MONASH
University

FIT2107 Semester 2 2022

Week 1 – Introduction to Software Quality

25-07-2022

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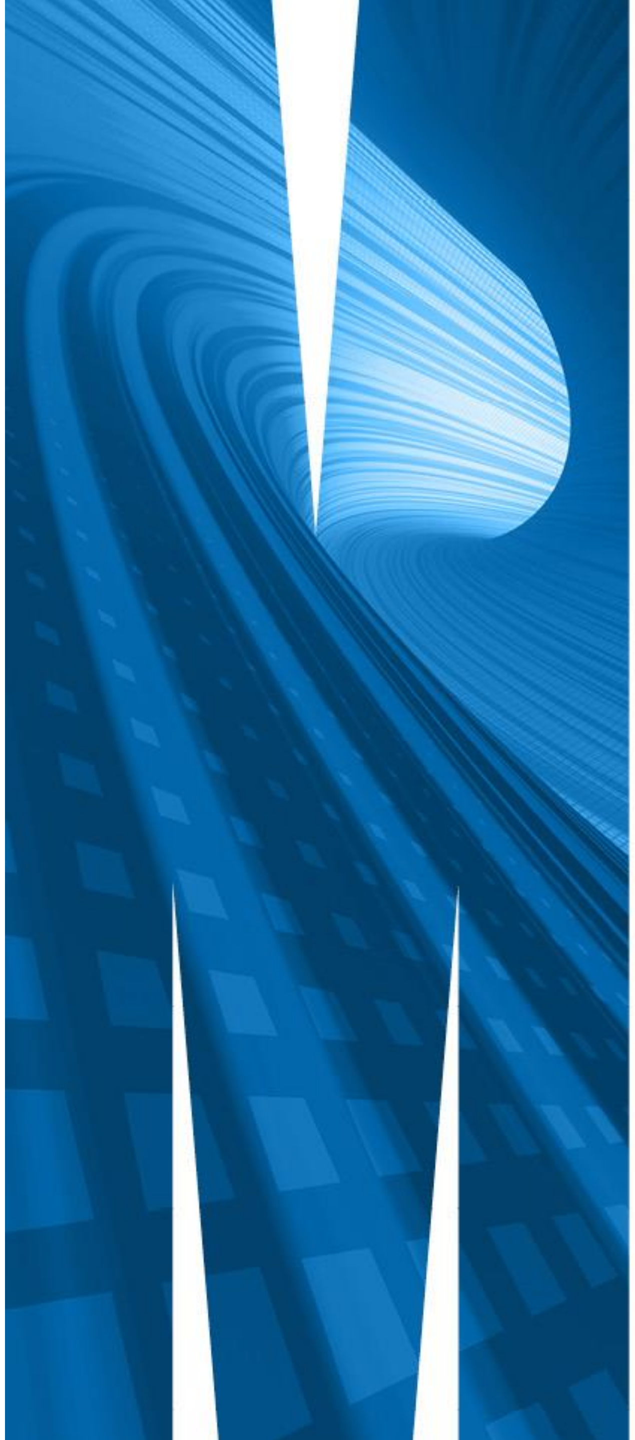


Cases of Quality Failures

Queensland Health Payroll

- In 2009 Queensland government attempted to replace to the payroll system
- Queensland Health's 85,000 workers went without pay, or were overpaid
- The project of $384 million cost over $1.25 billion
- An audit found that the project's difficulties were caused by
  - woeful project scope definition
  - poor governance
- The inquiry commission by Supreme court further revealed
  - unwarranted urgency
  - lack of diligence.
- Results?
  - The incumbent government lost the election due to this scandal.
  - IBM had to pay millions in legal battle.

https://delimiter.com.au/2013/08/07/anatomy-of-qld-health-it-disaster%E2%80%A8-ibm-should-never-have-been-appointed/

Cases of Quality Failures.

Malaysian Banks Hacking.

- On 8th April 2014, Microsoft announced that they will stop supporting Windows XP
- 90% of Malaysia's ATM were running on Windows XP.
- Although being notified a potential exploit on XP, 3 local banks choose not to do anything about it because the old ATM software cannot be run on Windows 7/8.
- They will need to spend extra money on new hardware and software
- The software developers didn't bother to test the system
- Results?
  - A group of hackers got away with RM3million (~1 million AUD)

http://www.themalaymailonline.com/malaysia/article/banks-knew-atms-were-open-to-attacks-source-claims
http://www.financetwitter.com/2014/09/here-is-how-malaysian-atms-were-hacked-of-rm3-million-by-latin-americans.html

Cases of Quality Failures.

Uber Self Drive Crash.

- “The fatal crash that killed pedestrian Elaine Herzberg in Tempe, Arizona, in March occurred because of a software bug in Uber's self-driving car technology. Uber's sensors did, in fact, detect Herzberg as she crossed the street with her bicycle. Unfortunately, the software classified her as a "false positive" and decided it didn't need to stop for her.
- Distinguishing between real objects and illusory ones is one of the most basic challenges of developing self-driving car software. Software needs to detect objects like cars, pedestrians, and large rocks in its path and stop or swerve to avoid them. However, there may be other objects—like a plastic bag in the road or a trash can on the sidewalk.
- Software designers face a basic trade off here. If the software is programmed to be too cautious, the ride will be slow and jerky, as the car constantly slows down for objects that pose no threat to the car or aren't there at all. Tuning the software in the opposite direction will produce a smooth ride most of the time—but at the risk that the software will occasionally ignore a real object.”

Risk Management

- All projects have risks that can affect
  - Timeliness of delivery (or indeed whether the product is delivered at all!)
  - Quality of product
- Risk management is concerned with
  - Identifying risks
  - Defining strategies for preventing or controlling the risk
- Risk analysis should happen at start of project
  - Improve the likelihood of a realistic project plan
  - Increase the chance of completing project on-time and on-budget
- Risks should be reassessed throughout the lifecycle

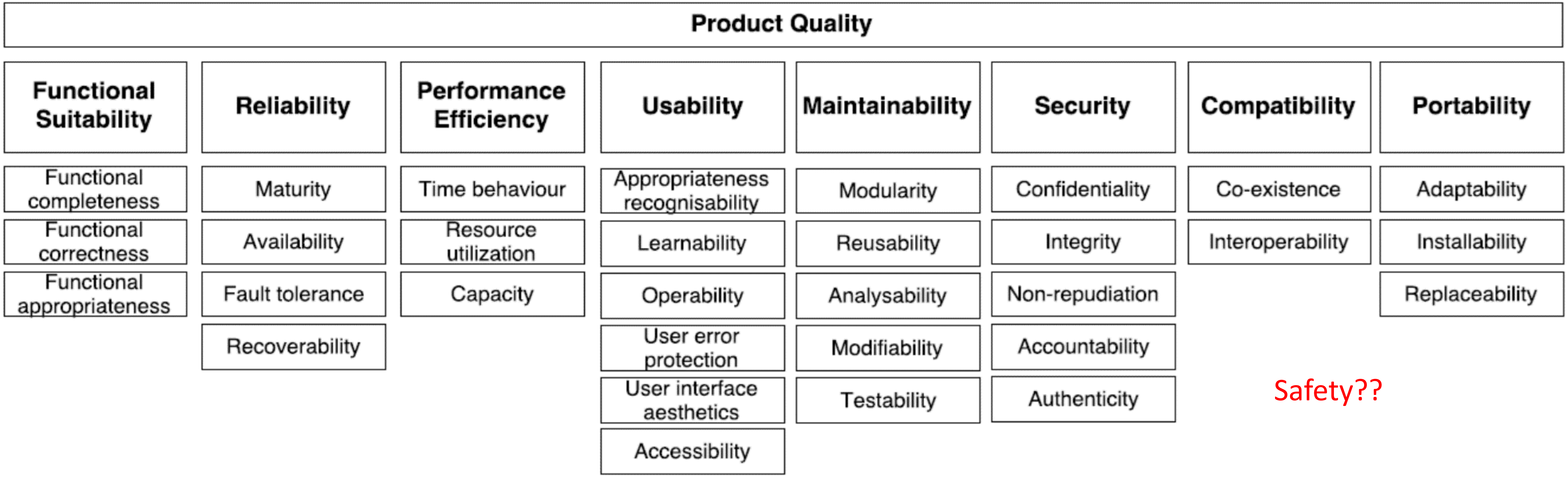
What is Software Quality?

- Quality means the degree to which a product or a process meets requirements (functional quality).
- Supports the delivery of functionality requirements such as maintenance, robustness etc. (non-functional quality).
- What makes software quality so hard?
  - Software systems are growing in **complexity**: Modern systems are composed of millions of lines of code!
  - Some **quality requirements** are difficult to specify in an unambiguous way.
  - Software systems are **intangible**: Our senses cannot help us understand them.
  - Software systems are **malleable**: Small changes can have huge repercussions.
  - **Limited human resources** for finding defects: Window for finding/fixing defects is small.
- The focus may be **‘fitness for purpose’** rather than specification conformance.

Software Fitness for Purpose

- Has the software been properly tested?
- Is the software sufficiently dependable to be put into use?
- Is the performance of the software acceptable for normal use?
- Is the software usable?
- Is the software well-structured and understandable?
- Have programming and documentation standards been followed in the development process?
- Good quality software must answer YES to the above questions!!!

Software Quality Attributes (ISO 25010)



Product Quality

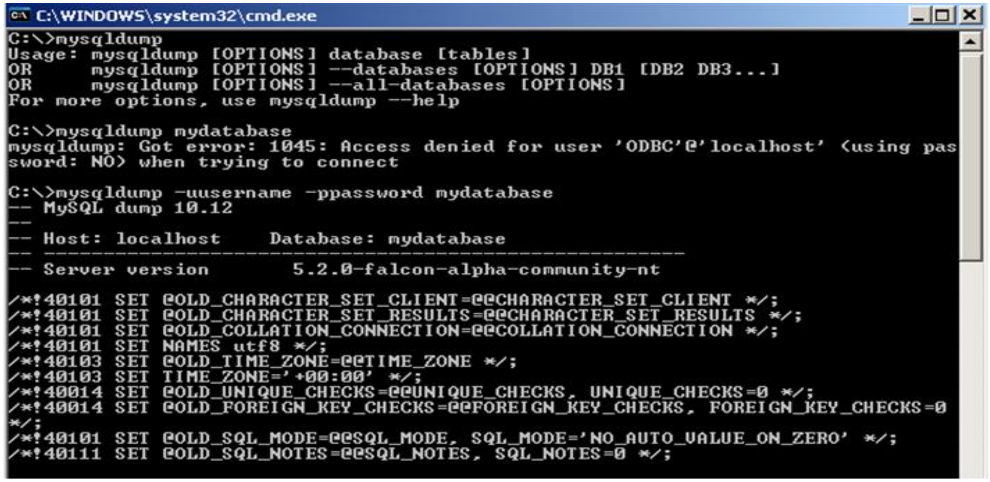
Functional Suitability	Reliability	Performance Efficiency	Usability	Maintainability	Security	Compatibility	Portability
Functional completeness	Maturity	Time behaviour	Appropriateness recognisability	Modularity	Confidentiality	Co-existence	Adaptability
Functional correctness	Availability	Resource utilization	Learnability	Reusability	Integrity	Interoperability	Installability
Functional appropriateness	Fault tolerance	Capacity	Operability	Analysability	Non-repudiation		Replaceability
	Recoverability		User error protection	Modifiability	Accountability		
			User interface aesthetics	Testability	Authenticity		
			Accessibility				

Safety??

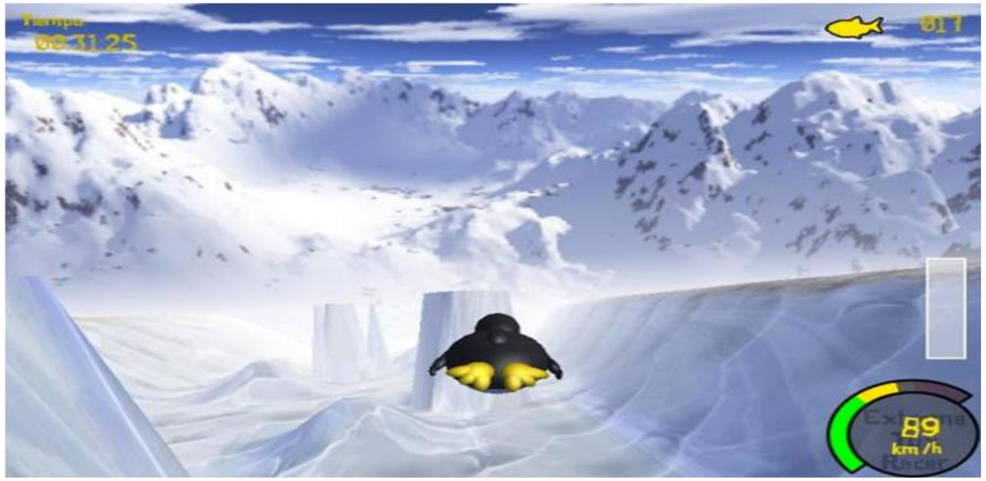
Source: L. Garcés, F. Oquendo and E. Y. Nakagawa, "A Quality Model for AAL Software Systems," 2016 IEEE 29th International Symposium on Computer-Based Medical Systems (CBMS), Dublin, 2016, pp. 175-180, doi: 10.1109/CBMS.2016.46.

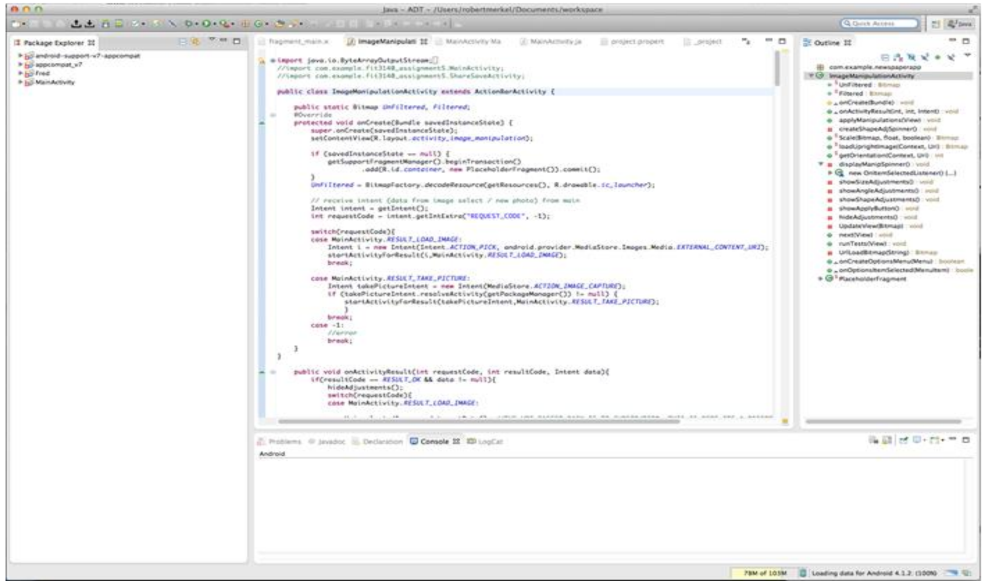
In Class Exercise

Evaluate the following products on ISO 25010 standards.

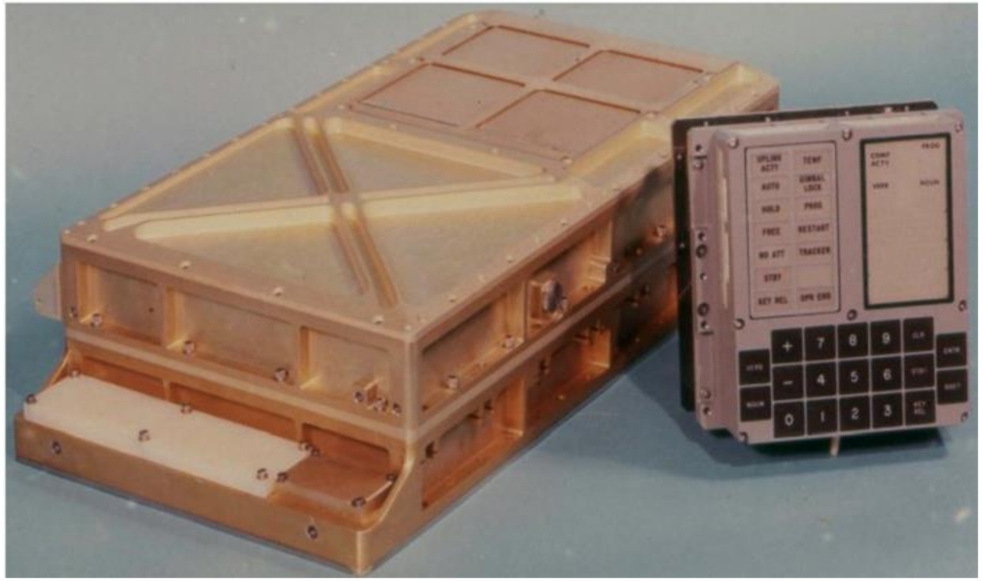


```
C:\>mysqldump
Usage: mysqldump [OPTIONS] database [tables]
OR     mysqldump [OPTIONS] --databases [OPTIONS] DB1 [DB2 DB3...]
OR     mysqldump [OPTIONS] --all-databases [OPTIONS]
For more options, use mysqldump --help

C:\>mysqldump mydatabase
mysqldump: Got error: 1045: Access denied for user 'ODBC'@'localhost' (using pas
sword: NO) when trying to connect

C:\>mysqldump -uusername -ppassword mydatabase
-- MySQL dump 10.12
--
-- Host: localhost    Database: mydatabase
-- ------------------------------------------------------
-- Server version       5.2.0-falcon-alpha-community-nt

/*!40101 SET @OLD_CHARACTER_SET_CLIENT=@@CHARACTER_SET_CLIENT */;
/*!40101 SET @OLD_CHARACTER_SET_RESULTS=@@CHARACTER_SET_RESULTS */;
/*!40101 SET @OLD_COLLATION_CONNECTION=@@COLLATION_CONNECTION */;
/*!40101 SET NAMES utf8 */;
/*!40103 SET @OLD_TIME_ZONE=@@TIME_ZONE */;
/*!40103 SET TIME_ZONE='+00:00' */;
/*!40014 SET @OLD_UNIQUE_CHECKS=@@UNIQUE_CHECKS, UNIQUE_CHECKS=0 */;
/*!40014 SET @OLD_FOREIGN_KEY_CHECKS=@@FOREIGN_KEY_CHECKS, FOREIGN_KEY_CHECKS=0
*/;
/*!40101 SET @OLD_SQL_MODE=@@SQL_MODE, SQL_MODE='NO_AUTO_VALUE_ON_ZERO' */;
/*!40111 SET @OLD_SQL_NOTES=@@SQL_NOTES, SQL_NOTES=0 */;
```





```
import java.io.ByteArrayOutputStream;
//import com.example.fit3148_assignment5.MainActivity;
//import com.example.fit3148_assignment5.ShareSaveActivity;

public class ImageManipulationActivity extends ActionBarActivity {

    public static Bitmap UnFiltered, Filtered;
    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_image_manipulation);

        if (savedInstanceState == null) {
            getSupportFragmentManager().beginTransaction()
                    .add(R.id.container, new PlaceholderFragment()).commit();
        }
        UnFiltered = BitmapFactory.decodeResource(getResources(), R.drawable.ic_launcher);

        // receive intent (data from image select / new photo) from main
        Intent intent = getIntent();
        int requestCode = intent.getIntExtra("REQUEST_CODE", -1);

        switch(requestCode){
        case MainActivity.RESULT_LOAD_IMAGE:
            Intent i = new Intent(Intent.ACTION_PICK, android.provider.MediaStore.Images.Media.EXTERNAL_CONTENT_URI);
            startActivityForResult(i,MainActivity.RESULT_LOAD_IMAGE);
            break;

        case MainActivity.RESULT_TAKE_PICTURE:
            Intent takePictureIntent = new Intent(MediaStore.ACTION_IMAGE_CAPTURE);
            if (takePictureIntent.resolveActivity(getPackageManager()) != null) {
                startActivityForResult(takePictureIntent,MainActivity.RESULT_TAKE_PICTURE);
                }
            break;
        case -1:
            //error
            break;
        }
    }

    public void onActivityResult(int requestCode, int resultCode, Intent data){
        if(resultCode == RESULT_OK && data != null){
            hideAdjustments();
            switch(requestCode){
            case MainActivity.RESULT_LOAD_IMAGE:
```



What is Software Quality Assurance?

- A set of activities that define and assess the adequacy of software processes to provide evidence that establishes confidence that the software processes are appropriate for and produce software products of **suitable quality** for their intended purposes. (IEEE).
- A planned and systematic pattern of all actions necessary to provide adequate confidence that an item or **product conforms** to **adequate quality**.
- A set of activities designed to **evaluate the process** by which the products are developed or manufactured
- It includes the following activities:
  - Process definition
  - Process implementation
  - Auditing
  - Training

Software Quality Control (SQC)

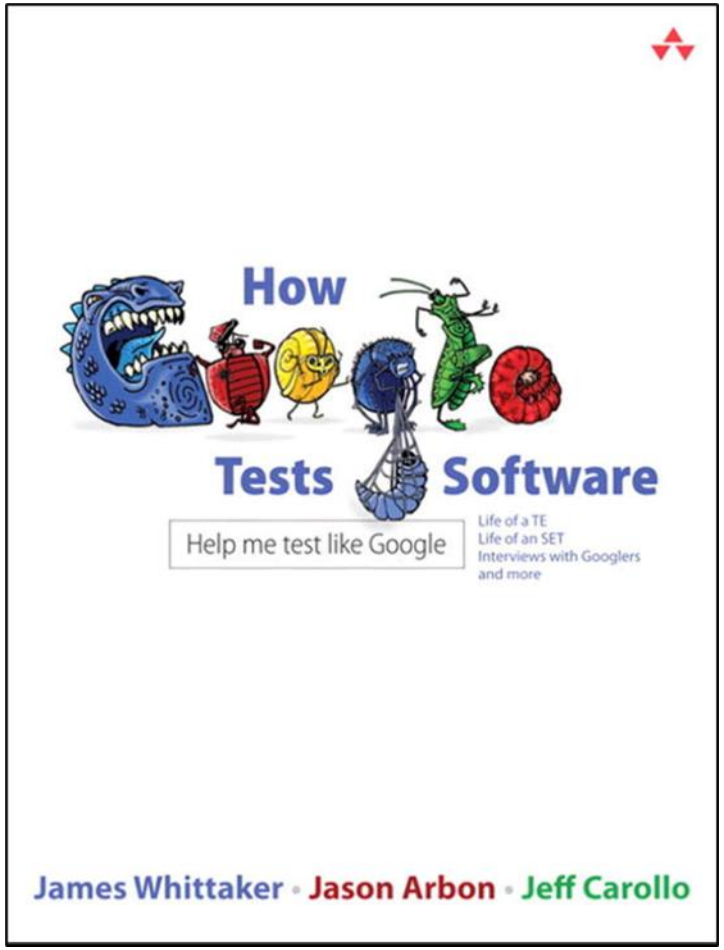
- SQC is a set of activities for ensuring quality in software products.
- It includes the following activities:
  - Reviews
    - **Code Reviews**
    - Requirement review
    - etc
  - Testing
    - **Unit testing**
    - Integration testing
    - Etc…

Limits of SQA

- No SQA technique can remove all risk
  - Blame Alan Turing
- In practice, reducing risk to super low levels is very costly
  - NICTA verified microkernel
  - 1 LOC per programmer/month!
- Need to balance costs of SQA with magnitude of risk

How Google Tests Software

“Quality is more an act of prevention than it is detection”


How Google Tests Software
Help me test like Google
Life of a TE
Life of an SET
Interviews with Googlers and more
James Whittaker · Jason Arbon · Jeff Carollo

Software Engineer (SWE)

- Write code/test code (including test-driven design)
- Write unit tests
- Engineers own quality for everything they touch

Software Engineer in Test (SET)

- Review designs
- Check code quality and risk
- Refactor
- Partner with SWE aiming to increase quality and test coverage, rather than adding new features

Test Engineer (TE)

- Write test automation scripts
- Interpret test results
- Drive test execution
- Product experts
- Quality advisers
- Risk analyzers

https://www.amazon.com/Google-Tests-Software-James-Whittaker/dp/0321803027

Closing Notes

- Python will be mainly used for FIT2107
  - assignments, workshops, exams, etc.
  - We shall use Python in an object oriented way.
- Warning: This is not a Python Unit but require basic knowledge of Python language.
- If you don’t have much experience in Python
  - It’s better to start learning Python NOW!!!!
- Expectation: By the end of Week 1, all students must be able to understand software quality assurance
- They can program and compile Python scripts on an IDE (e.g., PyCharm or VS Code or command line/terminal).