Gcov: cod coverage Lab 8: Unit Testing

Comp Sci 1585 Data Structures Lab: Tools for Computer Scientists





Outline

Introduction

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Unit Testing

Introduction

Catch

Gcov: code coverage Unit testing lets you test your code piece-by-piece, instead of all at once at the end of development. It also automates the testing process so you know when you introduce bugs into your code. Some go so far as to write tests before writing code. This is called test-driven development (TDD). Some frameworks include

- Catch
- Boost Unit Test Framework (UTF)
- Google test
- Gcov: Code coverage tool



Outline





2 Methodology





- Catch
- Gcov: code coverage

- Each test should be testing one (and only one) small *unit* of your software
- A single test is typically broken up into:
 - Bootstrapping your test
 - Expected behavior
 - Actual behavior (running the code *unit* that is being tested)
 - Comparing expected to actual behavior
 - If actual behavior does not match expected behavior, print out an informative message describing the problem



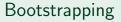
Super Simple Example

Methodology

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GCOV: CODE

```
// Function to be tested
int add(int x, int y)
{
    return x + y;
}
```



Catch

Gcov: code coverage

```
#include "add.hpp"
#include "catch.hpp"
```

TEST_CASE("Integer Arithmetic", "[int]") { // Bootstrapping your test setup int value_to_add = 1; int initial_value = 4;

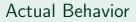


Introduction Methodology

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Gcov: code coverage TEST_CASE("Integer Arithmetic", "[int]") {
 /* Bootstrapping up here */

SECTION("Adding 1 to a number increases it by 1")
{
 // Defining expected behavior
 int expected_value = 5;

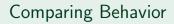


Catch

Gcov: code coverage

TEST_CASE("Integer Arithmetic", "[int]") { /* Bootstrapping up here */

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Introduction Methodology

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Gcov: code coverage TEST_CASE("Integer Arithmetic", "[int]") {
 /* Bootstrapping up here */

SECTION("Adding 1 to a number increases it by 1")
{
 // Defining expected behavior
 int expected_value = 5;

// Compare expected against actual
 CHECK(expected_value == actual_value);
}



Test Driven Development

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Gcov: code coverage Test Driven Development (TDD) emphasizes writing tests first that guide the development of your code.

- Don't write your code first!
- Instead, start by writing tests
- Progression of development: Fail, Pass, Repeat
 - Scaffold your code: Define interface (i.e. header files), Return dummy values that do nothing and cause your test to fail
 - Implement a single test: bootstrap, expected behavior, actual behavior, comparison
 - Run your tests (it should fail)
 - Go back to code and fix it
 - Run your tests (it should pass)
 - Move on to next test



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3 Catch





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Gcov: code coverage

Catch2: a simple unit testing framework

https://github.com/catchorg/Catch2

1 Make an simple .cpp (like test_main.cpp) with just: #define CATCH_CONFIG_MAIN #include "catch.hpp"

- Write some tests in their own tests_whatever.cpp and include your code files to test in this file.
- S Compile the tests_whatever.cpp like normal (or faster with a makefile)

Check out some examples



Gcov: code

Outline







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Gcov: code coverage

Are all lines of your code being executed by your tests? Are there code blocks that are not being reached (and thus are not being *covered* by your test)?

Code Coverage

Goal: obtain 100% coverage with your tests



Code Coverage

- Introduction Methodology
- Gcov: code coverage

- 1 Compile your tests with the --coverage flag
- 2 Run your test suite executable
- 8 Run \$ gcov -mr [.cpp files] with all .cpp files in your project to compute code coverage

Check out the example