Empirical Methods in Software Engineering (01OPJIU)

Introduction

http://softeng.polito.it/EMSE/

SOftEng
http://softeng.polito.it

Who

- Software Engineering group
  - Marco Torchiano
- And what about you?
  - Who are you?
  - Which is your research topic?
  - What do you expect from this course?

Agenda

- Motivation
- Context
- Topics
- Exam rules
- Schedule

Motivation

- An increasing number of empirical studies are being conducted
- A common basic knowledge is required
  - To improve quality of studies
  - To design and discuss the studies

SE

Multi person construction of multi version software

- Parnas

SE

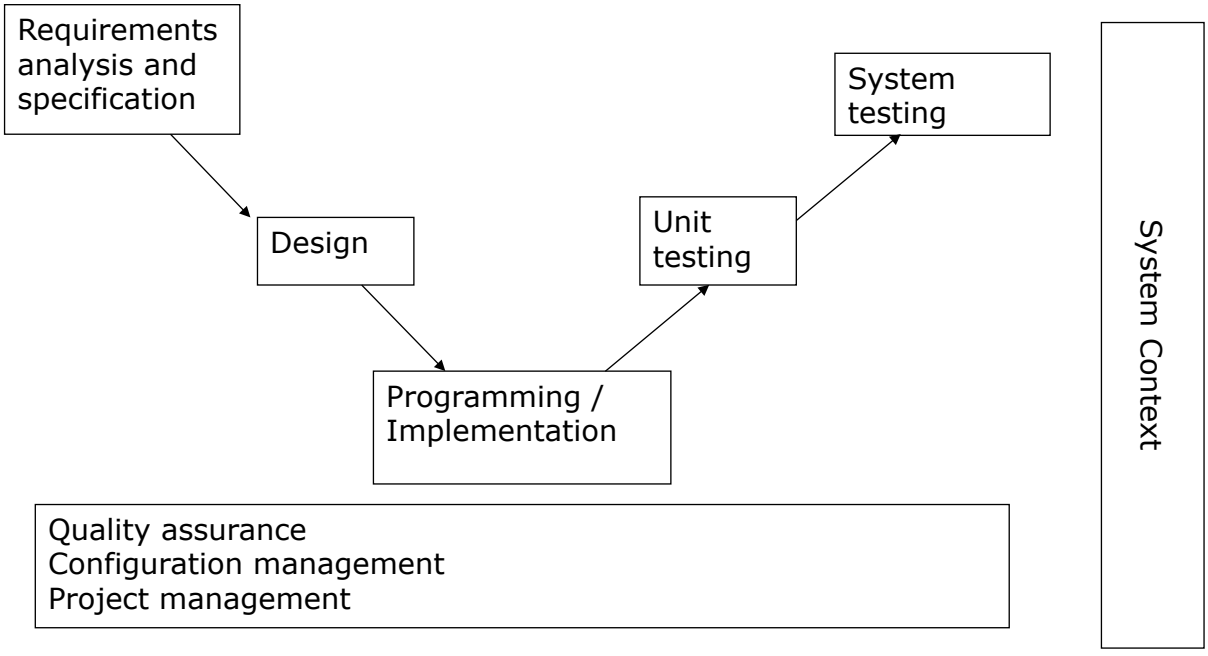
A discipline that deals with the building of software systems which are so large that they are built by a team or teams of engineers

- Ghezzi, Jazayeri, Mandrioli

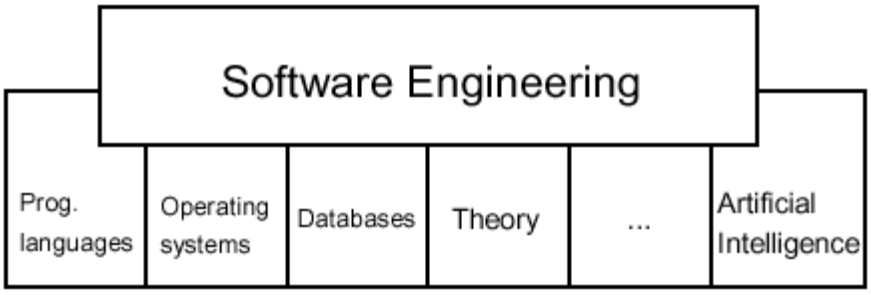
SE

- Sub-discipline of computer science
  - defining models, techniques, methods and tools to support the development of large software systems based on sound engineering principles
  - defining models, techniques, methods and tools to manage software development projects and organizations
  - empirically evaluating the effectiveness of models, techniques, methods and tools in specific contexts
    - Rombach

Software development



SE and CS



- Software engineering builds on the foundations of other computer science disciplines
- Also influenced their development
  - strong links in both directions

SE and CS

- Programming languages
  - formal languages to describe rqmts and designs
  - modularity concepts in new programming languages (e.g. Modula, C++, Ada)
- Operating Systems
  - first experience with large systems (principles such as virtual machines, layers …)
  - new operating systems (e.g. UNIX) contain simple development environments

SE and CS

- Databases
  - manipulation of complex data structures
  - SE- data base technologies (OO)
- Theory
  - FSM-model for specification and verification ….
  - theory of abstract data types, reliability models
- Artificial Intelligence
  - Explorative Processes (e.g. Prolog for prototyping)
  - Expert systems – provide practical SE assistance (i.e. “Development Assistants”)

Is SE a science?

- No foundations in physics, chemistry, biology, ..
- Huge impact of human factors (individual and organizational level)
- Regular hypes and fashions ..
  - CASE Tools, OO, agile, services, ..

What is a science?

- Application of scientific method
  - Define hypothesis
  - Perform experiment to test hypothesis
    - If experiment contradict hypothesis, reject
    - Other wise keep
  - As more and more evidence accumulates, the hypothesis becomes a scientific theory

What is NOT a science

- Hypothesis that cannot be falsified is not scientific [K. Popper]
  - Gold is soluble in hydrochloric acid
    - False, scientific
  - Some homeopathic medicine does work
    - May be true
    - Unscientific because cannot be rejected by one experiment / observation report

SE as a science

- Need to apply scientific method
- Need to empirically evaluate models, techniques and tools (empirical SE)
  - Is Java 'better' than C?
  - Is OO design 'better' than structured design?
  - Is agile 'better' than traditional?

Other inspiring disciplines

- Social sciences
  - Effect of education, age and sex on income
  - Effect of immigration on crime
- Medicine
  - Effect of smoke on lung cancer
  - Effect of cholesterol on heart illnesses

Topics

- Empirical Method
- Experimental Process
- Measurement
- Data analysis
- Surveys
- Action Research
- Systematic Literature Review

Exam rules

- Dirtying your hands with an experiment
  - Play the role of subject
  - Analyze the data
- Critics (alternative)
  - Perform SLR
  - Characterize and assess empirical study

Schedule

- Tue Nov 22
- Fri Nov 25
- Tue Nov 29
- Fri Dec 2
- Tue Dec 6
- Tue Dec 13
- Fri Dec 16

Schedule w/topics (tentative)

- Tue Nov 22 – Empirical method is SE
- Fri Nov 25 – Experimental Process
- Tue Nov 29 – Software Measurement
- Fri Dec 2 – Data Visualization
- Tue Dec 6 – Data Analysis
- Tue Dec 13 – Survey
- Fri Dec 16 – Systematic Literature Reviews
  - Guest lecture by Prof. Marcela Genero – UCLM

Announcement

- Where's Software Engineering Research Headed?
  - Hakan Erdogmus
  - Friday Dec 2, 11am
  - Sala Riunioni DAUIN