# AE4B99RPH: Problem Solving and Games
# Clean code.

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# Clean Code

**Based on**
**Robert C. Martin: *Clean Code: A Handbook of Agile Software Craftsmanship*, Prentice Hall, 2008.**

## Which of the following codes is cleaner? Why?

Two implementations of the same algorithm:

```python
def generate_primes_up_to(max_value):
    """Find primes up to the max_value
    using the Sieve of Eratosthenes.

    """
    if max_value >= 2:  # There are some primes
        # Initialize the list (incl. 0)
        f = [True for i in range(max_value+1)]
        # Get rid of the known non-primes
        f[0] = f[1] = False
        # Run the sieve
        for i in range(2, len(f)):
            if f[i]:   # i is still a candidate
                # mark its multiples as not prime
                for j in range(2*i, len(f), i):
                    f[j] = False
        # Find the primes and put them in a list
        primes = [i for i in range(len(f)) if f[i]]
        return primes
    else:   # max_value < 2
        return list() # no primes, return empty list
```

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    """
    if max_value < 2:
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        mark_non_primes(candidates)
        return collect_remaining(candidates)

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    return [PRIME for i in range(max_value+1)]

def mark_non_primes(candidates):
    # Mark 0 and 1, they are not primes.
    candidates[0] = candidates[1] = NONPRIME
    for number in range(2, len(candidates)):
        if candidates[number] == PRIME:
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        candidates[multiple] = NONPRIME

def collect_remaining(candidates):
    primes = [i for i in range(len(candidates))
                    if candidates[i]==PRIME]
    return primes
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## What is "clean code"?

Bjarne Stroustrup, author of C++ language and author of "The C++ Programming Language" book:

> I like my code to be **elegant and efficient**. The logic should be **straightforward** to make it hard for bugs to hide, the **dependencies minimal** to ease maintenance, error handling complete according to an articulated strategy, and **performance close to optimal** so as not to tempt people to make the code messy with unprincipled optimizations. **Clean code does one thing well**.

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Grady Booch, author of “Object Oriented Analysis and Design with Applications” book:

> Clean code is **simple and direct**. Clean code **reads like well-written prose**. Clean code **never obscures the designer’s intent** but rather is full of **crisp abstractions** and **straightforward lines of control**.

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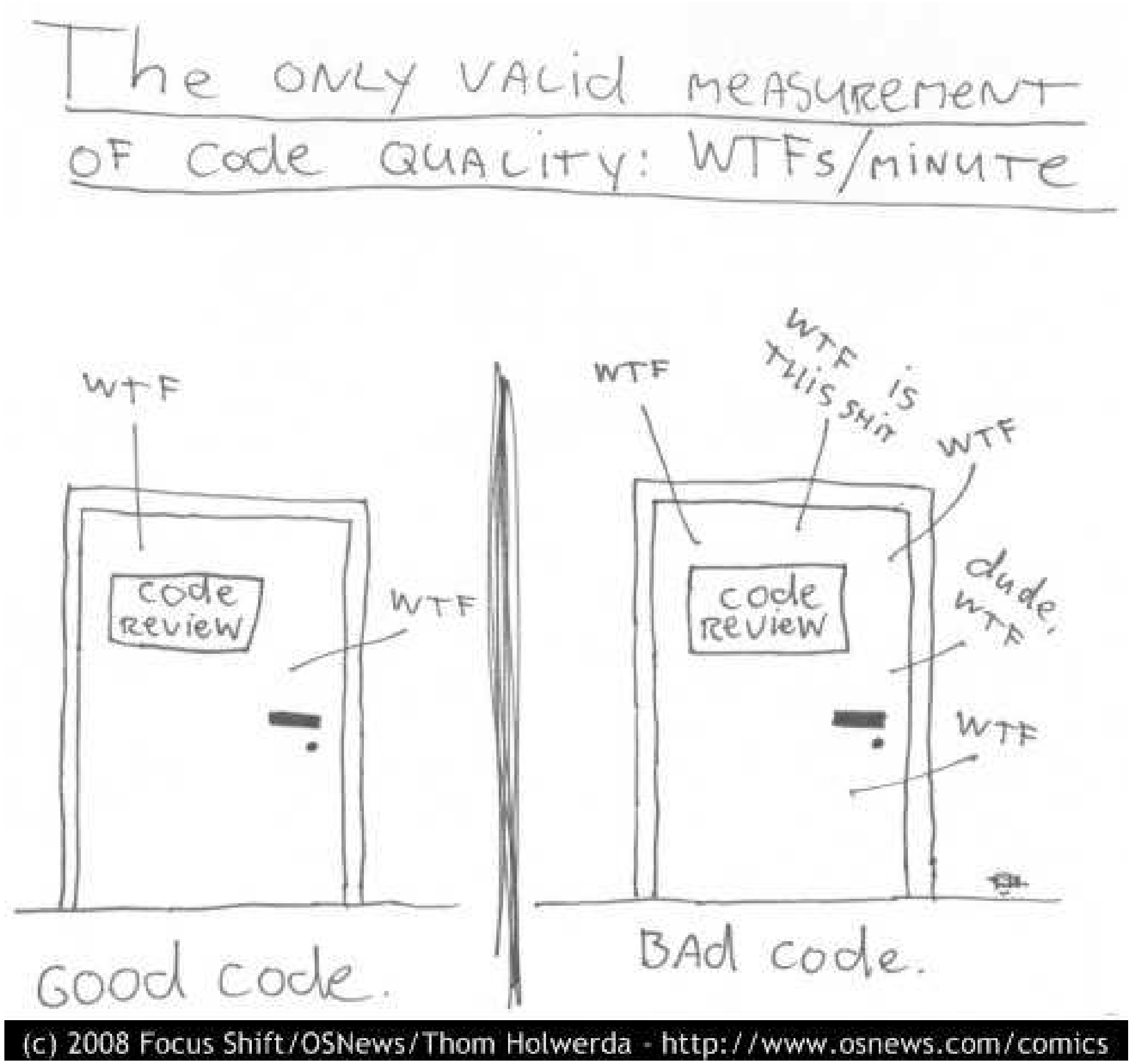
Dave Thomas, OTI founder (acquired by IBM in 1996), Eclipse godfather:

> **Clean code can be read, and enhanced by a developer other than its original author**. It has **unit and acceptance tests**. It has **meaningful names**. It provides one way rather than many ways for doing one thing. It has **minimal dependencies**, which are explicitly defined, and **provides a clear and minimal API**.

## Clean code in practice

### The only valid measurement of code quality: WTFs/minute


The only valid measurement of code quality: WTFs/minute
WTF
code review
WTF
Good code.
WTF
WTF is this shit
WTF
dude, WTF
WTF
code review
Bad code.
(c) 2008 Focus Shift/OSNews/Thom Holwerda - http://www.osnews.com/comics

# Meaningful names

- ✔ It is **very hard** to come up with meaningful names! Put sufficient effort in it.
- ✔ Do not be affraid to change the name if you come up with better!
- ✔ Good name **reveals author’s intention**.
  If a name requires a comment, it does not reveal its intention. Compare:
  - ✘ `self.d = 0   # Elapsed time in days`
  - ✘ `self.elapsed_time_in_days = 0`
- ✔ Class names: **nouns** (with adjectives):
  - ✘ `Customer`, `WikiPage`, `AddressParser`, `Filter`, `StupidFilter`, `Corpus`, `TrainingCorpus`
- ✔ Function/method names: **verbs** (with objects):
  - ✘ `post_payment`, `delete_page`, `save`, `train`, `test`, `get_email`
- ✔ Single word for single concept! Do not use the same word for more than one purpose.
- ✔ Don’t be affraid of long names!
  - ✘ Long descriptive name is better than a long comment.
  - ✘ The larger the variable scope, the longer and more describing the variable name should be.
- ✔ Do not use magic numbers in the code! Use **named constants**!

## The Sieve of Eratosthenes: meaningful names

```python
def generate_primes_up_to(max_value):
    """Find primes up to the max_value
    using the Sieve of Eratosthenes.

    """
    if max_value >= 2:  # There are some primes
        # Initialize the list (incl. 0)
        f = [True for i in range(max_value+1)]
        # Get rid of the known non-primes
        f[0] = f[1] = False
        # Run the sieve
        for i in range(2, len(f)):
            if f[i]:   # i is still a candidate
                # mark its multiples as not prime
                for j in range(2*i, len(f), i):
                    f[j] = False
        # Find the primes and put them in a list
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            if candidates[number]==PRIME:
                # mark its multiples as not prime
                for multiple in \
                range(2*number, len(candidates), number):
                    candidates[multiple] = NONPRIME
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                  if candidates[i]==PRIME]
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Other meaningful names ahead!!!

## Comments

Clean code (almost) does not need comments!

- ✔ Comments compensate for our failure to express ourselves in the programming language. Compare:

```
# Check to see if the employee is eligible for full benefits
if (employee.flags & HOURLY_FLAG) and (employee.age > 65):
```

versus

```
if employee.is_eligible_for_full_benefits():
```

- ✔ Comments lie! Not always, not intentionally, but too often.
- ✔ Inaccurate comments are worse then no comments!
- ✔ Comments cannot repair bad code.
- ✔ Good comments:
  - ✘ little explanation, little clarification
  - ✘ emphasis, warning against consequences
  - ✘ TODOs
- ✔ Bad comments:
  - ✘ old (invalid), unimportant, unsuitable, redundant, or misleading comments
  - ✘ comments “because you have to comment”
  - ✘ commented-out code
  - ✘ non-local or irrelevant information

## The Sieve of Eratosthenes: comments

```
# This function generates prime numbers up to
# a user specified maximum. The algorithm
# used is the Sieve of Eratosthenes.
#
# Eratosthenes of Cyrene, b. c. 276 BC,
# Cyrene, Libya -- d. c. 194 BC, Alexandria.
# The first man to calculate the circumference
# of the Earth. Also known for working on
# calendars with leap years and ran
# the library at Alexandria.
#
# The algorithm is quite simple.
# Given an array of integers starting at 2,
# cross out all multiples of 2.
# Find the next uncrossed integer,
# and cross out all of its multiples.
# Repeat until you have passed
# the maximum value.
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# @author hugo
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We will get rid of other comments in a while!

## Functions and methods

- ✔ Functions shall be short! (And even shorter!)
- ✔ Function shall do a single thing and do it well. (And without side effects.)
- ✔ Ideally, functions shall be shorter than 5 lines. In that case:
  - ✘ they usually do exactly 1 thing.
  - ✘ they can have precise and meaningful name.
  - ✘ they cannot contain nested `if`, `for`, . . . commands.
  - ✘ the blocks inside `if`, `for`, . . . commands can be only a single line long.
- ✔ Short functions allow for testing individual parts of the program!
- ✔ Sections inside functions/methods:
  - ✘ A clear indication that the function/method does not do a single thing, and should be split up.
- ✔ Function/method parameters:
  - ✘ Keep their number small! 0, 1, 2, exceptionally 3.
  - ✘ Create the function/method name so that it evokes the order of arguments.
  - ✘ Boolean parameters usually suggest that the function/method does not do a single thing. Split it up!

## The Sieve of Eratosthenes: functions

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        for number in range(2, len(candidates)):
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```python
PRIME = True
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class PrimesGenerator:
    """Prime numbers generator."""
    def __init__(self):
        self.candidates = []
        self.max = None

    def get_primes_up_to(self, max_value):
        """Return list of primes up to the max_value."""
        if max_value < 2: return []
        self.max = max_value+1
        self.init_candidates_up_to_max_value()
        self.mark_non_prime_candidates()
        return self.collect_remaining_candidates()

    def init_candidates_up_to_max_value(self):
        self.candidates = [PRIME for i in range(self.max)]

    def mark_non_prime_candidates(self):
        # Cross out 0 and 1, they are not primes.
        self.candidates[0] = self.candidates[1] = NONPRIME
        for number in range(2, int(self.max**0.5)+1):
            if self.candidates[number]==PRIME:
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    def mark_as_not_prime_multiples_of(self, number):
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            self.candidates[multiple] = NONPRIME

    def collect_remaining_candidates(self):
        return [i for i in range(self.max)
                  if self.candidates[i]==PRIME]
```

## Summary

- ✔ Clean code is a subjective concept, yet:
  - ✘ there are some generally accepted features of clean code, and
  - ✘ all programmers shall strive for it.
- ✔ Clean code shall be foremost readable (almost like sentences in natural language).
- ✔ 80 % of clean code are well chosen names!
- ✔ Suitable names can be chosen if the functions are short!
- ✔ If your program contains repeated pieces of almost the same code, it is almost always possible to define it as a new function/method.