Software Systems Verification and Validation

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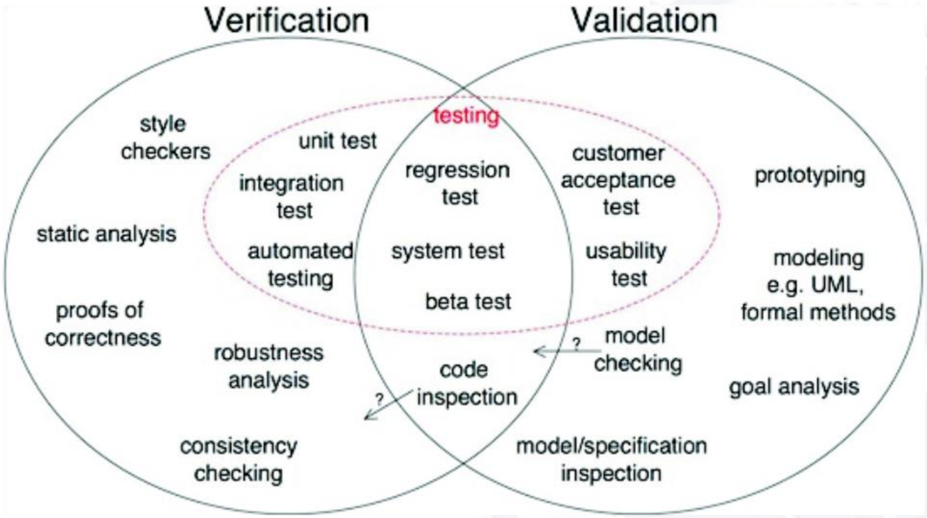
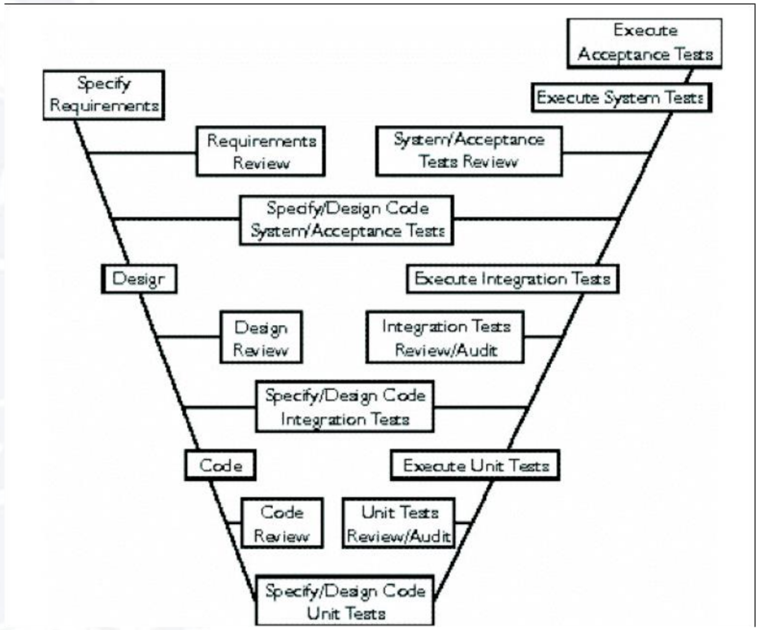
"Tell me and I forget, teach me and I may remember, involve me and I learn."

(Benjamin Franklin)

What we will learn!

SDLC – V Model



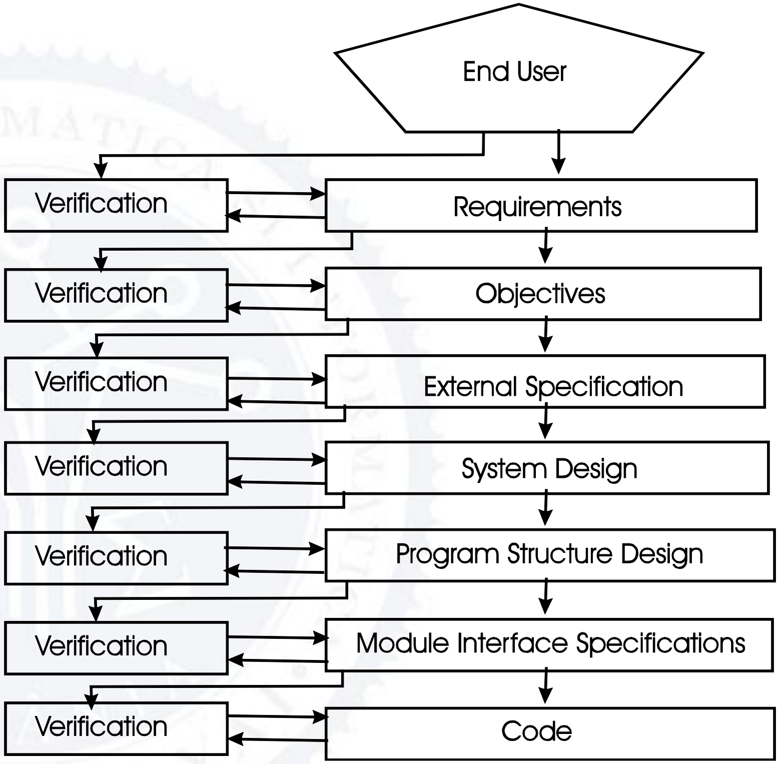

Execute Acceptance Tests
Specify Requirements
Execute System Tests
Requirements Review
System/Acceptance Tests Review
Specify/Design Code System/Acceptance Tests
Design
Execute Integration Tests
Design Review
Integration Tests Review/Audit
Specify/Design Code Integration Tests
Code
Execute Unit Tests
Code Review
Unit Tests Review/Audit
Specify/Design Code Unit Tests

Outline

- Human testing
- Human testing methods
  - Inspections
  - Walkthroughs
  - Pair-programing

Human testing

- Prevent errors
  - introduction of a verification step at the end of each process.



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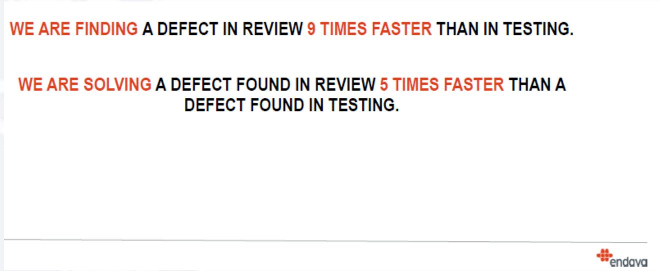
Human testing methods

- Is it useful? they contribute to productivity and reliability:
  - The earlier errors are found, the lower the cost of correcting the errors.
  - Psychological change of programmers when computer-based testing commences.
- Human testing methods are:
  - Inspections
  - Walkthroughs
  - Pair-programing



WE ARE FINDING A DEFECT IN REVIEW 9 TIMES FASTER THAN IN TESTING.

WE ARE SOLVING A DEFECT FOUND IN REVIEW 5 TIMES FASTER THAN A DEFECT FOUND IN TESTING.

- Objective - to find errors but not to find solutions to the errors.
- Advantage - when an error is found it is usually located.
  - **Finds from 30% to 70% of the logic-design/coding errors in programs (?).**
- Inspection and computer-based testing are complementary.

[Mye04] (chapter 3), [PY08] (chapter 18), [Fre10] (chapter 4)

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Inspection

- **Inspection** - process of trying to find defects in development documents during various phases of the software development process.
- Fagan Inspection team ([4 members])
  - Moderator - duties
    - Distributing materials and scheduling the inspection session.
    - Leading the session
    - Ensuring that the errors are subsequently corrected.
  - Author of the product (analyst, designer, programmer)
  - Secretary
  - Reader
- Checklists
- Time - 90-120 minutes

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Inspection activities

- **Planning**
  - the moderator selects the team members
  - distribution of the materials to the members; task assignment
- **Presentation/Overview - not compulsory**
  - used to present details to the members of the inspection team
- **Individual preparation**
  - reading and understanding the received documentation
- **Inspection meeting**
  - critical observations of each individual inspectors - discussed
  - conclusions of the inspection - documented
- **Rework**
  - the author makes the required changes and correct the errors
- **Follow-up**
  - to verify if the modification did eliminate the errors
  - may be only between the author and the moderator

Inspection checklists

- Inspection scope - to find errors
- Depending on the analyzed document - special kind of errors
- **Specification Document**
  - Does the specification conform to the user’s needs?
  - Are there ambiguities in the specification?
  - Do the input/output date are clearly stated? What about input/output conditions?
  - Are there requirements that are not present in the specification?
  - Are there performance conditions? What precise computation conditions?
- **Analysis Document**
  - Does the design conform to the specification?
  - Are all the functionalities from the specification specified?
- Is there an analysis documentation about the made decisions? Inspection scope - to find errors

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  - Is there an analysis documentation about the made decisions?

- **Code**
  - Does the code conform to the design?
  - Are all the methods are called?
  - Are all the variables initialized?
  - Problems with: infinite cycles, out of bound indexes, improper allocation of memory.
- **Test Document**
  - The test cases are well documented?
  - The test cases are well chosen?
  - Are the test data sufficient to coverage criterion?
  - For the integration testing, the order of integration is clear?
  - At regression testing is the testing continued?

Inspection advantages [CB03]

- Early error discovery
- Reduce product development time and cost
- Group method
- Mean to education
- The source of error is known (locating defect)
- Eliminates the debugging stress if few day remains until product release

- Inspection – more efficient than testing [CB03]
  - detecting, locating, repairing defect
  - a two-pass approach (individuals first and by the group)
  - checklist – calls attention to specific defect prone areas

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Walkthrough

- **Walkthrough** [You79], [CB03] - process of trying to find defects in development documents during various phases of the software development process.
- Similar to Inspection
- **Team members** ([3-5] members)
  - Moderator ([CB03]- moderator = the producer of the reviewed material
    - ➔ a larger amount of material can be processed by the group)
  - Secretary
  - Tester
- **Procedures** are slightly different
  - Planning
  - Meeting - the participants “play computer” (no checklist)
  - No Individual preparation [CB03]
  - Rework [You79]
  - Follow-up
- Different error-detection technique
- Time - 90-120 minutes

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Pair-Programming

- Variation of program inspection.
- Merges coding and inspection activities.
- The inspection activities
  - are not driven by checklists
  - are based on shared programming practice and style
- Programmers frequently alternate roles
- Is carried out in normal workdays, without excessive overtime and without severe schedule pressure.
- No mediator, so responsibility for open and non-defensive discussion of decisions/alternatives falls to the programmers.

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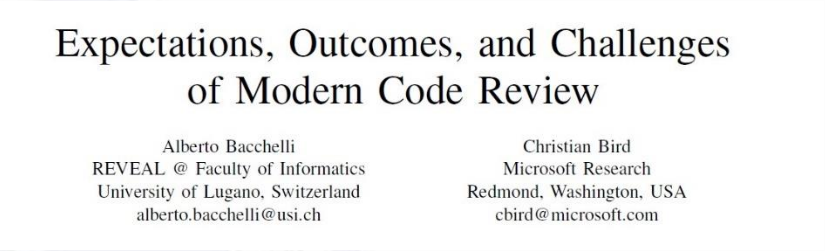
- Modern Code Review



Expectations, Outcomes, and Challenges of Modern Code Review

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A systematic literature review and taxonomy of modern code review[☆]

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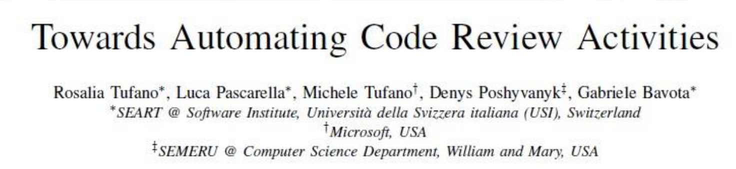

Towards Automating Code Review Activities

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‡SEMERU @ Computer Science Department, William and Mary, USA*

Using Pre-Trained Models to Boost Code Review Automation

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Go to www.menti.com and use the code 18 11 0

Next Lecture

- Testing. Test planning.
- Test case design - Black-box testing

- Testing Management Tool - TestLink
- Continuous integration - Jenkins

References

- [PY08] M. Pezzand and M. Young. *Software Testing and Analysis: Process, Principles and Techniques*. John Wiley and Sons, 2008.
- [Mye04] Glenford J. Myers, *The Art of Software Testing*, John Wiley & Sons, Inc., 2004
- [You79] E. Yourdon, Structured Walkthroughs, Prentice-Hall,Englewood Cliffs, NJ, 1979
- [CB03] Jean-Francois Collard and Ilene Burnstein. *Practical Software Testing*. Springer-Verlag New York, Inc., 2003.
- [Fre10] M. Frentiu, Verificarea si validarea sistemelor soft, Presa Universitara Clujeana, 2010

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