

COMP110: Principles of Computing

Test Driven Development

Learning outcomes

By the end of this session, you will...

- ▶ asdf

Test driven development



Unit testing

- ▶ A **unit test** or **test case** is a piece of code that verifies a unit (e.g. a function or class) of a program

Unit testing

- ▶ A **unit test** or **test case** is a piece of code that verifies a unit (e.g. a function or class) of a program
- ▶ E.g. verifies that a function called with a particular set of parameters returns the expected result

Unit testing

- ▶ A **unit test** or **test case** is a piece of code that verifies a unit (e.g. a function or class) of a program
- ▶ E.g. verifies that a function called with a particular set of parameters returns the expected result
- ▶ The following might be unit tests for a `factorial` function:
 - ▶ `factorial(1) == 1`
 - ▶ `factorial(2) == 2`
 - ▶ `factorial(3) == 6`
 - ▶ `factorial(4) == 24`

Why do unit testing?

- ▶ Can find problems that normal testing misses

Why do unit testing?

- ▶ Can find problems that normal testing misses
- ▶ **Bottom-up** testing — if the **parts** work properly, it's easier to make the **whole** work properly

Why do unit testing?

- ▶ Can find problems that normal testing misses
- ▶ **Bottom-up** testing — if the **parts** work properly, it's easier to make the **whole** work properly
- ▶ When code is **changed**, can verify that nothing was broken

Caveats

- ▶ Have to spend time writing tests

Caveats

- ▶ Have to spend time writing tests
 - ▶ Not really a drawback — good unit tests will probably **save** more time in debugging than it takes to write them

Caveats

- ▶ Have to spend time writing tests
 - ▶ Not really a drawback — good unit tests will probably **save** more time in debugging than it takes to write them
- ▶ Can give a false sense of security

Caveats

- ▶ Have to spend time writing tests
 - ▶ Not really a drawback — good unit tests will probably **save** more time in debugging than it takes to write them
- ▶ Can give a false sense of security
 - ▶ Unit tests can't cover 100% of a complex program — **not a substitute** for other forms of testing

Test driven development (TDD)

- ▶ A development process that advocates writing the unit tests **first**

Test driven development (TDD)

- ▶ A development process that advocates writing the unit tests **first**
- ▶ Repeat the following three steps:

Test driven development (TDD)

- ▶ A development process that advocates writing the unit tests **first**
- ▶ Repeat the following three steps:
 1. **Red**: create a new test case, which should initially **fail**

Test driven development (TDD)

- ▶ A development process that advocates writing the unit tests **first**
- ▶ Repeat the following three steps:
 1. **Red**: create a new test case, which should initially **fail**
 2. **Green**: write code to make the new test **succeed**
(without causing the other test cases to fail)

Test driven development (TDD)

- ▶ A development process that advocates writing the unit tests **first**
- ▶ Repeat the following three steps:
 1. **Red**: create a new test case, which should initially **fail**
 2. **Green**: write code to make the new test **succeed**
(without causing the other test cases to fail)
 3. **Refactor**: **improve** the code, ensuring that all tests still **succeed**

Why TDD?

- ▶ All the benefits of **unit testing**, plus...

Why TDD?

- ▶ All the benefits of **unit testing**, plus...
- ▶ Often easier to convert a **user story** into test cases rather than directly into code

Why TDD?

- ▶ All the benefits of **unit testing**, plus...
- ▶ Often easier to convert a **user story** into test cases rather than directly into code
- ▶ Writing the bare minimum of code to make the test “green” lets you **focus on user stories**, not on **over-generalisation** or **non-essential functionality**

Why TDD?

- ▶ All the benefits of **unit testing**, plus...
- ▶ Often easier to convert a **user story** into test cases rather than directly into code
- ▶ Writing the bare minimum of code to make the test “green” lets you **focus on user stories**, not on **over-generalisation** or **non-essential functionality**
 - ▶ **KISS**: Keep It Simple, Stupid
 - ▶ **YAGNI**: You Aren’t Gonna Need It

Red

- ▶ Create a new test case, which should initially **fail**

Red

- ▶ Create a new test case, which should initially **fail**
- ▶ Write only enough code to allow the test case to compile and run, e.g. write a **stub** function

Red

- ▶ Create a new test case, which should initially **fail**
- ▶ Write only enough code to allow the test case to compile and run, e.g. write a **stub** function
- ▶ What if the test succeeds?

Red

- ▶ Create a new test case, which should initially **fail**
- ▶ Write only enough code to allow the test case to compile and run, e.g. write a **stub** function
- ▶ What if the test succeeds?
 - ▶ Maybe you already implemented that feature?

Red

- ▶ Create a new test case, which should initially **fail**
- ▶ Write only enough code to allow the test case to compile and run, e.g. write a **stub** function
- ▶ What if the test succeeds?
 - ▶ Maybe you already implemented that feature?
 - ▶ Maybe the test case is wrong?

Red

- ▶ Create a new test case, which should initially **fail**
- ▶ Write only enough code to allow the test case to compile and run, e.g. write a **stub** function
- ▶ What if the test succeeds?
 - ▶ Maybe you already implemented that feature?
 - ▶ Maybe the test case is wrong?
 - ▶ Maybe your unit testing code is broken?

Green

- ▶ Add the **bare minimum** of code to make the new test case succeed

Green

- ▶ Add the **bare minimum** of code to make the new test case succeed
 - ▶ **Keep It Simple, Stupid!**

Green

- ▶ Add the **bare minimum** of code to make the new test case succeed
 - ▶ **Keep It Simple, Stupid!**
- ▶ Verify that **all** unit tests now succeed

Green

- ▶ Add the **bare minimum** of code to make the new test case succeed
 - ▶ **Keep It Simple, Stupid!**
- ▶ Verify that **all** unit tests now succeed
- ▶ What if old tests now fail?

Green

- ▶ Add the **bare minimum** of code to make the new test case succeed
 - ▶ **Keep It Simple, Stupid!**
- ▶ Verify that **all** unit tests now succeed
- ▶ What if old tests now fail?
 - ▶ Fix it

Green

- ▶ Add the **bare minimum** of code to make the new test case succeed
 - ▶ **Keep It Simple, Stupid!**
- ▶ Verify that **all** unit tests now succeed
- ▶ What if old tests now fail?
 - ▶ Fix it
 - ▶ **Or** revert and start again — can be faster than debugging

Green

- ▶ Add the **bare minimum** of code to make the new test case succeed
 - ▶ **Keep It Simple, Stupid!**
- ▶ Verify that **all** unit tests now succeed
- ▶ What if old tests now fail?
 - ▶ Fix it
 - ▶ **Or** revert and start again — can be faster than debugging
 - ▶ (you **did** commit before you started, right?)

Refactor

- ▶ E.g. remove duplication, improve names, add documentation, apply design patterns, ...

Refactor

- ▶ E.g. remove duplication, improve names, add documentation, apply design patterns, ...
- ▶ To generalise or not to generalise?

Refactor

- ▶ E.g. remove duplication, improve names, add documentation, apply design patterns, ...
- ▶ To generalise or not to generalise?
- ▶ **Do** generalise if it makes the code **simpler**

Refactor

- ▶ E.g. remove duplication, improve names, add documentation, apply design patterns, ...
- ▶ To generalise or not to generalise?
- ▶ **Do** generalise if it makes the code **simpler**
- ▶ **Don't** generalise because you “might” need it later

Refactor

- ▶ E.g. remove duplication, improve names, add documentation, apply design patterns, ...
- ▶ To generalise or not to generalise?
- ▶ **Do** generalise if it makes the code **simpler**
- ▶ **Don't** generalise because you “might” need it later
 - ▶ You **Aren't Gonna Need It!**
 - ▶ Wait until it **is** needed in another cycle

Refactor

- ▶ E.g. remove duplication, improve names, add documentation, apply design patterns, ...
- ▶ To generalise or not to generalise?
- ▶ **Do** generalise if it makes the code **simpler**
- ▶ **Don't** generalise because you “might” need it later
 - ▶ You **Aren't Gonna Need It!**
 - ▶ Wait until it **is** needed in another cycle
- ▶ Verify that **all** unit tests still succeed