CS1632, Lecture 4: Test Plans and TM

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You've got requirements.
You're looking for defects.

How?

Develop a test plan!

Formality

- This could be as formal or informal as necessary.
- Think about what you are testing – what level of responsibility / tracking is necessary?

What are you testing?

Throw-away script?

Development tool?

Internal website?

Enterprise software?

Commercial software?

Operating system?

Avionics software?

Testing is context-dependent

- How you test
- How much you test
- What tools you use
- What documentation you provide

- ...All vary based on software context.

Formal Test Plans

test plan is a sequence of test cases.

test case is the fundamental “unit” of a test plan.

A test case mainly consists of…

- Preconditions: State of the system before testing
  - Environment / global variable values, …
  - State of the screen, state of the database, …
- Execution Steps: Steps to obtain postconditions
- Postconditions: State of the system after testing
  - Environment / global variables are set, …
  - Output printed to screen, network packet sent, …

See IEEE 829, "Standard for Software Test Documentation", for more details

Example

Assuming an empty shopping cart, when I click "Buy Widget"
the number of widgets in the shopping cart becomes one.

Preconditions: Empty shopping cart
Execution Steps: Click "Buy Widget“
Postconditions: Shopping cart displays one widget

We also want to add:

dentifier: A way to identify the test case

- Could be a number
- Often a label, e.g. INVALID-PASSWORD-THREE-TIMES-TEST

Test Case: A description of the test case

f doing method unit testing, we also add

Input values: Values passed as method arguments

Output values: Value(s) returned from method

Difference between input value and precondition?

- Arguments passed directly to the method are input values
- A global variable set before method is called is a precondition
- User input entered before method is called is a precondition

n full, a test case contains the following items

Identifier
Test Case
Preconditions
Input Values
Execution Steps
Output Values
Postconditions

See IEEE 829, "Standard for Software Test Documentation", for more details

Example

Assuming that the SORT_ASCENDING flag is set, calling the sort method with [9,3,4,2] will return a new array sorted from high to low i.e., [2,3,4,9].

Precondition: SORT_ASCENDING flag is set
Input values: Array [9,3,4,2]
Execution steps: Call sort method with input values
Output values: Array [2,3,4,9]
Postconditions: None

Another Example

```
int print_hello_world() {
    System.out.print("Hello World");
    return 1;
}
```

Suppose you wanted to write a test case for above method:

- What would be the output values? 1.
- What would be the postconditions? Hello World is printed.

Test Plan

- A collection of test cases for testing a system
- These do not always test an entire system
- They may test a subsystem or related piece of functionality
  - Examples:
  - Database Connectivity Test Plan
  - Pop-up Warning Test Plan
  - Pressure Safety Lock Test Plan
  - Regression Test Plan

Pressure Safety Lock Test Plan

LOW-PRESSURE-TEST
HIGH-PRESSURE-TEST
SAFETY-LIGHT-TEST
SAFETY-LIGHT-OFF-TEST
RESET-SWITCH-TEST
RESET-SWITCH2-TEST
FAST-MOVEMENT-TEST
RAPID-CHANGE-TEST
GRADUAL-CHANGE-TEST
MEDIAN-PRESSURE-TEST
LIGHT-FAILURE-TEST
SENSOR-FAILURE-TEST
SENSOR-INVALID-TEST

A group of test plans make up a test suite…

Regression Test Suite

- Pressure Safety Regression Test Plan
- Power Regulation Regression Test Plan
- Water Flow Regression Test Plan
- Control Flow Test Plan
- Security Regression Test Plan
- Secondary Safety Process Test Plan

Test Run – Actual execution

- Test run: An actual execution of a test plan or test suite.
- Analogy time: class vs object, test plan vs test run
  - The test plan is the structure, but you need to actually execute
- During the test run, the tester manually (or automatically) executes each test case and sets the status

Possible Statuses

- PASSED – Completed with expected result
- FAILED – Completed but unexpected result
- PAUSED – Test paused in middle of execution
- RUNNING – Test in the middle of execution
- BLOCKED – Cannot be completed because precondition not fulfilled
- ERROR – Problem with running test itself

Defects

If the test case fails, a defect should be filed

- Unless the test case has already failed, of course.
- You don’t need to re-file a duplicate

We will talk about filing defects on the next lecture

Creating a test plan…

- Start top-down: what is a good way to subdivide the system into features (test plans)?
- For a given feature (test plan), what aspects do I want to test?
- For each aspect, what test cases do I want that will hit different equivalence classes / success or failure cases / edge or corner cases / etc.?
- How deep should I go down?
- Test cases should be independent of each other, and reproducible!

Traceability Matrix

Consider:

- One test case may test multiple requirements
- One requirement may be tested by multiple test cases
- It's a complex many-to-many relationship!

Traceability Matrix: table that describes the relationship between requirements and test cases

- How requirements are enforced throughout software development
- Can tell us where we are missing test coverage, or have superfluous tests

Good Traceability Matrix Example

REQ1: TEST_CASE_1, TEST_CASE_2

REQ2: TEST_CASE_3

REQ3: TEST_CASE_4, TEST_CASE_7

REQ4: TEST_CASE_5, TEST_CASE_9

REQ5: TEST_CASE_6, TEST_CASE_10

All requirements have at least one test case associated with them; all test cases map to a requirement.

Problematic Traceability Matrix 1

REQ1: TEST_CASE_1, TEST_CASE_2

REQ2:

REQ3: TEST_CASE_4, TEST_CASE_7

REQ4: TEST_CASE_5, TEST_CASE_9

REQ5: TEST_CASE_6, TEST_CASE_10

No test case is testing requirement 2!

Problematic Traceability Matrix 2

REQ1: TEST_CASE_1, TEST_CASE_2

REQ2: TEST_CASE_3

REQ3: TEST_CASE_4, TEST_CASE_7

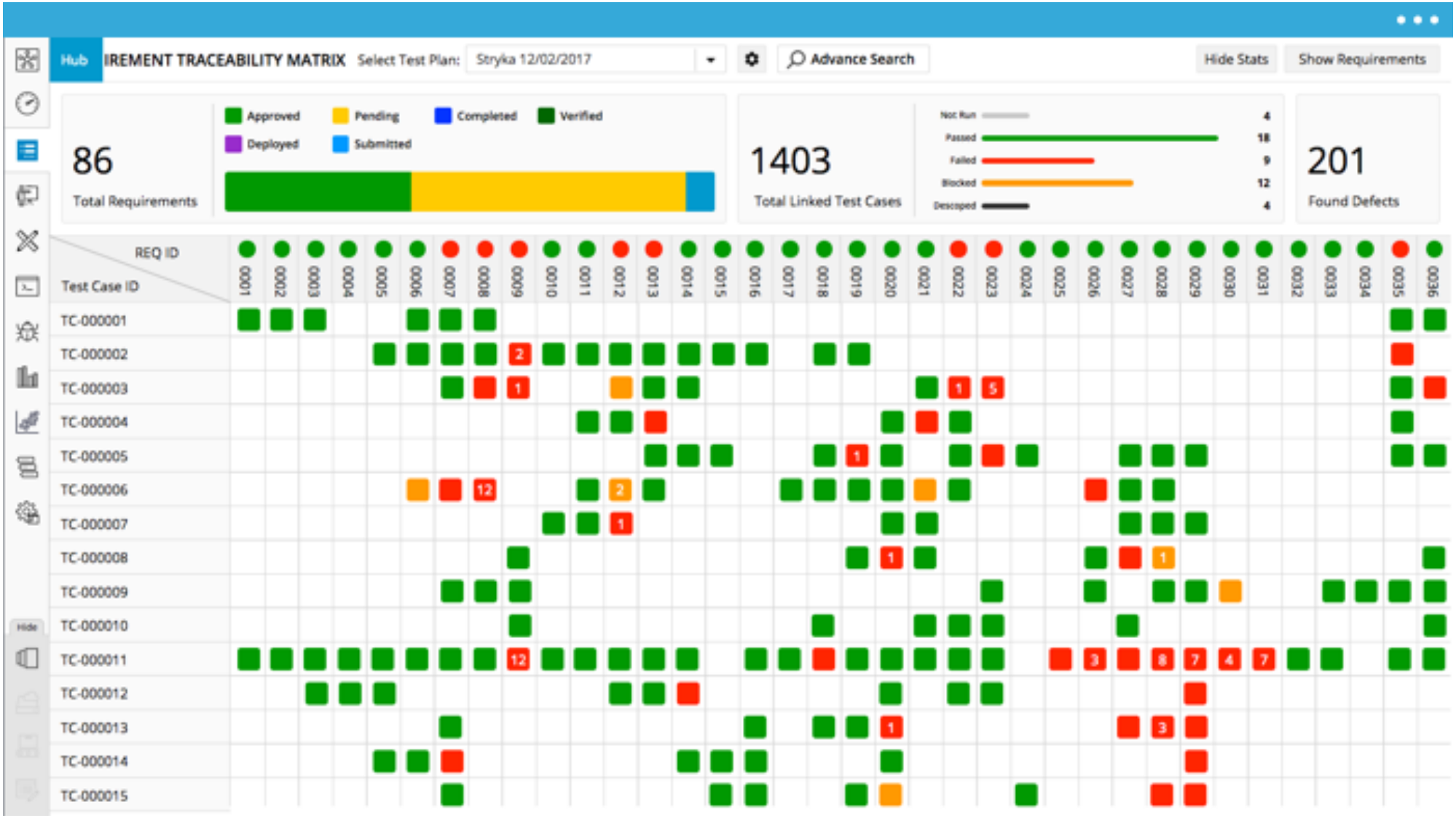
REQ4: TEST_CASE_5, TEST_CASE_9

REQ5: TEST_CASE_6, TEST_CASE_10

?????: TEST_CASE_11

What is test case 11 checking?

Traceability Matrix in Actual Matrix Format



Now Please Read Textbook Chapters 6 and 8

In particular, read Chapter 8 carefully since that's mostly what you will be doing for our first in-class exercise on 9/11.