Programming Languages: Imperative Program Construction Syllabus

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Course Info.

- Course No.: IM 2013.
- Time: Thursday, 9:10 am — 12:10 noon.
- Location: Room 101, Management II — or online.
- Credits: 3.
- Course Homepage: `https://scmu.github.io/plip/`, or find the course through NTU COOL: `https://cool.ntu.edu.tw/courses/9100`.
- Lecturer: 穆信成 Shin-Cheng Mu (`scm@iis.sinica.edu.tw`).
- Teaching Assistant: 齊安浩 (`r09725055@ntu.edu.tw`).

Topics

Things I wish to cover in this term:

- Guarded Command Language, Hoare Logic, and weakest precondition.
- Simple program derivation.
- General loop construction.
  - Conjuncts as invariants.
  - Strengthening the invariant.
  - Associative invariants.
- Case studies of some interesting algorithms.
- Separation Logic.

Lecture Style and Grading

- Partly lecture, partly practicals.
- Please bring your laptop, and be sure that it is fully charged before each class.
- No roll-calls.
- Try finishing your practical sheets for your own benefits. Practical sheets and homework (if any) are not graded. However, if you submit the practicals to me (by email), I will check them and comment on them.
- Grading: $(mid\ `max`\ final) * 0.6 + (mid\ `min`\ final) * 0.4$. (The ratio often ended up being relaxed to 0.7 and 0.3 in previous years.)

Course Materials

We will not follow any textbook completely, but most of this course are adapted from:

- A. Kaldewaij. *Programming: the Derivation of Algorithms*. Prentice Hall, 1990.

Handouts will be issued with each lecture, and students need not buy any textbooks. Other highly recommended materials include:

- R. C. Backhouse. *Algorithmic Problem Solving*. Wiley, 2011.
- E. W. Dijkstra. *A Discipline of Programming*. Prentice Hall, 1976.
- D. Gries. *The Science of Programming*. Springer Verlag, 1981.
- C. C. Morgan. *Programming from Specifications*. Prentice Hall, 1990.

Some materials are borrowed from a very recommended course given by Prof. Carroll Morgan:

- (In-)Formal Methods: the Lost Art. COMP 6721, University of New South Wales. `http://www.cse.unsw.edu.au/cs6721/2021T2/Web/`, 2021.

Prof. 蔡益坤 Yih-Kuen Tsay's course on Software Specification and Verification (**軟體規格與驗證**, IM 7079) is also very relevant.

A few weeks into the term we will start using a tool called Guabao, `https://scmlab.github.io/guabao/`. Details to be announced.