Introduction to the Software Engineering Course

Xin Feng

Outline

- Introduction to course
- What is software
- What is software engineering
- Why is software engineering needed
- Software engineering application and research

Teachers

- Section 1002
  - Jefferson Fong
    - Office: T3-602-R1
    - Phone: 3620256
    - Email: jeffersonfong@uic.edu.hk
  - Jim He
    - Office: T3-501-R9
    - Phone:3620129
    - Email: hejing@uic.edu.hk

Teachers

- Section 1001
  - Judy Feng
    - Office: T3-502-R22
    - Phone: 3620030
    - Email: xinfeng@uic.edu.hk
  - Bill Zhong
    - Office: T3-502-R26
    - Phone: 3620552
    - Email: billjrzhong@uic.edu.hk

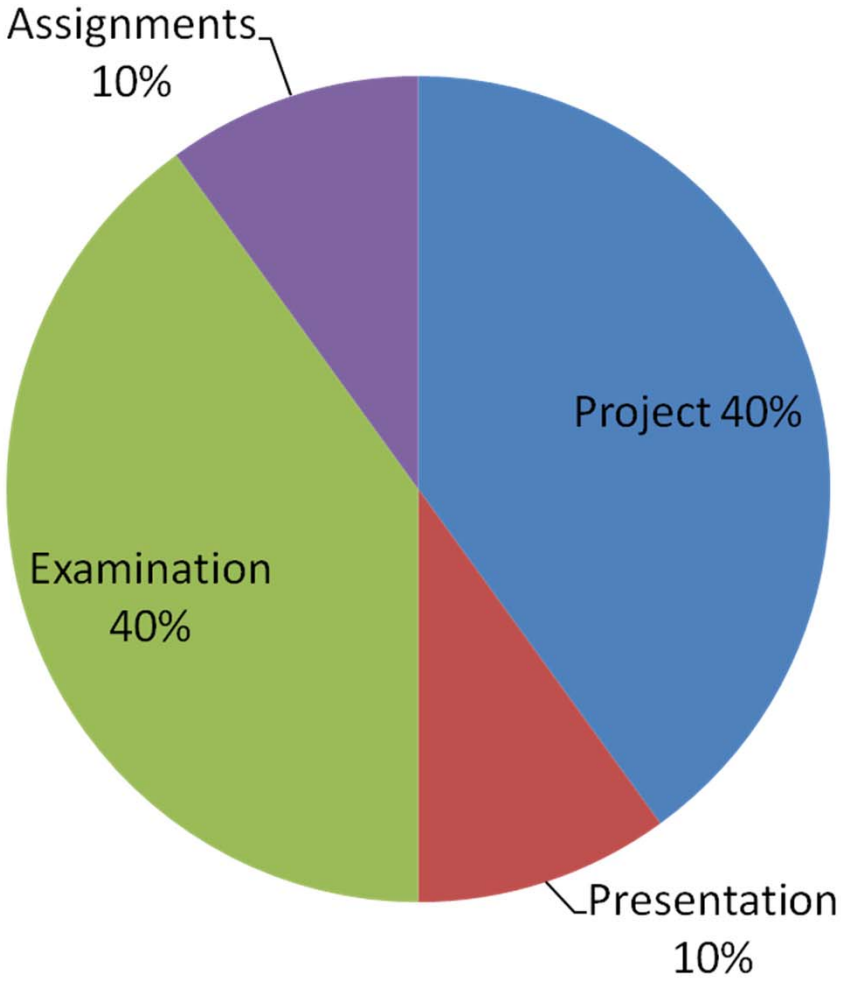
Lecture Hours (Jefferson)

Mon.	Tue.	Wed.	Thu.	Fri.
			11 am – 12 pm	
10 am – 12 pm				

Lecture Hours (Judy)

Mon.	Tue.	Wed.	Thu.	Fri.
10 am – 12 pm				
	2 pm – 3 pm			

Evaluation



Syllabus and Rubrics

- Syllabus
  - Objectives of this course
  - Assessments
  - Contents covered
- Rubrics
  - How assignments, project, quizzes, exams are assessed.

Both syllabus and rubrics are available on iSpace

How to Fail Quickly

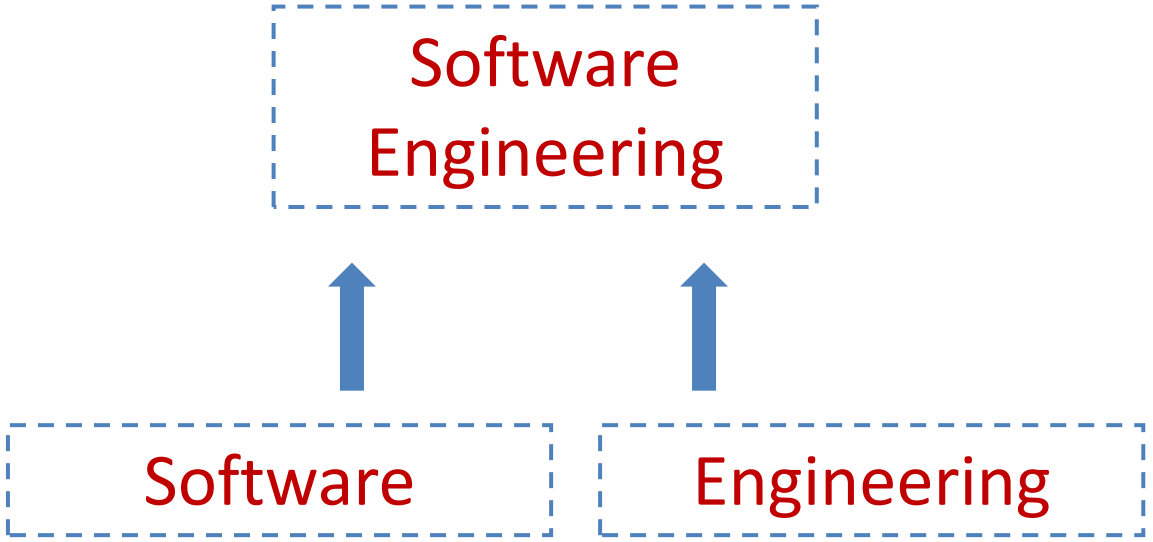
- Assignment
  - Copy others
    - Both (copied and copying) are given 0
  - Do not submit homework before deadline
    - 24 hours after the deadline
      - 30% deduction
    - 24 hours – 48 hours after the deadline
      - 50% deduction
    - More than 48 hours after the deadline
      - 100% deduction
- Quiz and exam
  - Plagiarism
  - Do not show up

References

- David Kung, Object Oriented Software Engineering, 2013
- Bernd Bruegge, Object-oriented software engineering : using UML, patterns, and Java (2nd edition), 2004
- Mark Priestley, Practical object-oriented design with UML, (2nd edition), 2004
- Curtis Tsang, Object-oriented technology : from diagram to code with visual paradigm for UML, 2004
- Ian Sommerville, Software Engineering (9th edition), 2011

What Is Software Engineering???

What Is Software Engineering



What Is Software

What Is Software???

What Is Software

Software == Programs (*True* or *False?*)

What Is Software

- Software is
  - instructions that, when executed, provide desired function and performance,
  - data structures that enables the programs to adequately manipulate information, and
  - documents that describe the operations and use of the programs
- Software is [Sommerville]
  - computer programs and associated documentation.

What Is Software

Software = Programs + Documentation

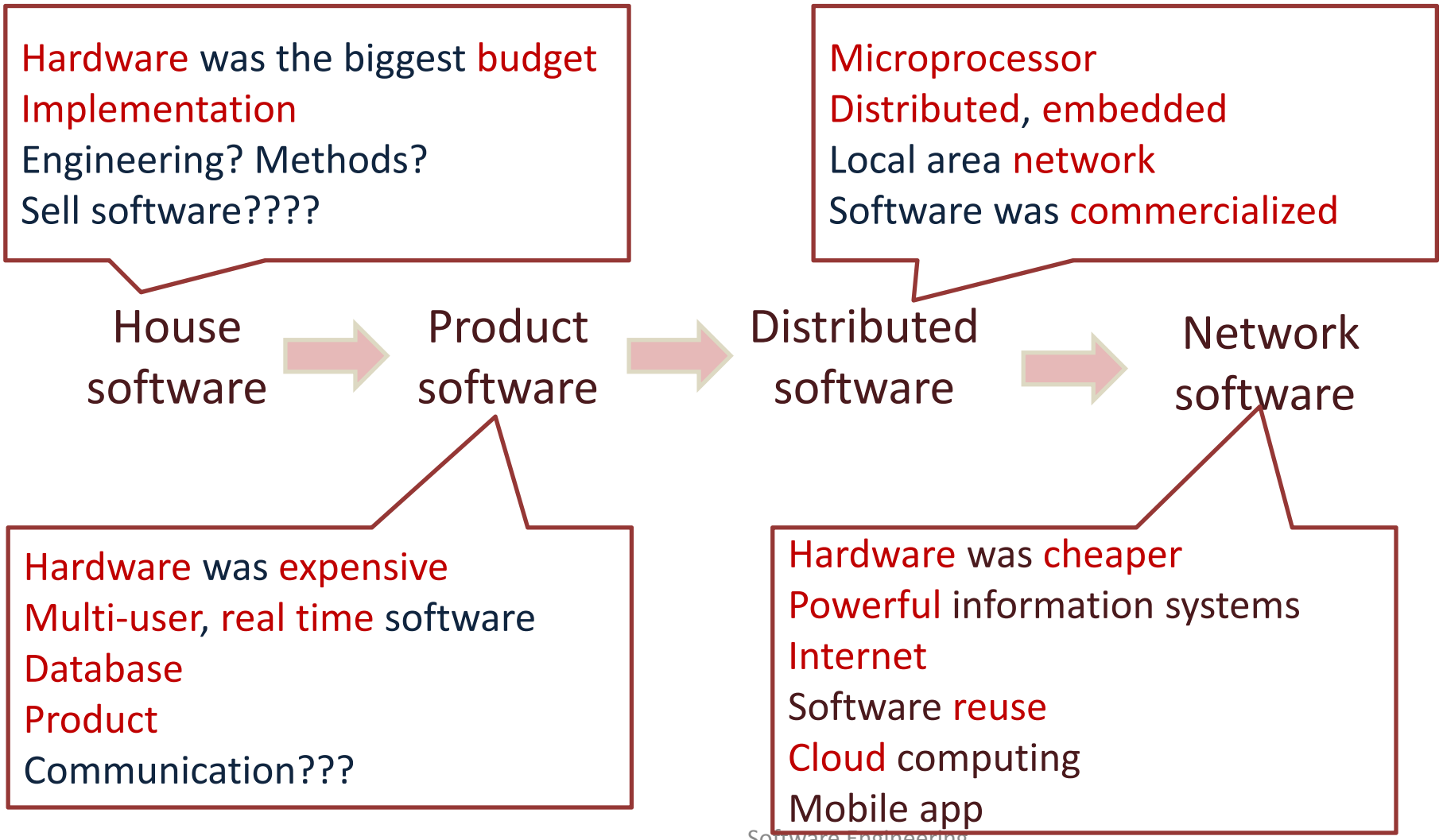
What Is Software

- Characteristics
  - Software has no mass
  - It is not rather manufactured in the classical sense.
  - Software does not “wear out”, but it does “deteriorate (衰退)”.
    - Can you give any example?

Software

- Types of Software
  - Generic software
    - System software
    - IDE(Integrated Development Environment)
    - …
  - Customized software
    - Real-time software
    - Business software
    - Embedded software
    - …

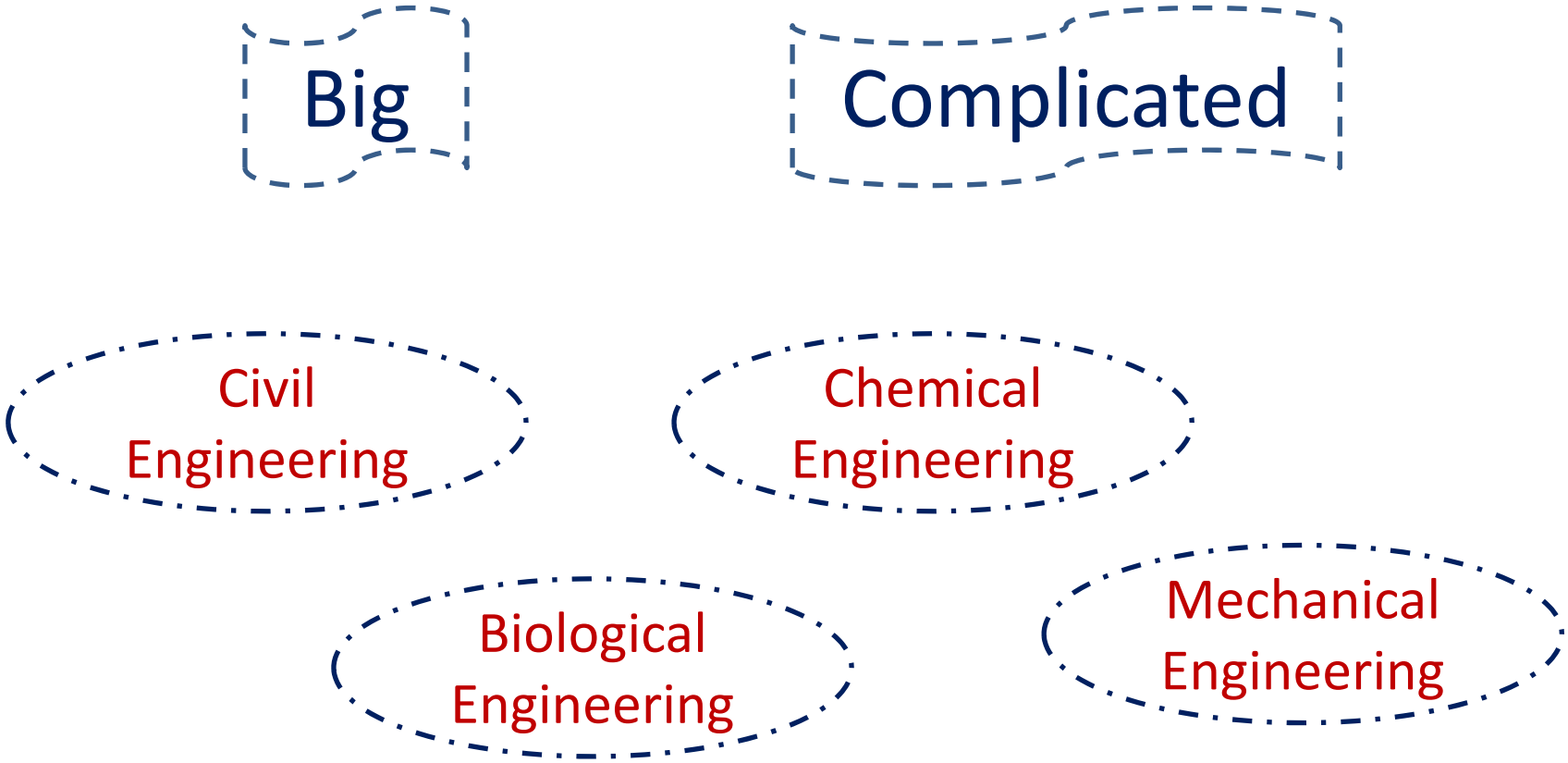
Software Development History



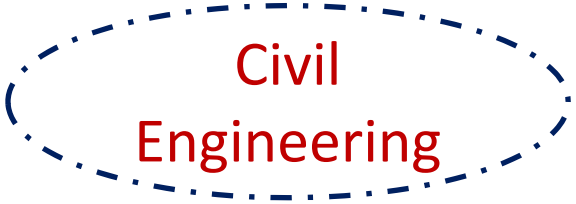
What Is Engineering???

Any keywords can describe engineering?

What Is Engineering



What Is Engineering



What is this about???

What will be done???

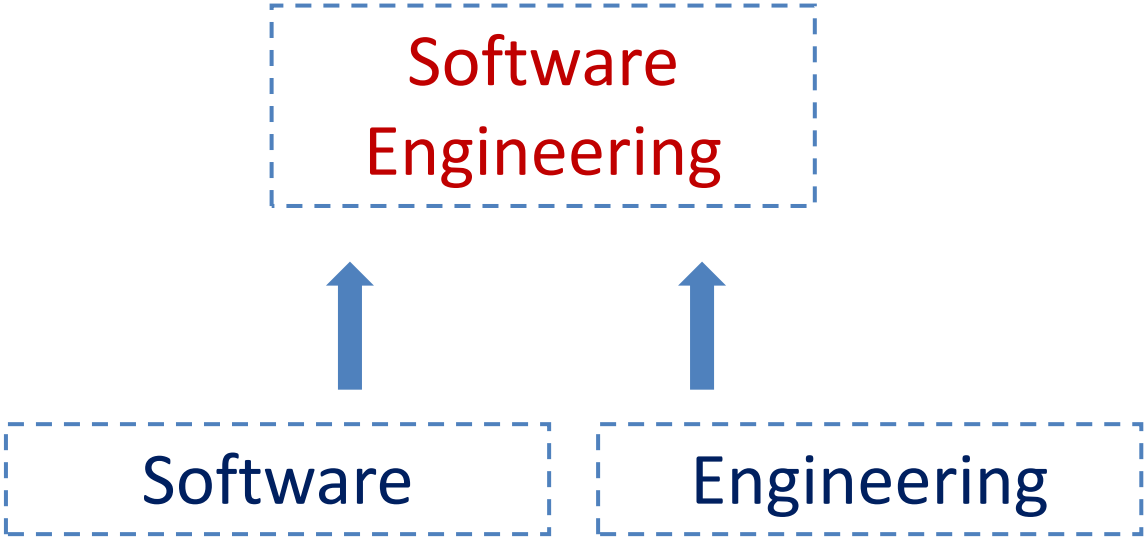
Questions to Answer on Engineering

- Questions to answer in engineering
  - What is the problem to be solved?
  - What are the characteristics of the entity to solve?
  - How will the entity be constructed?
  - What approach will be used to uncover errors that were made in the design and construction of the entity?
  - How will the entity be supported over the long term, when corrections, adaptations and enhancements are requested by users of the entity?

What Is Engineering

- Engineering
  - the application of scientific and mathematical principles to practical ends such as the design, manufacture, and operation of efficient and economical structures, machines, processes, and systems
  - the analysis, design, constructions, verifications, and management of technical entities

What Is Software Engineering



Software Engineering

- Software Engineering is [Sommerville]
  - an engineering discipline which is concerned with all aspects of software production
- Software Engineering is [IEEE 93]
  - (1) the application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software; that is, the application of engineering to software.
  - (2) the study of approaches as in (1).

Questions to Answer on Engineering

- Questions to answer in engineering
  - What is the problem to be solved?
  - What are the characteristics of the entity to solve?
  - How will the entity be constructed?
  - What approach will be used to uncover errors that were made in the design and construction of the entity?
  - How will the entity be supported over the long term, when corrections, adaptations and enhancements are requested by users of the entity?

Questions to Answer on Software Engineering

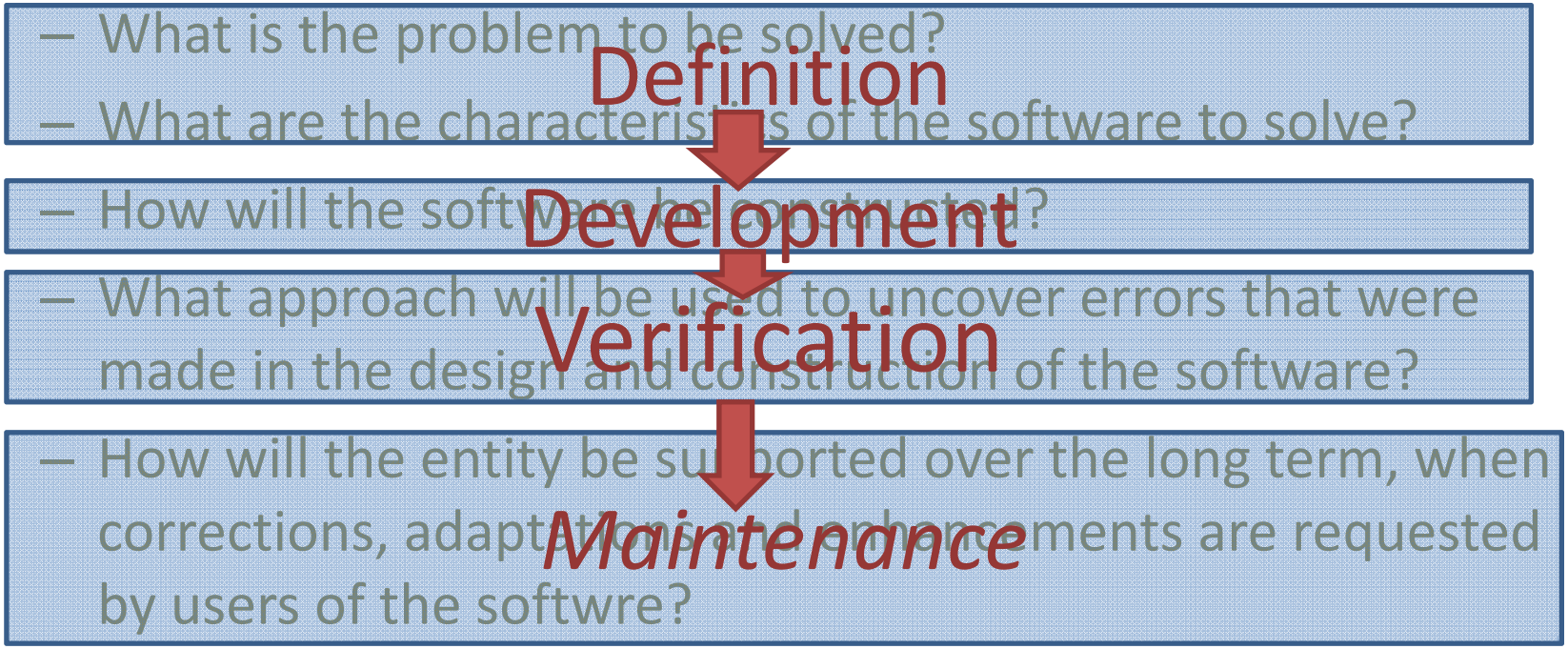
- Questions to answer in software engineering
  - What is the problem to be solved?
  - What are the characteristics of the software to solve?
  - How will the software be constructed?
  - How to uncover errors that were made in the design and construction of the software?
  - How will the software be supported over the long term, when corrections, adaptations and enhancements are requested by users of the software?

Questions to Answer on Software Engineering

- Questions to answer in software engineering
  - **What** is the problem to be solved?
  - **What** are the characteristics of the software to solve?
  - **How** will the software be constructed?
  - **How** to uncover errors that were made in the design and construction of the software?
  - **How** will the software be supported over the long term, when corrections, adaptations and enhancements are requested by users of the software?

Questions on Software Engineering?

- Questions to answer in software engineering



Why Software Engineering?

- Software crisis
  - IBM OS/360 operating systems (1964)
    - Fred Brook
    - cost and budget overruns
    - over 10 years
    - over 1000 programmers
    - a multi-million dollar mistake

Why Software Engineering?

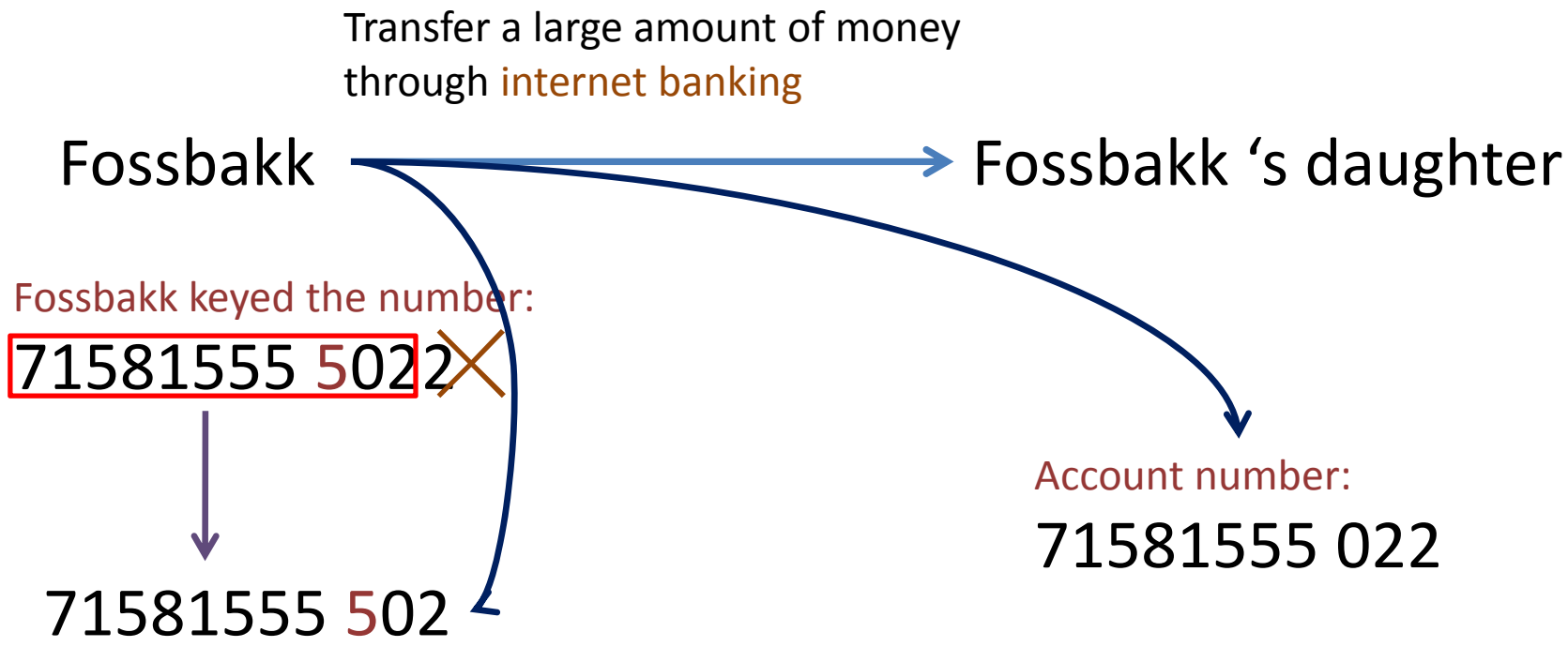
- Software crisis
  - HK International Airport chaos
    - 1998
    - 12 billions
    - compressing the testing
    - compressing training time for the new systems at the airport
    - cost time, money, and reputation.

Why Software Engineering?

- Software crisis
  - Therac 25 (a radiation therapy machine) incidents
    - a computerized radiation therapy machine
    - 6 accidents between 1985-1987
    - massive overdoses
    - Death or injured
    - the worst series of radiation accidents

Why Software Engineering?

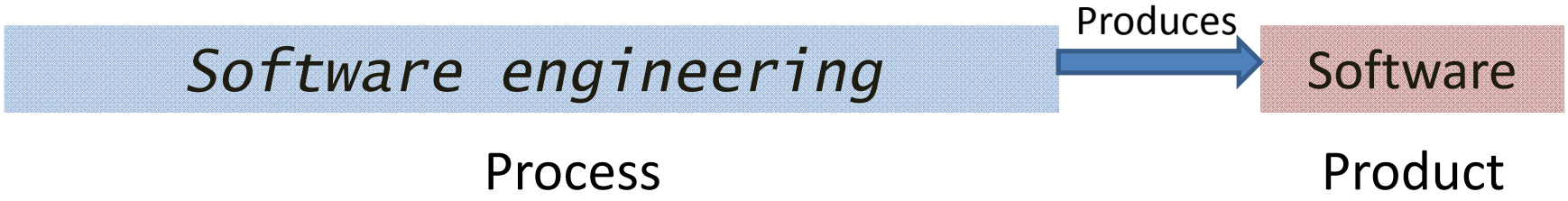
- A $100,000 keying error



Purpose of Software Engineering

- Obtain high **quality** software
- Reduce development **cost**
- Meet the **deadline** of project

Relationship Between Software and Software Engineering



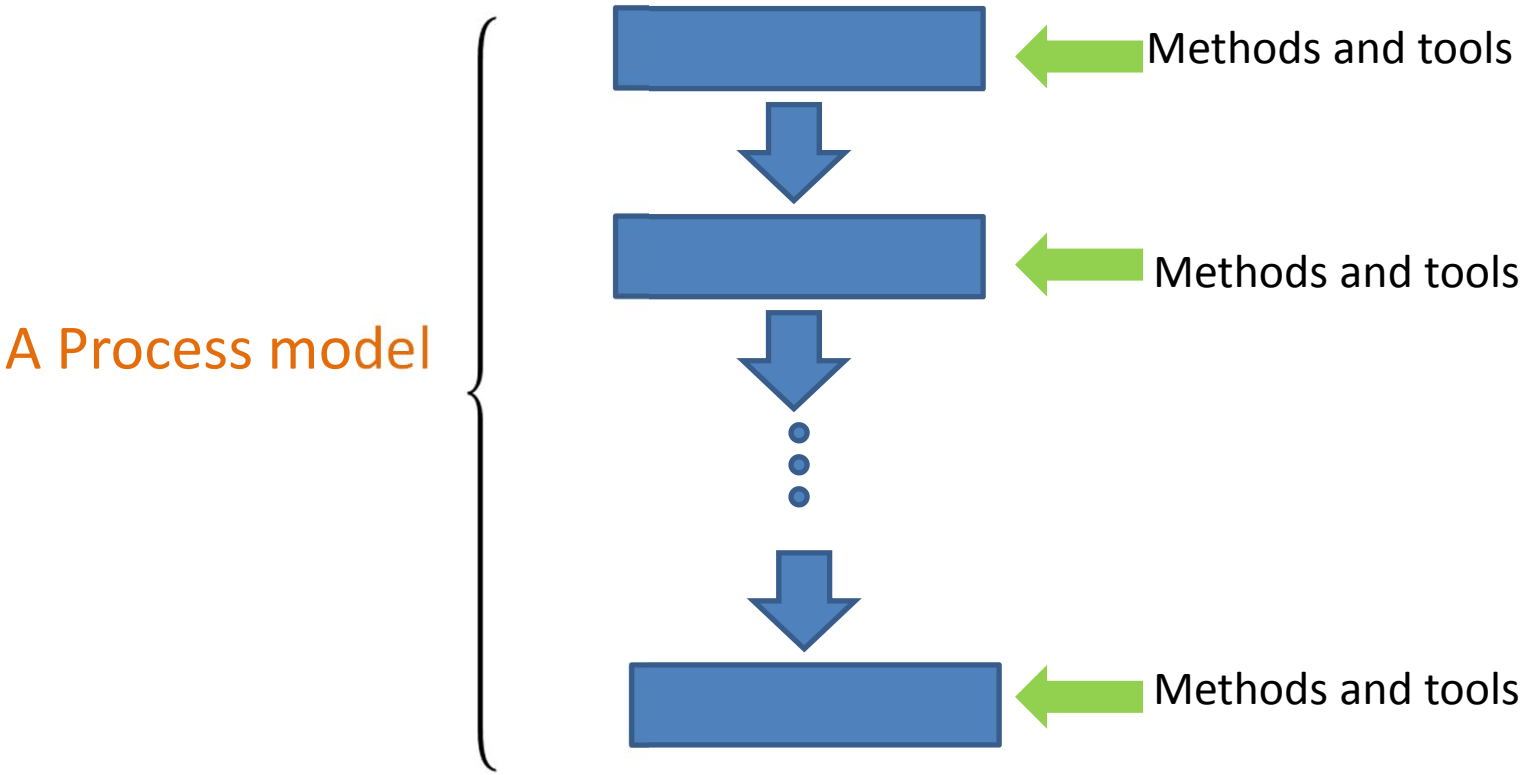
Difference Between Software Engineering and Computer Science

- Computer Science
  - Theories
  - Fundamentals
- Software Engineering
  - Practical problems
  - A subject in Department of Computer Science

Software Engineering – Sub-domains

- Computer-Aided Software Engineering (CASE)
  - Programs used to support software engineering
- Empirical Software Engineering
  - emphasizes the use of empirical studies
- Experimental Software Engineering
  - focusing on experiments on software systems
- Automated Software Engineering
  - Focus on automating the phases in software engineering
  - Knowledge-based Software Engineering

Software Engineering



Objectives

- Principles of software engineering
- Project development practices
- Market tools that support software project development

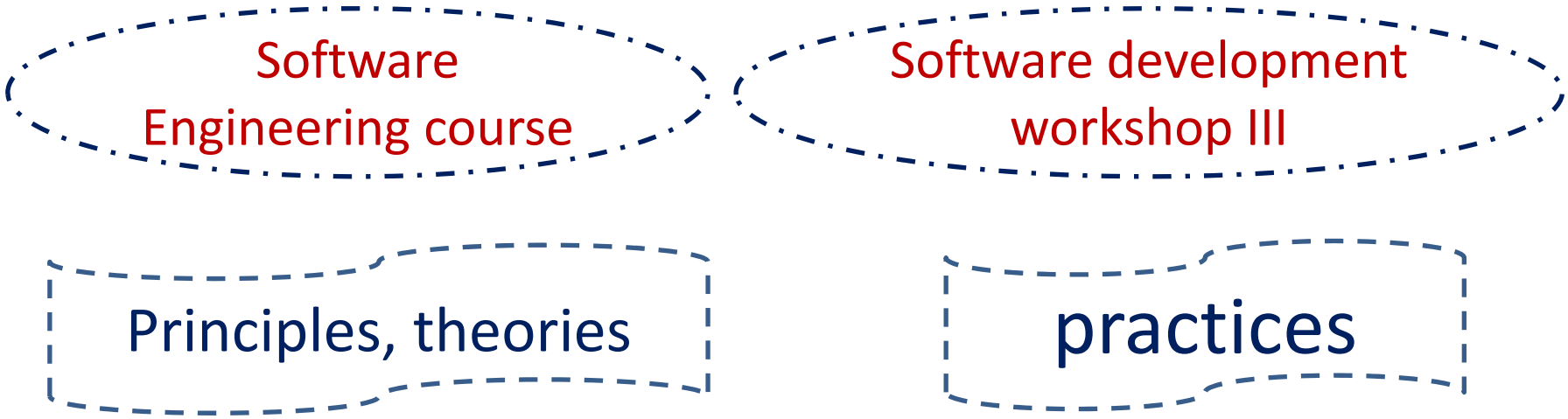
Practices

- Project development practices
  - Requirement **analysis**
  - Software **design**
  - Software **programming**
  - Software **verification** and **validation**
  - Software **maintenance**

Tools

- Market tools that support software project development
  - Models
  - Testing
  - Management

Software Engineering & Software Development Workshop III

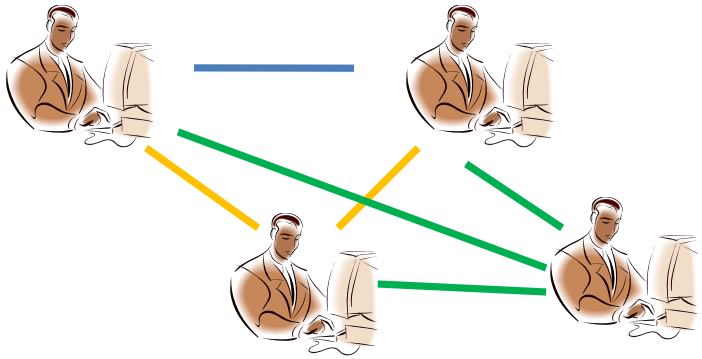


Players in a Project

- Project leaders
  - plan, supervision, allocation of tasks
- Engineers
  - analysis, design, code, test
  - programmer, tester, analyst, architecture engineer, SQA engineer …
- Customers
  - requirement, validation.

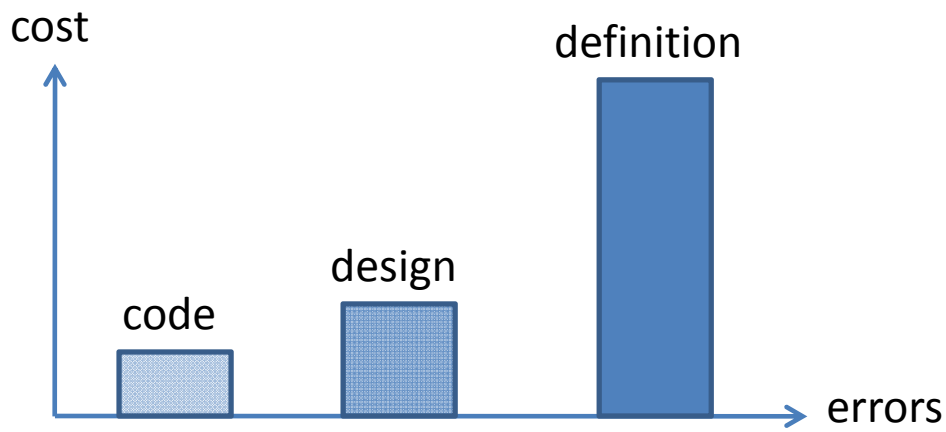
Myths and Realities

- Project leaders
  - Myth: “If we get behind schedule, we can add more programmers and catch up with the schedule”
  - Reality: “Add more programmers to a late software can make it later”.



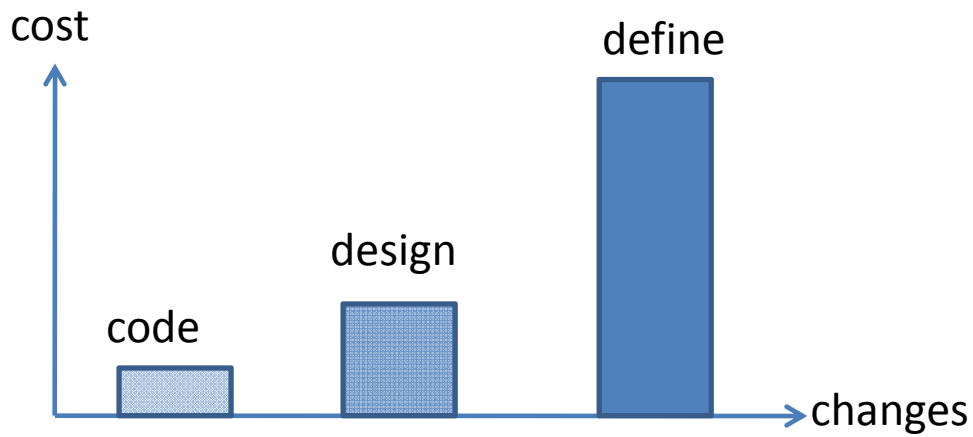
Myths and Realities

- Engineers
  - Myth: “Once we write the program and get it to work, our job is done”
  - Reality: “The sooner you start writing a program, the longer it will take you to get done”.



Myths and Realities

- Customers
  - Myth: “Project requirements continually change, but change can be easily accommodated because software is flexible”
  - Reality: “Changes to the product can be very difficult and the cost can be very high”

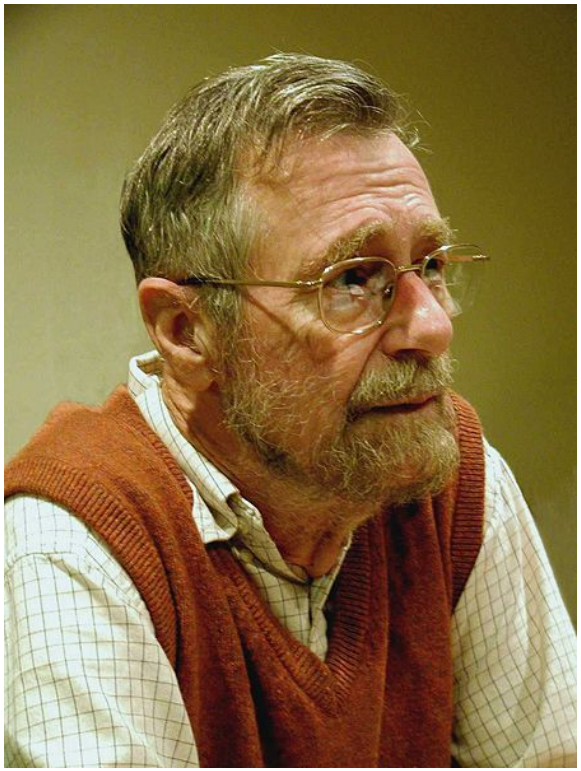


Pioneers in Software Engineering

- Barry Bohem (1935)
  - Constructive cost model (COCOMO)
  - Spiral Model of the software process

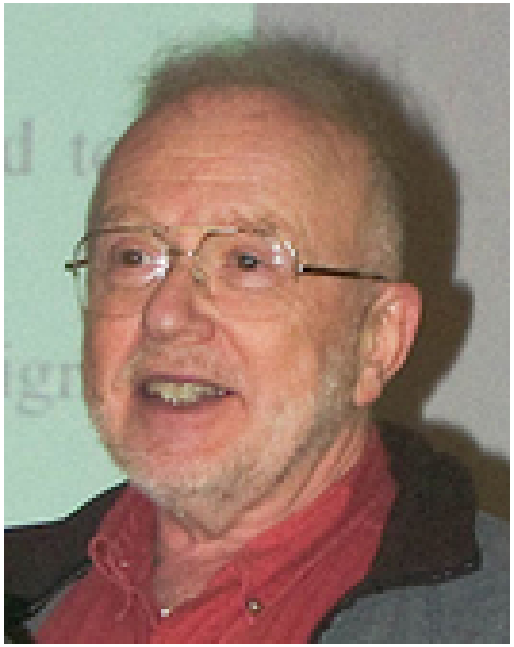
Pioneers in Software Engineering

- Edsger Dijkstra (1930)
  - Shortest path program
  - The multiprogramming system
  - Structured programming
    - “Goto” statements are harmful



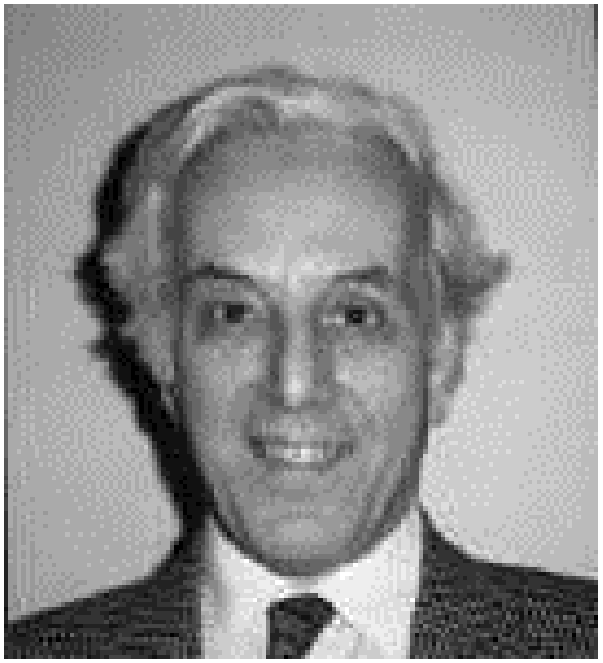
Pioneers in Software Engineering

- David Parnas (1941)
  - Information hiding (Foundation of OO)
  - Modular design
  - Tabular specification



Pioneers in Software Engineering

- Michael Jackson (1958)
  - Jackson system development



Pioneers in Software Engineering

- Peter Chen (Chinese: 陳品山)
  - Entity-Relationship Model (ERP)
  - Computer-Aided Software Engineering

Peter Chen (陳品山)

Comments on this Course

Boring…

Theoretical…

Exciting…

Practical…

Software Engineering at Microsoft

- Microsoft claims to be a BIG software engineering company
- Software engineering is, as a matter of fact, applied to all the companies, no matter
  - what service is provided
  - what scale is the company

Software engineering institutes/schools/programs around the world

- USA
  - Carnegie Mellon University
    - SEI: http://www.sei.cmu.edu/
  - Top 10 most popular software engineering colleges in US
    - http://www.campusexplorer.com/colleges/major/FCF8A86C/Engineering/DC71CFC1/Computer-Software-Engineering/
  - ……
- Canada
  - University of Waterloo
    - https://uwaterloo.ca/software-engineering/
  - University of Victoria
    - http://www.seng.uvic.ca/
  - ……

Software engineering institutes/schools/programs around the world

- Australia
  - The University of Western Austria
    - http://web.csse.uwa.edu.au/
  - Swinburne University
    - http://courses.swinburne.edu.au/courses/Bachelor-of-Engineering-(Software-Engineering)-I044/local
  - University of Wollongong
    - http://www.uow.edu.au/informatics/scsse/index.html
  - The University of Newcastle
    - http://www.newcastle.edu.au/program/10984.html
  - ……
- UK
  - Oxford University
    - https://www.cs.ox.ac.uk/softeng/
  - University of Salford Manchester
    - http://www.salford.ac.uk/courses/software-engineering
  - ……

Software engineering institutes/schools/programs in China

- School of software, Tsinghua University
  - http://www.thss.tsinghua.edu.cn/publish/soft/3650/index.html
- Software Institute, Nanjing University
  - http://software.nju.edu.cn/index.php?option=com_content&view=article&id=3&catid=41&Itemid=2
- Software Institute, Sun Yat-sen University
  - http://ss.sysu.edu.cn/informationsystem/ArticleList.aspx?id=31

Software engineering companies/organizations

- SEA (Software Engineering Australia)
  - http://www.business.gov.au/GBDirectory/S/Pages/SoftwareEngineeringAustralia(SEA).aspx
- Microsoft
  - http://careers.microsoft.com/careers/en/hk/professions.aspx
- SAP
  - http://www.sdn.sap.com/irj/sdn/index?rid=/webcontent/uuid/509d5d9a-e348-2a10-12b8-c6b9c2f2fc22
- ……

Software engineering research centers

- IBM
  - http://www.research.ibm.com/softeng/
- Microsoft
  - http://research.microsoft.com/en-us/groups/rise/
  - http://research.microsoft.com/en-us/groups/ese/
- Focus-Inova
  - http://www.focus-inova.com/en/home
- ……
- Fraunhofer Institute of Empirical Software Engineering
  - http://www.iese.fraunhofer.de/en.html
- The Irish Software Engineering Research center
  - http://www.lero.ie/
- Security and Software Engineering Research center
  - http://www.serc.net/about
- ……

Software Engineer

Software Engineer== Programmer

(*True* or *False*)

Career tracks

- Programmer
- Architect
- Analyst
- Tester
- Software quality assurance engineer
- Project leader
- Manager
- Researcher

Feedbacks from our graduates and employers

- 88% need to write documentation at work
- 60% think they need more training on documentation writing
- 60% think more software engineering knowledge needed
- 79% need to write testing plan at work
- 80% think software testing should be a course
- 60% industry people said they need better software engineer

Software Engineer

Software Engineer ⊃ Programmer

Software Development

Software development == Programming

(*True* or *False???*)

Assignment 1

- Questions:
  1. What are the differences between program and software,
  2. Why do we say : “The sooner you start writing a program, the longer it will take you to get done.”

  (Use no more than 3 sentence for each question)
- Submission
  - Deadline: 27 Feb 2019, 11.55 pm

Warm Up!!!

Summary

- Software engineering definition
- Software engineering tries to solve cost, time and quality problem
- Difference between program and software, programming and software, programmer and software engineer
- Software engineering pioneers
- Software engineering has been used in many companies
- Software engineering is researched