

**SE 2AA4, CS 2ME3 (Introduction to Software
Development)**

Winter 2018

31 Overview of Testing (Ch. 6)

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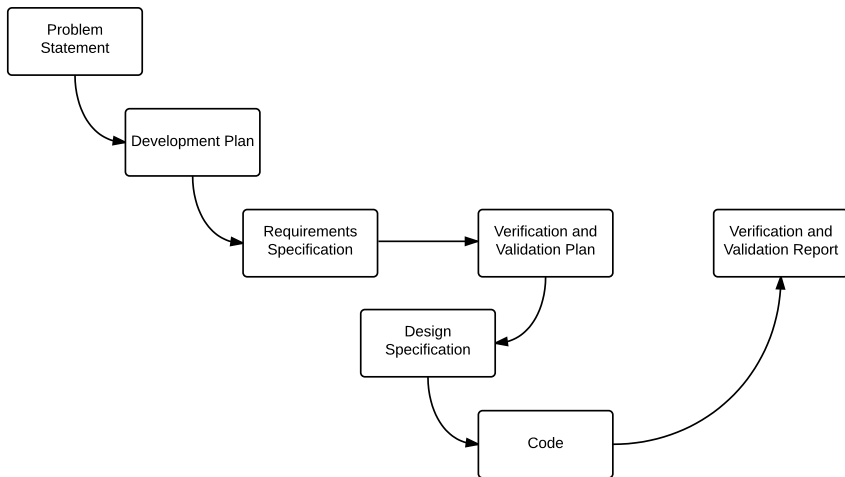
31 Overview of Testing (Ch. 6)

- Administrative details
- Rational design process review
- Types of test
 - ▶ White box versus black box
 - ▶ Manual versus automated
 - ▶ Static versus dynamic
 - ▶ Continuous integration testing
- Fault testing
- Homework problem

Administrative Details

- Today's slides are partially based on slides by Dr. Wassying
- A2: Solution pushed to repo
- A3: Part 2 - Code: due 11:59 pm Mar 26
- A4: Due April 9 at 11:59 pm
- No classes on Thurs, Mar 29 or Fri, Mar 30
- Final tutorial (examination review)
 - ▶ Monday, Mar 26
 - ▶ Tuesday, Mar 27
 - ▶ Friday, Apr 6 (no tutorial on Fri, Mar 30)
- Course Evaluation
 - ▶ <https://evals.mcmaster.ca>
 - ▶ Start: Tues, Mar 27, 10:00 am
 - ▶ Close: Tues, Apr 10, 11:59 pm
 - ▶ *Grade bonus for class participation!*

Rational Design Process



White Box Versus Black Box Testing

- Do you know (or can you guess) the difference between white box and black box testing?
- What if they were labelled transparent box and opaque box testing, respectively?

White Box Versus Black Box Testing

- White box testing is derived from the program's internal structure
- Black box testing is derived from a description of the program's function
- Should perform both white box and black box testing
- Black box testing
 - ▶ Uncovers errors that occur in implementing requirements or design specifications
 - ▶ Not concerned with how processing occurs, but with the results
 - ▶ Focuses on functional requirements for the system
 - ▶ Focuses on normal behaviour of the system

White Box Testing

- Uncovers errors that occur during implementation of the program
- Concerned with how processing occurs
- Evaluates whether the structure is sound
- Focuses on abnormal or extreme behaviour of the system

Dynamic Testing

- Is there a dynamic testing technique that can guarantee correctness?
- If so, what is the technique?
- Is this technique practical?

Dynamic Versus Static Testing

- Another classification of verification techniques, as previously discussed
- Use a combination of dynamic and static testing
- Dynamic analysis
 - ▶ Requires the program to be executed
 - ▶ Test cases are run and results are checked against expected behaviour
 - ▶ Exhaustive testing is the only dynamic technique that guarantees program validity
 - ▶ Exhaustive testing is usually impractical or impossible
 - ▶ Reduce number of test cases by finding criteria for choosing representative test cases

Static Testing Continued

- Static analysis
 - ▶ Does not involve program execution
 - ▶ Testing techniques simulate the dynamic environment
 - ▶ Includes syntax checking
 - ▶ Generally static testing is used in the requirements and design stage, where there is no code to execute
 - ▶ Document and code walkthroughs
 - ▶ Document and code inspections

Manual Versus Automated Testing

- What is the difference between manual and automated testing?
- What are the advantages of automated testing?
- What is regression testing?

Manual Versus Automated Testing

- Manual testing
 - ▶ Has to be conducted by people
 - ▶ Includes by-hand test cases, structured walkthroughs, code inspections
- Automated testing
 - ▶ The more automated the development process, the easier to automate testing
 - ▶ Less reliance on people
 - ▶ Necessary for [regression testing](#)
 - ▶ Test tools can assist, such as Junit, Cppunit, CuTest etc.
 - ▶ Can be challenging to automate GUI tests
 - ▶ Test suite for Maple has 2 000 000 test cases, run on 14 platforms, every night, automated reporting

Automated Testing at MapleSoft

- Three steps
 - ▶ Write the problem description
 - ▶ `result := solver(problem)`
 - ▶ `assert(result == expected)`
- Assert writes out code to reproduce any failures
- Track failures
 - ▶ Source code management (like subversion or git)
 - ▶ Database of test cases, functions called
 - ▶ Database of source files, functions defined
 - ▶ Database of 40 days of timings and resources used
- Automatically sends an e-mail to the programmer and his/her boss

Automation Cases

- How would you automate an application that does image processing (filtering, edge detection, format conversion etc.)?
- Can you automate testing the game play for a game?

Continuous Integration Testing

- What is continuous integration testing?

Continuous Integration Testing

- Information available on [Wikipedia](#)
- Developers integrate their code into a shared repo frequently (multiple times a day)
- Each integration is automatically accompanied by regression tests and other build tasks
- Build server
 - ▶ Regression tests
 - ▶ Unit tests
 - ▶ Integration tests
 - ▶ Portability tests
 - ▶ Static analysis
 - ▶ Profile performance
 - ▶ Extract documentation
 - ▶ Update project web-page
 - ▶ etc.
- Addresses sync between baseline and a developer's code

Continuous Integration Tools

- Gitlab
 - ▶ Example at [Rogue Reborn](#)
- Jenkins
- Travis
- Docker
 - ▶ Eliminates the “it works on my machine” problem
 - ▶ Package dependencies with your apps
 - ▶ A container for lightweight virtualization
 - ▶ Not a full VM

Quality Testing: Installability

- How might you test installability?