Introduction and Process

Lecture 1

Ruzanna Chitchyan, Jon Bird, Pete Bennett
TAs: Mitch Lui, Craig Barnfield, Kira Clements

Meet the Team

Lecturers

Ruzanna Chitchyan

Peter Bennett

Jon Bird

Lab Support

Mitch Lui

Craig Barnfield

Kira Clements

Purpose of Unit

Previous units aim to improve your knowledge as computer scientists

This unit helps package this knowledge as employability skill-sets

This is achieved by targeting the following industry-relevant issues:

- Transferable skills: Management, Collaboration, Communication
- Platform skills: applying your prior programming language knowledge
- Scalability skills: Development “in the large” at industrial scale

Software Development

But have you heard of ***Software Crisis***

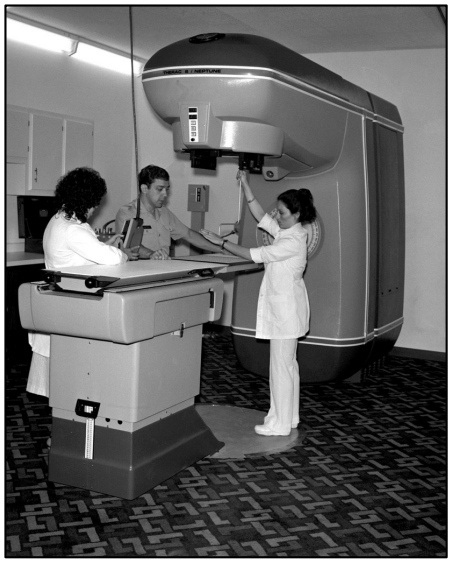
- Software is getting larger and larger
- Software is getting more complex
  - Complex domains (e.g., human behaviours)
  - Systems dependency (e.g., energy and cars)
- Time to market is shorter than ever

And Projects Fail

Ariane 5 Flight 501

Mars Climate Orbiter

Therac-25 Radiotherapy



Why Do Software Projects Fail?

- Bad developers – not the main problem!
- Over budget
  - Poor requirements
  - Over-ambitious requirements
  - Unnecessary requirements
- Contract management
- End-user training
- Operational management

Software Engineering

- Software Engineering
  - Engineering**: cost-effective solutions** to practical problems by applying **scientific knowledge** to building **things** for **people**
    - Cost-effective solutions: process and project management, contracts…
    - Scientific knowledge: modelling, proofs, testing, simulation, patterns...
    - Things=software
    - People: customers and end users

OK, so how do we do *that* ?

Collaboration Tools and Techniques

- UML Designs: Diagramming to reach a consensus on design
- GitHub: Sharing of documents for effective collaboration
- Kanban: Task allocation and progress monitoring
- Test-driven development: Stop other people breaking your code !
- Other techniques are encouraged: Feel free to experiment and explore

Weekly Themes

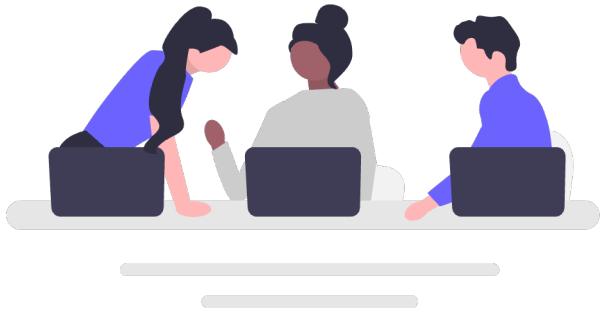
1. Introduction + Overview
2. Agile Development
3. Requirements Engineering
4. Design
5. Implementation
6. [Reading Week]
7. Project Management
8. Human Computer Interaction: Qualitative Analysis
9. Human Computer Interaction: Quantitative Analysis
10. [Easter break: 3 weeks]
11. Advanced Topics in Software Engineering
12. Module Closure

Week	Date	**Lecture** Monday 11:00-12:00 *PHYS BLDG G44 FRANK*	**Workshop** Monday 13:00-15:00 *MVB 2.11 PC*	**Groupwork**
1	23/01/22	Introduction and Process [slides] [materials]	Teams, Waterfall Method and Project Brief [slides] [case study] [project brief]	Research games, create list on team repo. Install Processing
2	30/01/22	Agile Methodology and User Centred Design	Intro to Processing, Agile Techniques	Decide on two game ideas
3	06/02/22	Requirements Engineering	Paper Prototyping, Requirements, Ideas Clinic	Collect requirements. Decide on final idea
4	13/02/22	Object Orientated Design	Classes Activity	Add requirements section to report
5	20/02/22	Implementation	ase Study, Spring Prep, Continuous Integration	Develop a working prototype over reading week!
6	28/02/22	READING WEEK	GAMES JAM	
	06/03/22	Project Management	IN CLASS TEST (assessing lectures 1-4)	Define team roles
8	13/03/22	HCI - Qualitative	HCI Qualitative Task	Add qualitative assessment (of your choice) to report
9	20/03/22	HCI - Quantitative	HCI Quantitative Task	Add quantitative assessment (of your choice) to report
	27/03/22	EASTER week 1	SPRINT 1	
	03/04/22	EASTER week 2	SPRINT 2	
	10/04/22	EASTER week 3	SPRINT 3	
10	17/04/22	Software Engineering Extended	IN CLASS TEST (assessing lectures 5-9)	Develop Game
11	24/04/22	Coursework Feedback		Finish Report
12	01/05/22	Bank Holiday Monday (no class)	Demo Day Weds/Thurs (tbc)	Submit Report

- 25% in class test A
- 25% in class test B
- **25% project report**
- **25% project presentation**

Coursework

- You get to work on one big project – for the whole term
- Apply all of the knowledge you have gained previously…to a significantly sized, real project
- Work on the project is structured, We won't just leave you to get on with it !
- Each week you will be given a structured activity, and support will be provided to complete that work
- You will be working as part of an integrated development team…



Groupwork

- We can only hope to tackle a real-world scale application...

  ....if we work in teams towards the end goal

- Working together is also a key transferable skill
- In any non-trivial industrial project, you'll be working in a team (maybe summer project!)
- It's not easy – which is why it is essential to practice now!

- Teams of 5 (or 6), assigned randomly

“Tasting Stick” Metaphor

- All of the previously named techniques are large and complex
- We don’t expect you to become experts in everything
- The aim is to give you a “taster” of everything
- So you can at least be able to say that you have tried them
- One way to think of this unit is as a “tasting stick”
- Working in groups, individuals are likely to specialise in some aspects

What's Happening This Week?

This week's theme - ***Introduction and Overview***!

Lecture: Grounding of the SE Discipline and Historic View

Introduction to Software Engineering
Waterfall Life Cycle Model

Workshop:

Teams, Waterfall Method and Project Brief

Software Development Life Cycle Processes:

Which tasks are to be done and in what order?

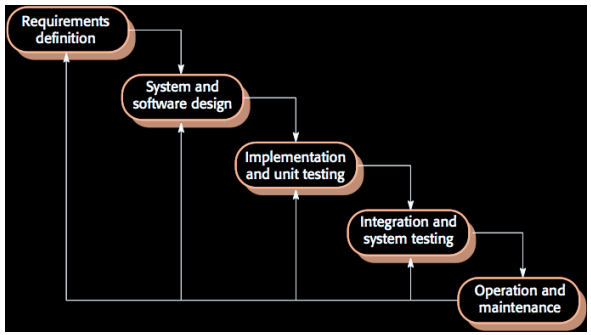
Software Development Tasks

- Requirements Analysis
- Planning
- Design: high level and detailed
- Development
- Testing
- Deployment
- Operation and Maintenance

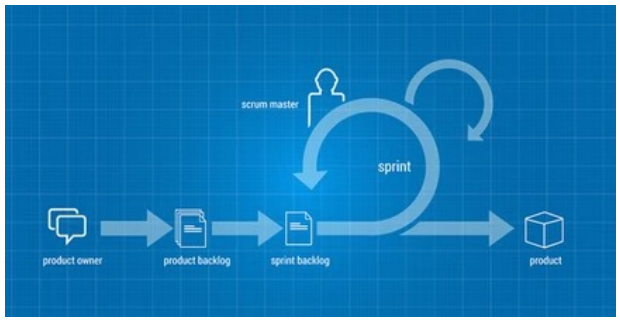
These to-does are combined in various sequences, making up different Software Development Life Cycle Processes

Software Development Life Cycle Examples

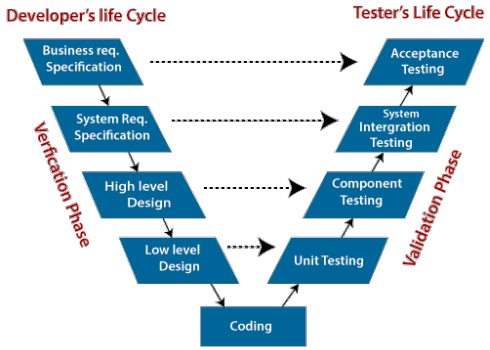
Waterfall



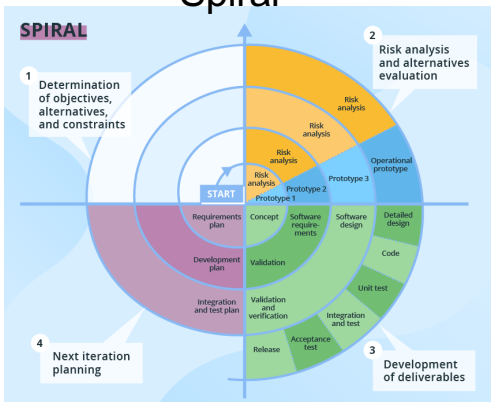
Agile



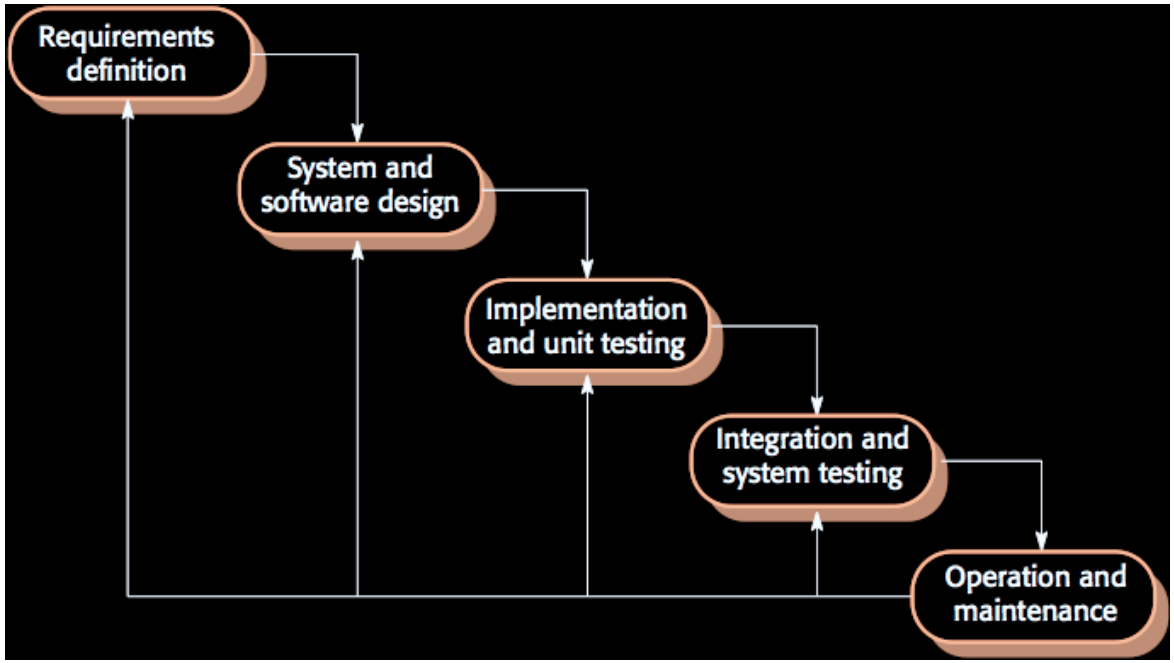
V-Model



Spiral



Waterfall Software Development Life Cycle



Requirements: What to Implement?

- What should the system do ?
- What are the needs of the users ?
- What are the needs of the host organisation ?
- What are interoperability needs of existing systems

We need to think about functional elements: what the system should do?
And also non-functional elements: quality properties of system operation, e.g., security, ease of use, response time etc.

Design: How to Structure Software?

- What objects, databases, servers, services etc. should we create?
- How are these elements structured into a system?

Why to design?

- Helps to decide where to place requirements
- How the parts of the system will be interacting
- Divide up work between team members

Implementation

Not just programming, but also…

- Parallel working and code sharing
- API partitioning and “firewalling”
- Versioning, integration and config management
- Development environments and automated build
- Automated testing
- Docs and training material

Verification and Validation

- Verification: check if the software/service complies with a requirements, constraints, and regulations. ("Are you building it right?")
  - Demonstrates that system meets specifications

- Validation: does this meet the needs of the customers/ stakeholders? ("Are you building the right thing?")
  - Demonstrate that system meets user needs

- Can pass verification but fails validation: if built as per the specifications yes the specifications do not address the user's needs.

- Involves checking, reviewing, evaluating & testing

Waterfall SDLC: Advantages and Disadvantages

- Simple to use and understand
- Every phase has a defined result and process review
- Development stages go one by one
- Perfect for projects where requirements are clear and agreed upon
- Easy to determine the key points in the development cycle
- Easy to classify and prioritize tasks

- The software is ready only after the last stage is over
- High risks and uncertainty
- Misses complexity due to interdependence of decisions
- Not suited for long-term projects where requirements will change
- The progress of the stage is hard to measure while it is still in the development
- Integration is done at the very end, which does not give the option of identifying the problem in advance

Review

- What is Software Engineering about?
- What is Software Development Life Cycle?
- Can you name any Software Development Life Cycles?
- What are the specific characteristics of Waterfall SDLC?