About the Course Software Testing & Verification

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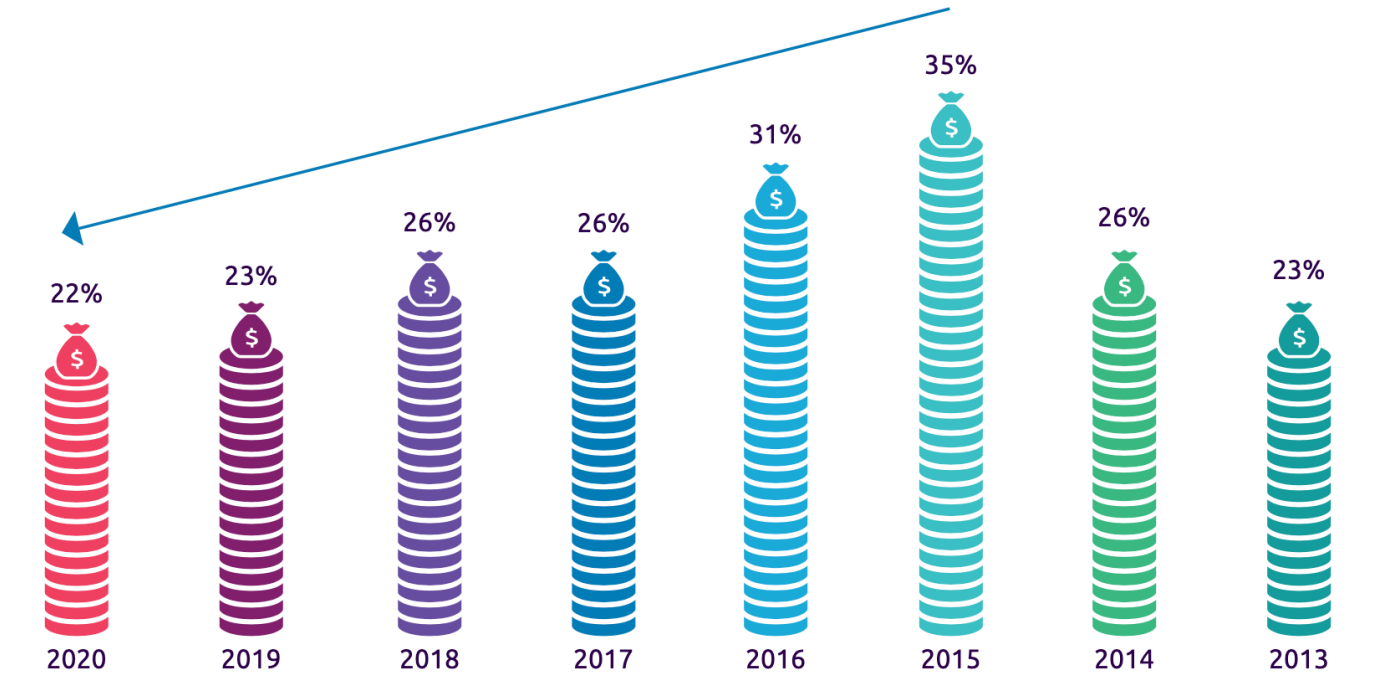
Why do we care?

1. Because we want to deliver quality products!
2. Because poor quality, including software bugs, may have severe consequences

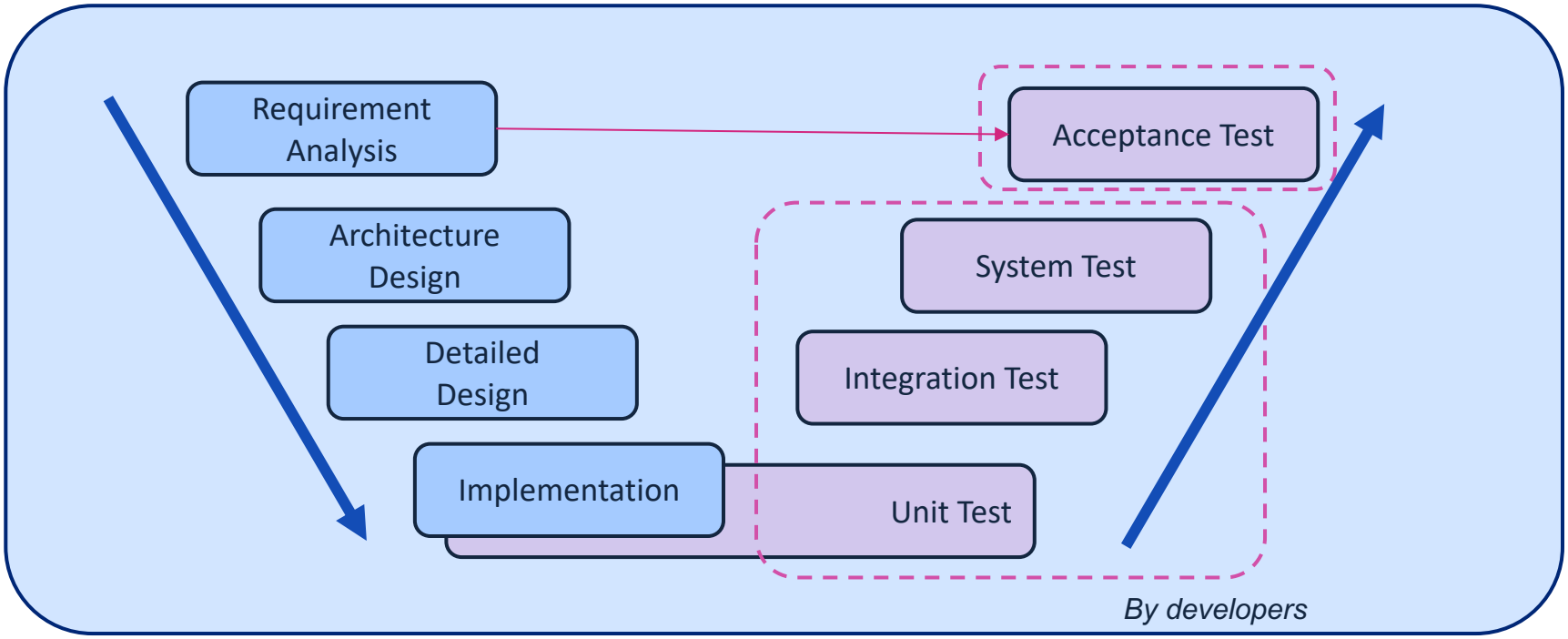
- e.g. some errors in the software of UK Inland Revenue is rumored to cause tax-credit over-payment of 3.45 billions USD. (Charette, *Why Software Fails*. IEEE Spectrum, 2005)
- Uber self-driving accident 2018

Invested effort in quality assurance (QA)



World Quality Report, 2020/21. 1750 mostly CIOs, 32 countries

The project management aspect of quality assurance is non-trivial



A typical testing project approach called “V-model”

In this course we will focus on the technical foundation of software verification

- How to specify what constitutes “correct” behavior?
- How to verify the correctness of a program?
- What constitute good tests ? When have we tested enough?
- Can we automate these steps?

(top level) Learning Goals

- **Know** a selected set of basic concepts, theories, techniques, and technologies of *Software Testing* and *Software Verification*
  They represent two complementary approaches towards software correctness : *pragmatism* vs *completeness*.

- **Able to relate** these theories and techniques to real problems.

Not in scope

- Project management aspects of quality assurance (QA) in a large project → covered in Software Project (bachelor).
- Automated verification algorithms → covered in the Program Semantic & Verification course (master).

Pre-requisite

- C#
- Working with IDE
- The “software verification” part will go into the mathematical foundation of verification. You will need background in:
  - Set theory
  - Predicate logic

Site & Materials

- ics.uu.nl/docs/vakken/b3stv

- Paul Ammann and Jeff Offutt, Introduction to Software Testing, **1st edition**, Cambridge University Press, Cambridge, UK, ISBN 0-52188-038-1, 2008. 2nd Ed is also ok, if you can't get 1st anymore.

- Lecture Notes (can be obtained from the website), for the program verification part.

Project & assignment

- Software testing homework (3x).
- Testing **Project**
- Proving program correctness **assignment** (3x)

Grading

- In total **9 components**: testing homework (3), project, proof assignments (3), 2x exams.
- **Criteria to pass the course**:
  1. You do all exams and projects.
  2. The average of your exams should be ≥ 5.0.
  3. Your score (see below) should be ≥ 6
- *score = **if** 5.0 ≤ raw ≤ 6.0 **then** raw rounded to the closest int*
  __else__ raw rounded to the closest 0.1
- *raw* = 0.05 * testing homework
  + 0.2 * proof assignments
  + 0.25 * testing project
  + 0.25 * exam-1 + 0,25 * exam-2

  Your *final* score = "score" (above), except if you didn't meet criteria 1 or 2 above; then your final score would either NVD or AANV.
- Resit: only if you fail and (4.0 ≤ *raw* or *final*=AANV)

Use of AI (ChatGPT etc)

- Using AI like ChatGPT for homeworks and proof assignments are **not allowed** (count as cheating).
- Using CoPilot for your testing project is allowed (we just see it as another test generator).
  - Do not blindly trust CoPilot !
  - You have the end-responsibility (you can't blame CoPilot if your solution doesn't work).

Software

- Jetbrains Raider IDE, you can get free education license. Works on Windows and Mac, supposedly also on Linux.
- Or Visual Studio **Enterprise** edition**. Not free.**
- Use Github to host your project. Please make your git-repository private!

Load

- We have a pretty dense programme. Expect to commit at least 16hrs/week.
- Suggested plan:
  - Lectures + lab/wekcollege sessions: 8h/w
  - Self-study the theory: 4h/w
  - Sprints for your Testing Project: 4h/w

Running the course

- Overall week-to-week plan: see website
- MS-Team B3STV, for:
  - **Submitting Testing-homeworks and Proof-assignments.**
  - **Channels where you can pose questions.**
- Lectures and werkcolleges are physical (on-site) every Monday and Thursday. You have the TAs during the werkcolleges.
- I will be monitoring Team-channels outside werkcollege hours.

Crew

- Wishnu Prasetya (lectures, werkcollege, Team)
- Gabriele Keller (lectures)
- Quincy Einmahl (TA, werkcollege)
- Charl-Pierre Marais (TA, werkcollege)
- Ben Stokmans (TA, werkcollege)
- Mitchel Zhu (TA, werkcollege)