

# Programming Languages: Imperative Program Construction Syllabus

Shin-Cheng Mu  
National Taiwan University and Academia Sinica

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## Course Info.

- Course No.: IM 5065, 725 U3930.
- Time: Thursday, 9:10 am — 12:10 noon.
- Location: Room 101, Management I.
- Credits: 3.
- Course Homepage: <https://scmu.github.io/plip/>, or find the course through NTU COOL: <https://cool.ntu.edu.tw/courses/19092>.
- Lecturer: 穆信成 Shin-Cheng Mu ([scm@iis.sinica.edu.tw](mailto:scm@iis.sinica.edu.tw)).
- Teaching Assistant: 陳琳瑄 ([r11725020@ntu.edu.tw](mailto:r11725020@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.
- Most practical sheets and homework (if any) are not graded — try finishing your practical sheets for your own benefits. If you submit these practicals to me, I will check them and comment on them.
- Some of the homework are graded.
- Grading:  $(mid \uparrow final) \times 0.5 + (mid \downarrow final) \times 0.25 + homework \times 0.25$

## 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.