Lecture 11 - Testing I - Non-Execution-Based Testing

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Outline

Quality Issues

Terminology:
Recall the definition of a **fault**.

Quality Issues

Definition 1

*A **failure** is an observed incorrect behaviour of the S/W product caused by a fault.*

Quality Issues

Definition 2

Error *is the amount by which the software product's output is incorrect (i.e. the statistical sense of error).*

Quality Issues

Definition 3

A **defect** *is a generic term for a fault, failure or error.*

Quality Issues

Definition 4

Quality *describes the extent to which the S/W product satisfies its specification.*

Software Quality Assurance (SQA)

1. Quality alone is not enough: the software also must be easily maintained.
2. SQA must be built in throughout the project, not simply imposed by the SQA group at the end of a workflow, say.

Software Quality Assurance (SQA)

3. **Primary Duty of SQA Group:** Ensure
    1. the quality (usual English meaning) of the S/W process, and thus ensure
    2. the quality (S/W product meaning) of the S/W product.
4. Once the developers complete a workflow and check their work, the SQA team must verify that all artifacts are correct.

Managerial Independence

1. Development and SQA teams should be led by independent managers, neither of whom can overrule the other.
2. **Reason:** Often major faults are found as the delivery deadline approaches. Then the S/W organization must decide between
    1. delivering the S/W on time with faults (likely development's choice, since they are more often driven by deadlines), or
    2. fixing the faults and delivering late (likely SQA's choice, since they are more often driven by quality).
3. Both must report to a third manager, who must then make the decision about what to do on a case-by-case basis.

Reviews

Definition 5

A **review** *is a* **walkthrough** *or an* **inspection**.

Common Features of All Reviews

1. **non-execution based testing**, i.e. no code is executed for this type of test
2. centred around a **meeting** of key stakeholders
3. chaired by SQA representative (because SQA has the biggest stake in getting all artifacts correct, and not letting faults slip through).

Common Features of All Reviews

4. the meeting is to test a document to **identify**, but **not attempt to fix**, faults in that document.
   Reasons:
   1. committee's solution is usually of lower quality than that of a trained expert
   2. committee's solution takes 4-6 times as much effort as an individual's.
   3. not all "faults" identified during a review are truly faults.
   4. takes too much time: a review should last at most two hours.

Walkthroughs

The two steps for a walkthrough:

1. preparation
2. team analysis of the document

Walkthroughs

4-6 participants (e.g. for an analysis artifact):

1. SQA (chair - as above)
2. manager responsible for requirements (previous workflow)
3. manager responsible for analysis (current workflow)
4. manager responsible for design (next workflow)
5. client representative (maybe less crucial for later workflows)

Managing Walkthroughs

Two fundamental approaches to conducting a walkthrough:

1. **participant** driven
2. **document** driven (usually more detailed and hence more time-consuming and effective at finding faults)

Managing Walkthroughs

Here is where the text explains (again) why reviews should **not** be used for performance appraisals:

1. in a review, success = finding faults
2. in a performance appraisal, success = finding no faults

Inspections

The five steps for an inspection (each with a formal process):

1. **overview** document author gives the overview; document is distributed to the participants.
2. **preparation** participants examine the document, individually.
3. **inspection** quick document walkthrough; immediately commence fault-finding.
4. **rework** document author corrects all faults noted in the written report from step 3.
5. **follow-up** moderator ensures that every fault identified has been fixed, and that no new faults were introduced in the process of fixing.

Inspections

Roles for an Inspection (e.g. for a Design Artifact):

1. **moderator** (from SQA)
2. **analyst** (i.e. stakeholder, previous workflow)
3. **designer** (i.e. document author; stakeholder, current workflow)
4. **implementer** (i.e. stakeholder, next workflow)
5. **tester** (SQA, a different person than the moderator)

Comparison of Walkthroughs and Inspections

Remarks:

1. Although inspections are more costly, there is evidence (see text §6.2.3) that they are more effective at finding faults.

Strengths and Weaknesses of Reviews

Strengths:

1. effective at detecting faults, especially
2. early in the life-cycle, when they are cheaper to fix.

Strengths and Weaknesses of Reviews

Weaknesses:

1. A large S/W product's artifacts are hard to review, unless they consist of smaller, independent components. Using OO helps to mitigate this.
2. Effectiveness of review team is hampered if not all documentation from the previous workflow is completed yet.

Examples

1. **inspection rate:**
   1. **requirements/designs:** # of pages / hour
   2. **code:** # of lines of code / hour
2. **fault density**
   1. **requirements/designs:** # of faults (major/minor) / page
   2. **code:** # of faults (major/minor) / 1000 lines of code
3. **fault detection rate:** # of faults (major/minor) detected / hour
4. **fault detection efficiency:** # of faults (major/minor) detected / person-hour

Remarks

1. The metrics attempt to measure our effectiveness at finding faults.
2. A spike in any of these metrics might indicate that the quality of the S/W development work has suddenly decreased, and not that fault detection has suddenly improved.