

ISTQB – Foundation Level

1

CHAPTER 3: STATIC TESTING

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AGENDA

2

- 3.1 Static techniques and the test process (K2)
- 3.2 Review process (K2)
- 3.3 Static analysis by tools (K2)

3.1 Static techniques and the test process

- Objectives

- LO-3.1.1 Recognize software work products that can be examined by the different static techniques. (K1)
- LO-3.1.2 Describe the importance and value of considering static techniques for the assessment of software work products. (K2)
- LO-3.1.3 Explain the difference between static and dynamic techniques. (K2)
- LO-3.1.4 Describe the objectives of static analysis and reviews and compare them to dynamic testing. (K2)

3.1 Static techniques and the test process

4

- Dynamic testing:
 - Software is executed using a set of input values and its output is then examined and compared to what is expected.
- Static testing:
 - Software work products are examined manually, or with a set of tools, but not executed

3.1 Static techniques and the test process

5

- Some issues arise for dynamic testing:
 - How can we evaluate or analyze a requirements document, a design document, a test plan, or a user manual?
 - How can we effectively pre-examine the source code before execution?
- One powerful technique that can be used is static testing, e.g. reviews.
- In principle all software work products can be tested using review techniques

3.1 Static techniques and the test process

6

- Software work product can be reviewed:
 - Requirements specifications,
 - Design specifications,
 - Code
 - Test plans,
 - Test specifications,
 - Test cases,
 - Test scripts
 - User guides or web pages

3.1 Static techniques and the test process

7

- Types of defects that are easier to find during static testing are:
 - Deviations from standards,
 - Missing requirements,
 - Design defects,
 - Non-maintainable code
 - Inconsistent interface specifications.
- Note that in contrast to dynamic testing, static testing finds defects rather than failures.

3.1 Static techniques and the test process

8

- Advantages:
 - Early defect detection and correction
 - Development productivity improvements
 - Reduced development timescales
 - Reduced testing cost and time
 - Lifetime cost reductions
 - Fewer defects and improved communication
- Potential problem:
 - Motivation of author is destroyed in bad review session
- Cost: 10-15% of development budget but can eliminate 70% of document defects

3.2 Review process (K2)

- Objectives

- LO-3.2.1 Recall the phases, roles and responsibilities of a typical formal review. (K1)
- LO-3.2.2 Explain the differences between different types of review: informal review, technical review, walkthrough and inspection. (K2)
- LO-3.2.3 Explain the factors for successful performance of reviews. (K2)

3.2.1 Phases of a formal review (K1)

10

- Phases of a formal review:
 - Planning
 - Kick-off
 - Preparation
 - Review meeting
 - Rework
 - Follow-up

3.2.1 Phases of a formal review (K1)

11

- Planning:
 - Select personnel
 - Allocating roles
 - Defining the entry and exit criteria
 - Selecting which parts of documents to look at
- Kick-off:
 - Distributing documents
 - Explaining the objectives
 - Checking entry criteria
- Individual Preparation:
 - The participants review the document before the review meeting
 - Noting potential defects, questions and comments

3.2.1 Phases of a formal review (K1)

12

- Review meeting:
 - Led by a review leader or moderator
 - Review leader ensure that all experts can express opinion without fear and conflicts will be prevented or resolved
 - Limited to 2 hours. Another meeting is called if needed but not before the next day.
 - Moderator can cancel or discontinue meeting if one or more reviewers don't appear, or if they are insufficiently prepared.
 - The document subjected to review is subject to discussion, not the author
 - The moderator should not be a reviewer at the same time

3.2.1 Phases of a formal review (K1)

13

- Review meeting:
 - Every reviewer must have the opportunity to adequately present their issues.
 - The issues should be weighted
 - Review team shall make a recommendation for the acceptance of the review object

3.2.1 Phases of a formal review (K1)

14

- Rework:
 - Fixing defects found
- Follow-up:
 - Checking that defects have been addressed

3.2.2 Roles and responsibilities (K1)

15

- Roles and responsibilities:
 - The moderator
 - The author
 - The scribe
 - The reviewers
 - The manager

3.2.2 Roles and responsibilities (K1)

16

- **Moderator:**
 - Lead the review meeting
 - Determine the type of review (with author)
 - Perform Entry check and follow-up after the meeting
- **Author:**
 - Author of the documents to be reviewed
 - Learn and improve the ability of writing
 - Illuminate unclear areas

3.2.2 Roles and responsibilities (K1)

17

- **Scribe (or recorder):**
 - Record defect and suggestion.
 - Documents all the issues
- **Reviewers:**
 - Identify and describe found defects
 - Should be represent different perspectives and roles
- **Manager:**
 - Decide on execution of review
 - Allocate time in project schedule
 - Review objectives

3.2.3 Types of review

18

- Informal review
 - no formal process;
 - There may be pair programming or a technical lead reviewing designs and code; optionally may be documented;
 - May vary in usefulness depending on the reviewer;
 - Main purpose: inexpensive way to get some benefit.
- Formal review:
 - Walkthrough
 - Technical review
 - Inspection

3.2.3 Types of review

19

- Walkthrough:
 - An informal review method to find defects, ambiguities, and problems in written documentation
 - Also to educate audiences regarding a software product
 - Meeting led by author;
 - Preparation is the least compared to the other types of reviews
 - Suitable for small development teams of 5-10 persons and causes little effort
 - Main objectives are mutual learning, development of an understanding of the test object, and error detection

3.2.3 Types of review

20

- Technical review:
 - Focus is compliance of the document with the specification, fitness for its intended purpose, and compliance to standards.
 - During preparation, the reviewers inspect the review object according to the specified review criteria.
 - Reviewers must be technically qualified experts
 - Management does not participate
 - Most of the effort lies in the preparation work
 - Main purposes: discuss, make decisions, evaluate alternatives, find defects, solve technical problems and check conformance to specifications and standards

3.2.3 Types of review

21

- Inspection:
 - The most formal review, follows a formal, prescribed process
 - Led by trained moderator
 - The inspection object is checked with formal entry criteria prior to starting
 - The inspectors prepare themselves using procedures, standards, and checklists.
 - Data are also collected for general quality assessment of the development process and the inspection process
 - Main objective of inspection is error detection

3.2.4 Success factors for reviews

22

- Possible difficulties:
 - Required persons are not available or not have required qualification or technical aptitude
 - Inaccurate estimates during resource planning by management
 - Wrong reviewers were chosen
 - Missing or insufficient documentation
 - Management support is lacking, because the necessary resources will not be provided and results will not be used for process improvement

3.2.4 Success factors for reviews

23

- Success factors for reviews:
 - Each review has a clear predefined objective
 - The right people for the review objectives are involved
 - Defects found are welcomed
 - Review techniques are applied that are suitable to the type and level of software work products and reviewers
 - Checklists or roles are used if appropriate to increase effectiveness of defect identification
 - Training is necessary
 - Management supports a good review process
 - There is an emphasis on learning and process improvement

3.3 Static analysis by tools (K2)

- Objectives

- LO-3.3.1 Recall typical defects and errors identified by static analysis and compare them to reviews and dynamic testing. (K1)
- LO-3.3.2 List typical benefits of static analysis. (K1)
- LO-3.3.3 List typical code and design defects that may be identified by static analysis tools. (K1)

3.3 Static analysis by tools (K2)

25

- Static analysis:
 - As with reviews, to reveal defects or parts that are defect-prone in a document
 - Tools do the static analysis
 - Document to be analyzed must follow a certain formal structure in order to be checked by a tool: code, HTML, XML, UML...
 - Typically used by developers
 - If a static analysis is performed before review, effort is much less in review
 - Not all defects can be found using static testing

3.3 Static analysis by tools (K2)

26

- Typical defects discovered by static analysis tools include:
 - Referencing a variable with an undefined value;
 - Inconsistent interface between modules and components;
 - Variables that are never used;
 - Unreachable (dead) code;
 - Programming standards violations;
 - Security vulnerabilities;
 - Syntax violations of code and software models.
 - Control flow anomalies
 - Data flow anomalies

3.3 Static analysis by tools (K2)

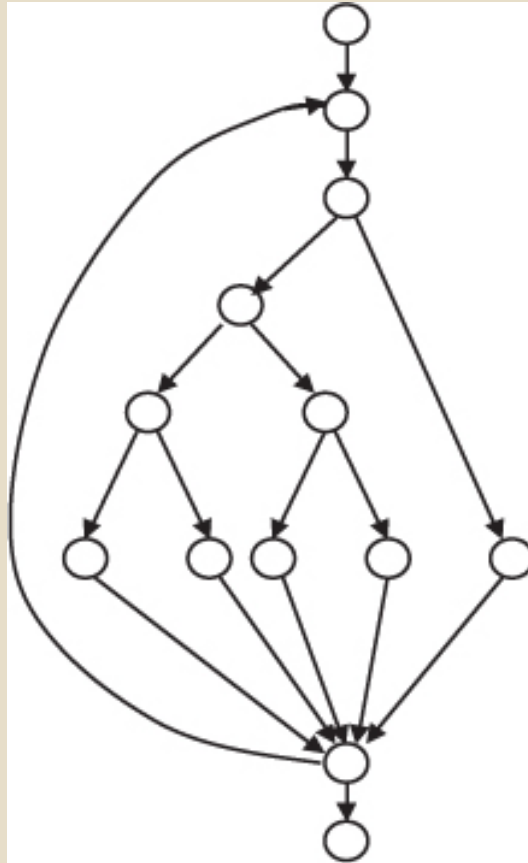
27

- Data Flow Analysis:
 - Data flow analysis is another means to reveal defects
 - The usage of data on paths through the program code is checked
 - For ex: Reading variables without previous initialization, or not using the value of a variable at all
 - The usage of every single variable is inspected
 - 3 types of data flow anomalies:
 - ✦ An undefined value of a variable is read
 - ✦ Variable is assigned a value that becomes invalid/undefined
 - ✦ Variable receives a value for the second time and the first value had not been used

3.3 Static analysis by tools (K2)

28

- Control Flow Analysis:



3.3 Static analysis by tools (K2)

29

- Determining Metrics
 - Static analysis tools also provide measurement values
 - Quality characteristics can be measured with measurement values, or metrics
 - Cyclomatic number: measures the structural complexity of program code

Summary

30

- Static techniques and the test process
- Review process
- Static analysis by tools

References

- Rex Black, Foundations of Software Testing
- ISTQB Foundation Syllabus.pdf

Q & A

Glossary

33

- **Static analysis:** Analysis of software artifacts, e.g. requirements or code, carried out without execution of these software artifacts.
- **Static code analyzer:** A tool that carries out static code analysis. The tool checks source code, for certain properties such as conformance to coding standards, quality metrics or data flow anomalies.
- **Static testing:** Testing of a component or system at specification or implementation level without execution of that software, e.g. reviews or static code analysis.

Glossary

34

- **Cyclomatic complexity:** The number of independent paths through a program.
- Cyclomatic complexity is defined as: $L - N + 2P$, where
 - - L = the number of edges/links in a graph
 - - N = the number of nodes in a graph
 - - P = the number of disconnected parts of the graph (e.g. a called graph and a subroutine) [After McCabe]

Glossary

35

- **Inspection:** A type of peer review that relies on visual examination of documents to detect defects, e.g. violations of development standards and non-conformance to higher level documentation. The most formal review technique and therefore always based on a documented procedure. [After IEEE 610, IEEE 1028] See also peer review.
- **Walkthrough:** A step-by-step presentation by the author of a document in order to gather information and to establish a common understanding of its content.

Glossary

36

- **Walkthrough:** A step-by-step presentation by the author of a document in order to gather information and to establish a common understanding of its content.
- **Technical review:** A peer group discussion activity that focuses on achieving consensus on the technical approach to be taken.

Glossary

37

- **Peer review:** A review of a software work product by colleagues of the producer of the product for the purpose of identifying defects and improvements. Examples are inspection, technical review and walkthrough.
- **Informal review:** A review not based on a formal (documented) procedure.
- **Formal review:** A review characterized by documented procedures and requirements, e.g. inspection.