

SNU 4190.210 Principles of Programming Part 0

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Objectives

- ▶ Learning:
 - ▶ Basics and Essence of programming
 - ▶ Concepts of program execution (or semantics)
- ▶ Balanced Viewpoint:
 - ▶ Programs can be seen as a tool for using computers.
 - ▶ Computers can be seen as a tool for executing programs.
- ▶ Broad Viewpoint:
 - ▶ Understanding today and future programming technology.

Objectives: After taking this course “Aha”

- ▶ I know how to design and write good programs.
- ▶ I know the current state of programming technology.
- ▶ I see how programming technology will evolve in the future.
- ▶ I am confident to write good programs in whatever language!

Contents

▶ Principles of Program Writing

간단한 부품의 반복구성	elements & compound
재귀와 반복	recursion & iteration
속내용 감추기	procedural & data abstraction
계층구조로 속내용 감추기	modularity & hierarchy
맞는 프로그램인지 확인하기	program proof
타입으로 정리+이해하기	types & typeful pgm'ng
물건중심의 프로그래밍	objects & imperative pgm'ng
값중심의 프로그래밍	value & applicative pgm'ng
예외상황 관리	exceptions & advanced control

▶ Concepts of Program Execution

- ▶ 이름(name, variable), 환경(environment), 메모리(memory, state), 실행(evaluation, interpretation, semantics)

Key points

- ▶ This course is not for teaching particular programming languages.
- ▶ Focus on principles (Basics and Essence)
 - ▶ The programming languages we use in the course are just tools for conveying the principles.
- ▶ What you learn in this course will be applicable to whatever language you use in the future.

Programming languages we use: Scheme + ML

- ▶ Small & Simple
 - ▶ We can focus on learning principles.
 - ▶ We don't need to know complex grammars and features.
- ▶ Powerful & Practical
 - ▶ High-level programming language
 - ▶ Used in industry
- ▶ Good News: Unfamiliar language
 - ▶ Experience in C/Java is not an advantage
 - ▶ No experience in C/Java is not a disadvantage
 - ▶ Fair to everyone

Programming

- ▶ Describes how to do (or “compute”) something
 - ▶ how to compute $\sqrt{2}$
 - ▶ how to make pizza
- ▶ Different from how to define something
 - ▶ $\sqrt{2}$ is the number whose square is 2.
 - ▶ Pizza is the cheapest Italian food.

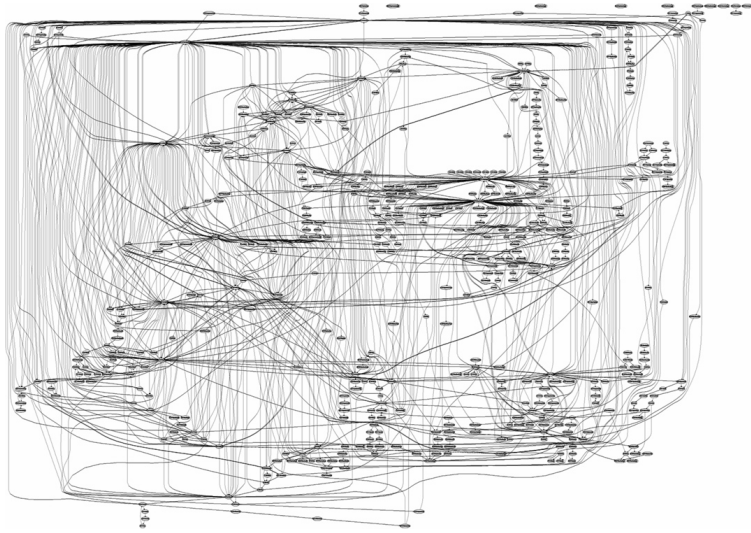
Difficulties in Programming

- ▶ Software is getting bigger and more complex.
 - ▶ Growth rate of complexity of sw >> that of hw
 - ▶ “Software is gas.”
- ▶ A machine executes a program automatically
 - ▶ A machine do not see what we want
 - ▶ A machine just executes what is written in a program

“장보기 = 우유 1리터, 신라면 4봉지, 그리고 찰과자두 사오기.”

 - ▶ Must consider all possible situations & Must make no mistakes
- ▶ Hard to predict the behaviours of a program “before execution”
 - ▶ Impossible to predict automatically: Proved(1936, Alan Turing)
 - ▶ Try to predict manually: reduce the efforts using various tools
 - ▶ Current state of the technology: Immature

SW is complex



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SW is complex

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As complex as nature

A network consisting of 10,000 neurons in a mammal

Polytechnique Fédérale de Lausanne, *Blue Brain Project*, 2008



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