CS 485
Advanced Object Oriented Design

Unit Testing C++

in Visual Studio

Spring 2017

Reading

- Microsoft Documentation

  https://msdn.microsoft.com/en-us/library/hh694604.aspx

- Martin Fowler's Description

  https://martinfowler.com/bliki/UnitTest.html

Fowler's description

- Low-level, focus on small part of the system
- Written by programmers to test their own code
    - not by a separate set of testers
- Expected to be faster than other tests

https://martinfowler.com/bliki/UnitTest.html

Unit

- Class
- Method
- Set of Methods
- Interface
- Set of classes
- ???

Implementation Details

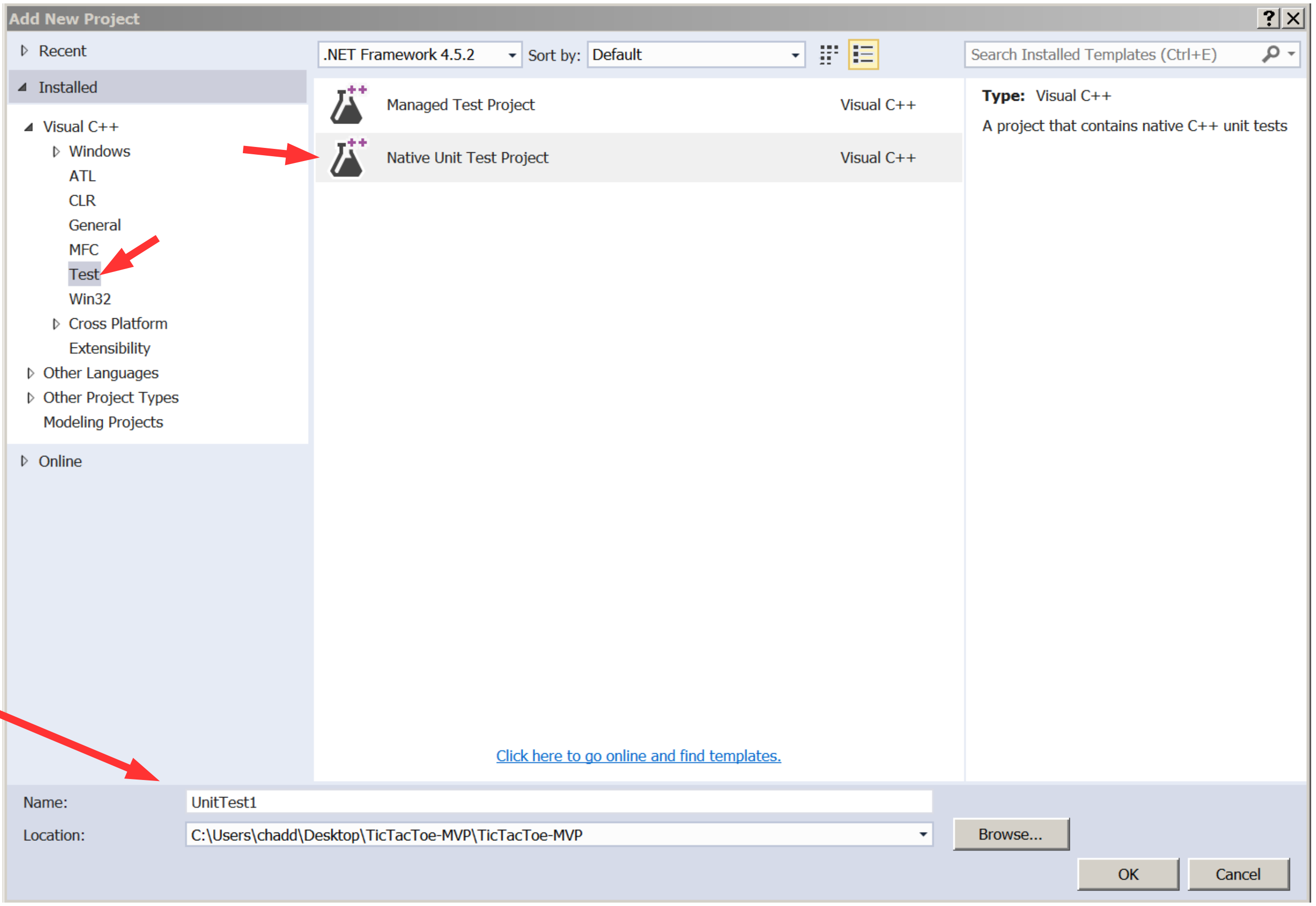
- Framework* for testing
  - easy to write many small tests
  - easy way to run the tests and track which individual test passed/failed
  - no need to build a driver
  - provide easy way to mark a test as pass/fail
  - Assert()

* A *software framework* provides code to solve a problem
and allows the user to write small bits of code in certain spots
to customize how the problem is solved.

problem → testing

Visual Studio and C++

- Add a new project to your solution
- Link that project (include dir & obj files) to an existing project to test in the normal way



Add New Project

.NET Framework 4.5.2 | Sort by: Default | Search Installed Templates (Ctrl+E)

Managed Test Project	Visual C++
Native Unit Test Project	Visual C++

Type: Visual C++

A project that contains native C++ unit tests

Click here to go online and find templates.

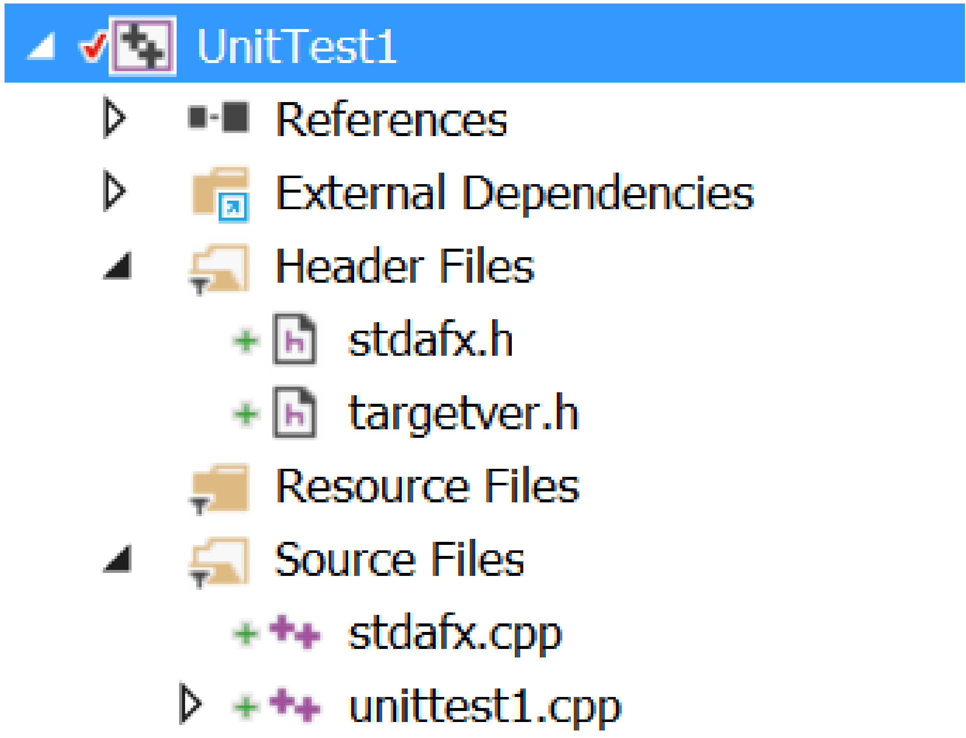
Name: UnitTest1

Location: C:\Users\chadd\Desktop\TicTacToe-MVP\TicTacToe-MVP

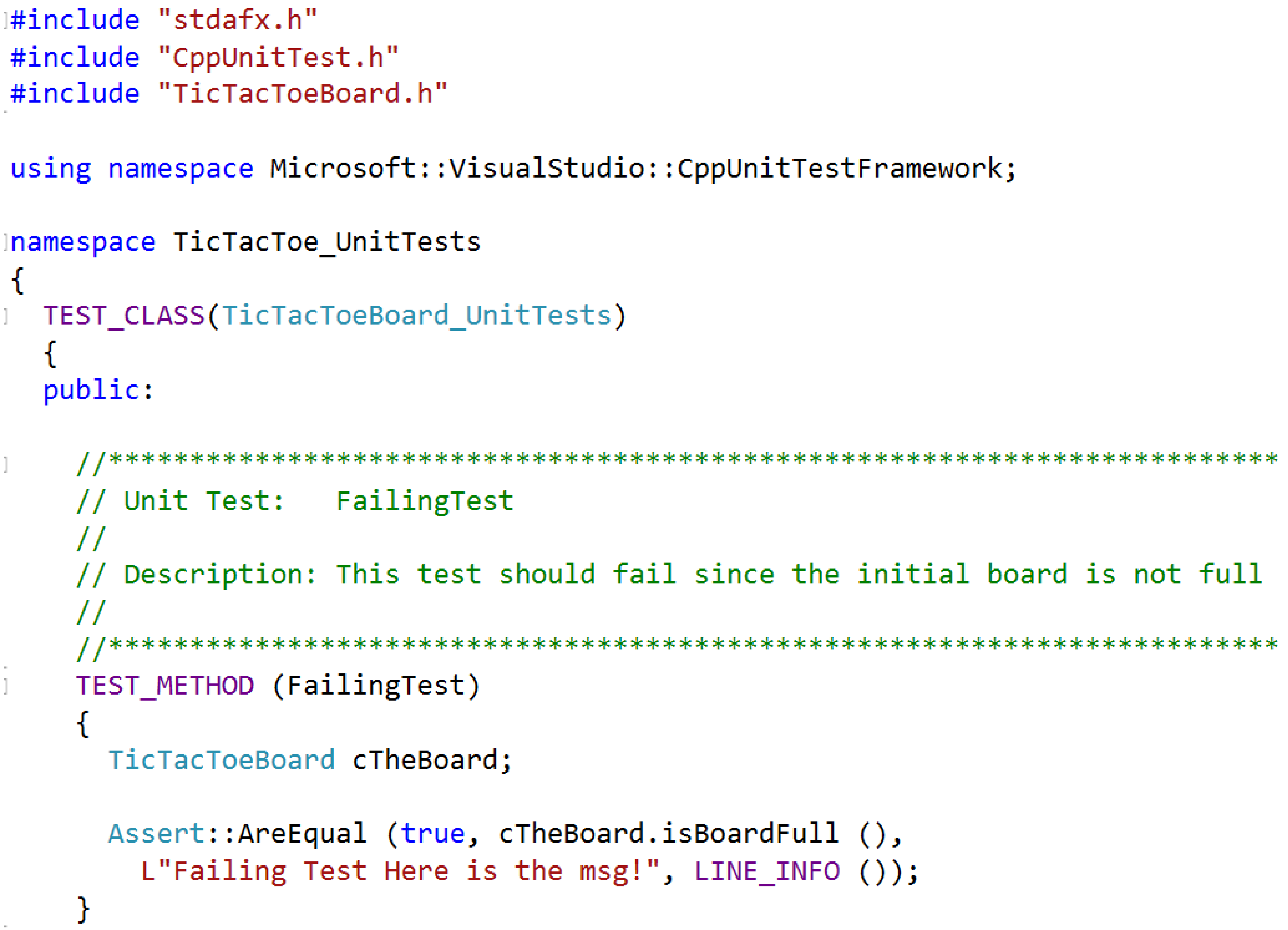
Give the project a decent name

The Unit Test Project

- Your tests go in the file unittest1.cpp
  - this file may have another, better name



Code



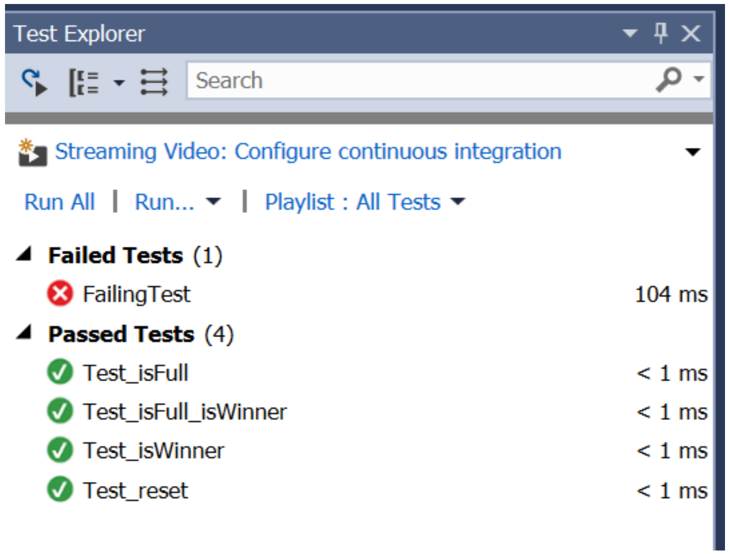
```cpp
#include "stdafx.h"
#include "CppUnitTest.h"
#include "TicTacToeBoard.h"

using namespace Microsoft::VisualStudio::CppUnitTestFramework;

namespace TicTacToe_UnitTests
{
  TEST_CLASS(TicTacToeBoard_UnitTests)
  {
  public:

    //************************************************************************
    // Unit Test:   FailingTest
    //
    // Description: This test should fail since the initial board is not full
    //
    //************************************************************************
    TEST_METHOD (FailingTest)
    {
      TicTacToeBoard cTheBoard;

      Assert::AreEqual (true, cTheBoard.isBoardFull (),
        L"Failing Test Here is the msg!", LINE_INFO ());
    }
```

Note what is autogenerated by the framework

To run

- Visual Studio Menu:
  - Test | Run | All Tests

- Test Explorer



Test Explorer

Search

Streaming Video: Configure continuous integration

Run All | Run... | Playlist : All Tests

Failed Tests (1)

```
✗ FailingTest                     104 ms
```

Passed Tests (4)

```
✓ Test_isFull                     < 1 ms
✓ Test_isFull_isWinner            < 1 ms
✓ Test_isWinner                   < 1 ms
✓ Test_reset                      < 1 ms
```

More elaborate test

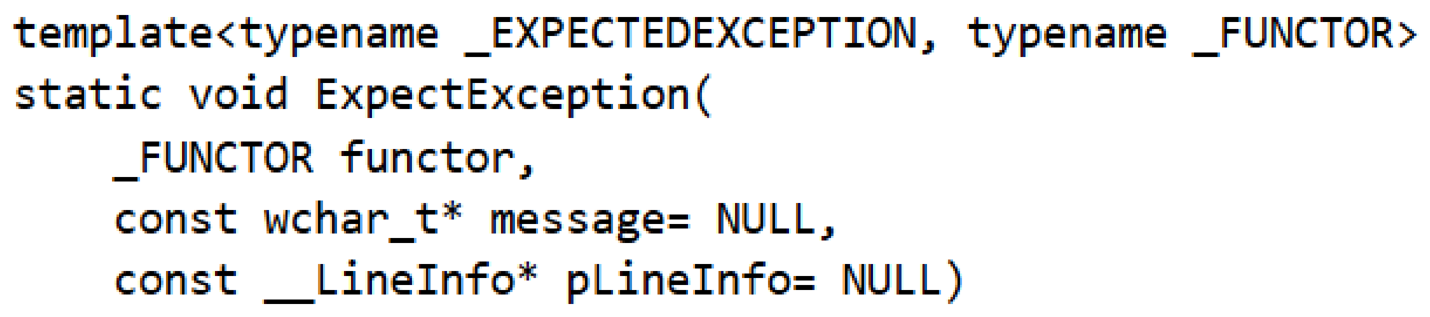
```
//************************************************************************
// Unit Test:   Test_isWinner
//
// Description: Test if isWinner() can find a winner
//
//************************************************************************
TEST_METHOD (Test_isWinner)
{
  TicTacToeBoard cTheBoard;

  cTheBoard.makeMove (0, 0, TicTacToeBoard::Player::ONE);
  cTheBoard.makeMove (0, 1, TicTacToeBoard::Player::ONE);
  cTheBoard.makeMove (0, 2, TicTacToeBoard::Player::ONE);

  Assert::AreEqual (true,
    cTheBoard.isWinner (TicTacToeBoard::Player::ONE),
    L"Win not detected!", LINE_INFO ());

}
```

One More

```
//*************************************************************************
// Unit Test:   Test_reset
//
// Description: Test if reset works
//
//*************************************************************************
TEST_METHOD (Test_reset)
{
  TicTacToeBoard cTheBoard;

  cTheBoard.makeMove (0, 0, TicTacToeBoard::Player::ONE);
  cTheBoard.makeMove (0, 1, TicTacToeBoard::Player::ONE);
  cTheBoard.makeMove (0, 2, TicTacToeBoard::Player::ONE);

  cTheBoard.reset ();

  Assert::AreEqual (false,
    cTheBoard.isWinner (TicTacToeBoard::Player::ONE),
    L"Reset did not work", LINE_INFO ());

}
```

Handled an expected exception

- Call a function in the UnitTest that should throw an exception
- Make sure that Exception is thrown
- ExpectException()



```
template<typename _EXPECTEDEXCEPTION, typename _FUNCTOR>
static void ExpectException(
    _FUNCTOR functor,
    const wchar_t* message= NULL,
    const __LineInfo* pLineInfo= NULL)
```

```
Assert::ExpectException<std::range_error>(func,
   L"Exception not thrown", LINE_INFO() );
```

https://msdn.microsoft.com/en-us/library/hh694604.aspx#BKMK_Exception_Asserts

https://blogs.msdn.microsoft.com/dgartner/2012/04/22/using-assertexpectexception-with-native-unit-testing-in-vs11/

Unit Test

- The unit test is in a class, so you can have private data members!
- Each test method runs in its own instance of the class
- No state is shared between test methods

“When the tests are run, an instance of each test class is created. The test methods are called in an unspecified order. You can define special methods that are invoked before and after each module, class, or method. For more information, see Organizing C++ Tests.”

https://msdn.microsoft.com/en-us/library/hh270864.aspx

Other functions

```
//  runs before each test method is run
TEST_METHOD_INITIALIZE(methodName)
{
    // method initialization code
}

//  runs after each test method is run
TEST_METHOD_CLEANUP(methodName)
{
    // test method cleanup code
}
```

```
//  runs after each test class is created
TEST_CLASS_INITIALIZE(methodName)
{
    // test class initialization code
}


TEST_CLASS_CLEANUP(methodName)
{
    // test class cleanup code
}
```

Console Output

std::cout does not work in the unit test

```
Logger::WriteMessage("running test");
```

https://msdn.microsoft.com/en-us/library/hh694604.aspx#BKMK_CppUnitTestLogger_h

Your Task

Email me your completed cpp file.

Commented, with both names!

- Download TicTacToe-MVP
- Add a new cpp file to TicTacToe_UnitTests TicTacToeModel_UnitTests.cpp
- The top of the file:

```
#include "stdafx.h"
#include "CppUnitTest.h"
#include "TicTacToeModel.h"

using namespace Microsoft::VisualStudio::CppUnitTestFramework;

namespace TicTacToe_UnitTests
{
  TEST_CLASS(TicTacToeModel_UnitTests)
  {
  public:
```

- Add a unit test that uses makeMove() to test if isWinner() is correct