to display.  If the text is null,
 *              the tool tip is turned off for this component
 */
public void setToolTipText(String text) {
```

## Ambiguous Documentation

**Definition (Ambiguity)**

The quality of being open to more than one interpretation; inexactness.

```python
def triples_sum_to_zero(l: list):
    """Takes a list of integers as an input. Returns True if there are three
distinct elements in the list that sum to zero, and False otherwise."""
    ...
```

## References I

[1] Allen Downey et al.
How to think like a computer scientist: learning with python.
2008.

[2] Venera Arnaoudova, Massimiliano Di Penta, and Giuliano Antoniol.
Linguistic antipatterns: What they are and how developers perceive them.
*Empirical Software Engineering*, 21:104–158, 2016.