CS100
Introduction to Programming

Lecture[0]

Course Introduction

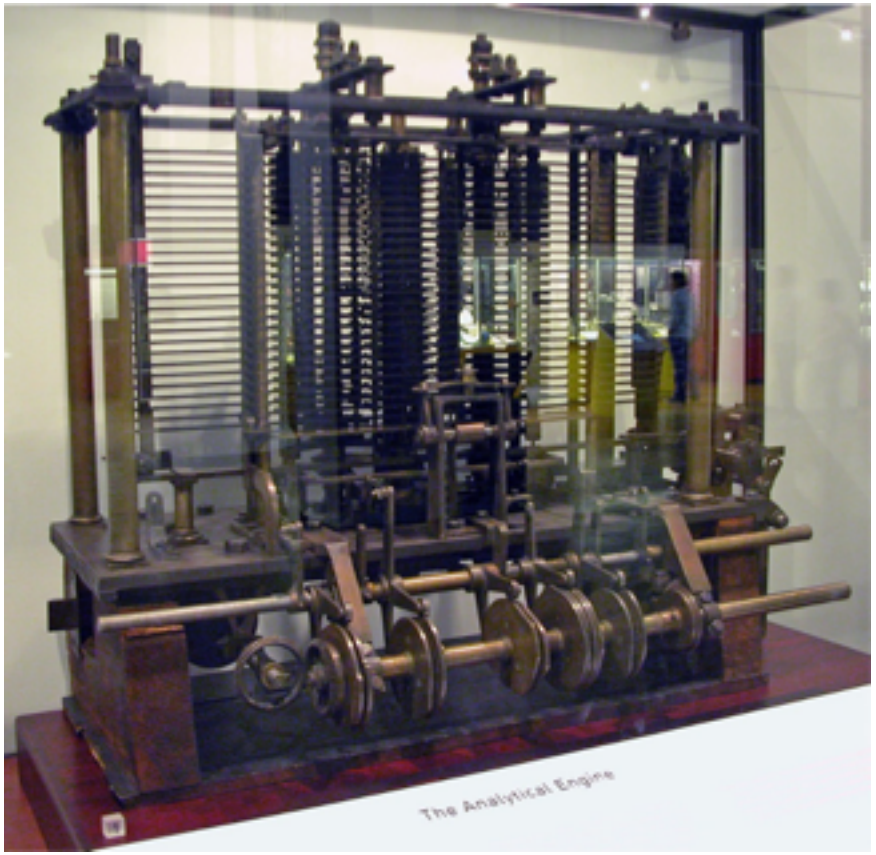
What is programming?

Computer **programming** is the process of writing instructions that get executed by computers. The instructions, also known as code, are written in a **programming language** which the computer can understand and use to perform a task or solve a problem.

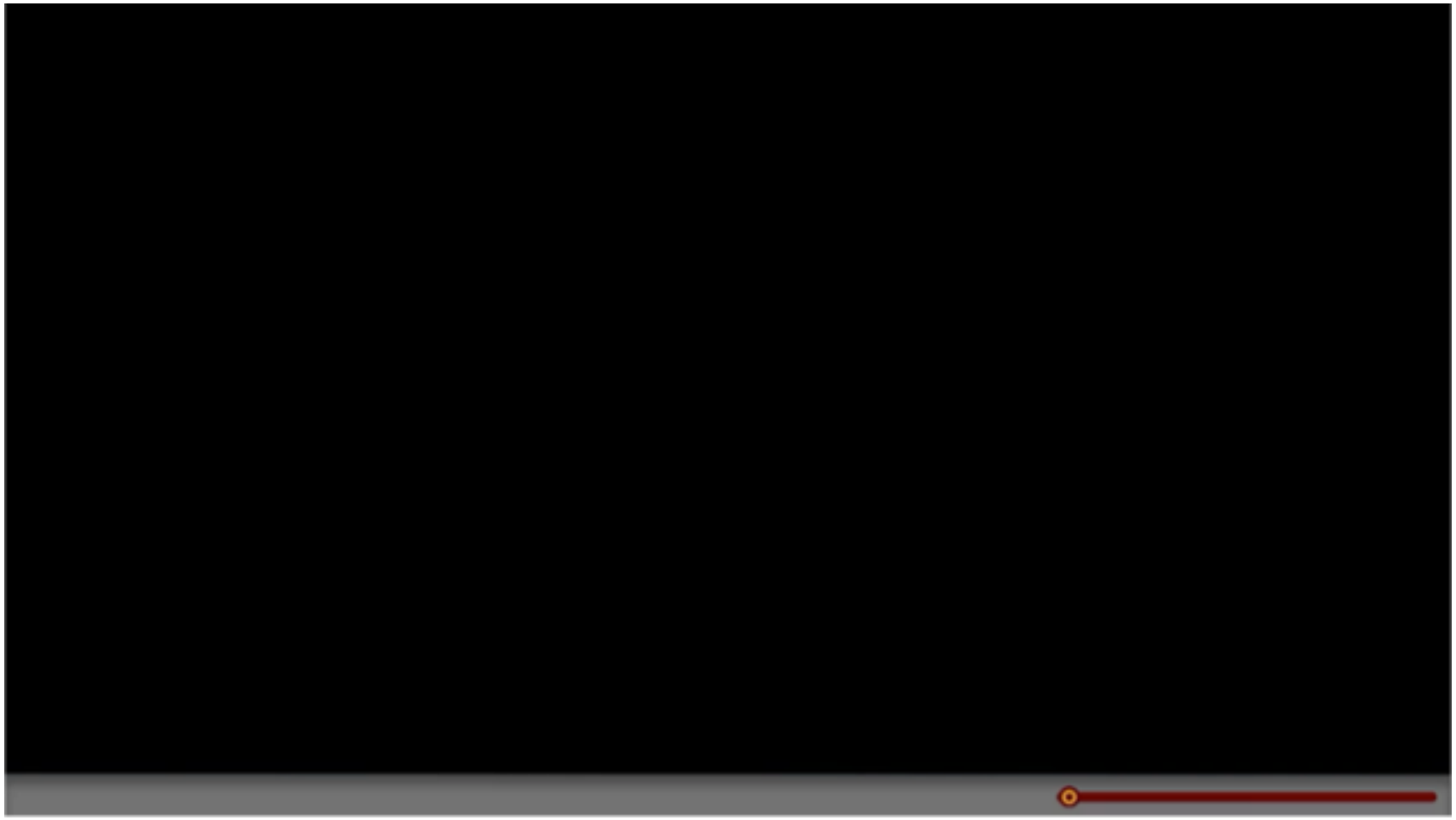
***Steve Jobs**: "**Everybody** in this country **should learn** to program a computer, because it teaches you how to **think**"*

A bit of history

- Analytical engine
  - Charles Babbage
  - Designed in 1837
  - Branching & Looping!
  - Turing-complete!



A bit of history



A bit of history

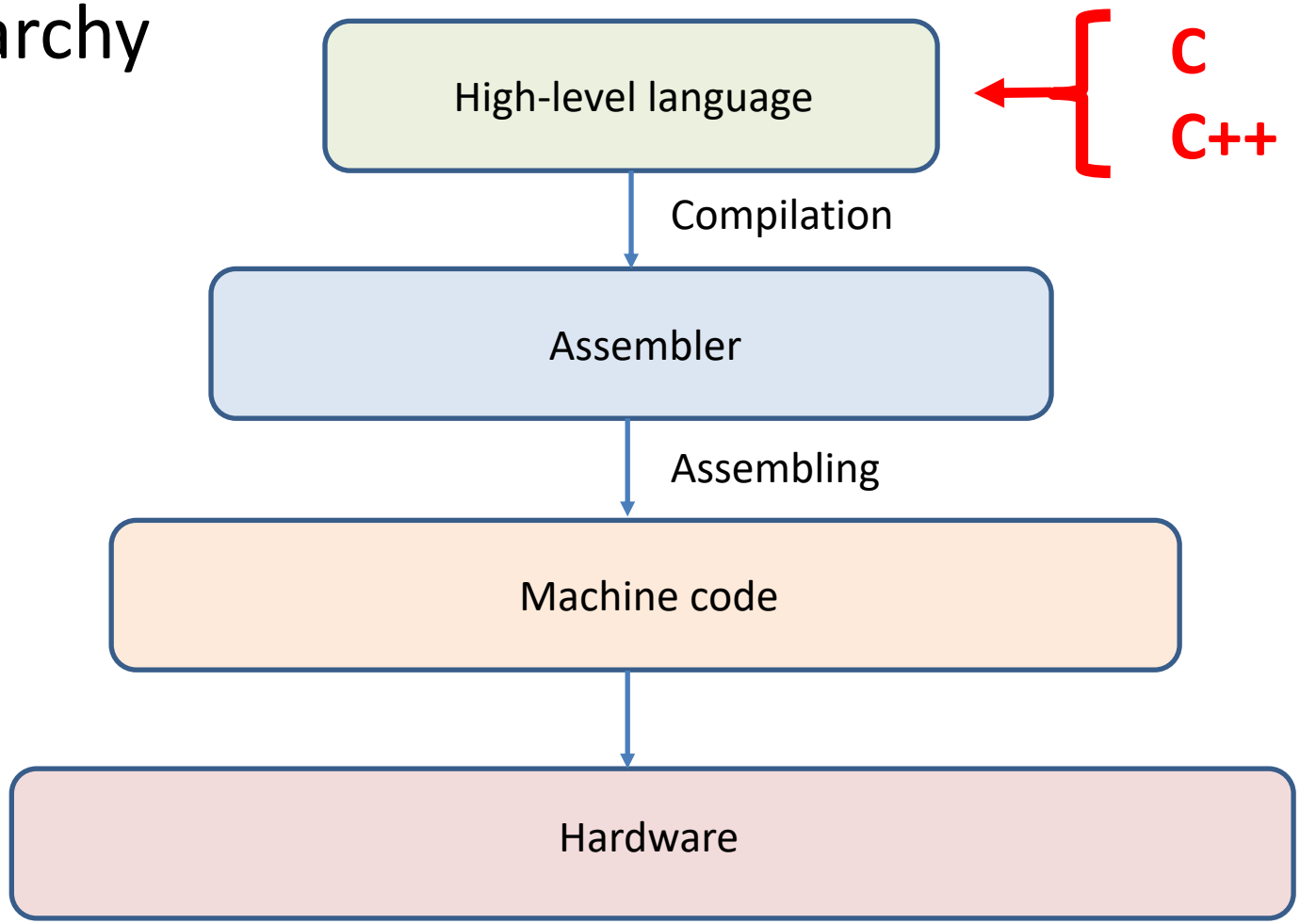
- In early devices such as “Analytical Engine”
  - Program is communicated via punched cards
  - Akin to modern day assembler language

A bit of history

- Ada Lovelace (1815-1852)
  - Considered to be the first "computer programmer"
  - Envisioned programs that would run on Charles Babbage's Analytical Machine and do more than mere number crunching

Modern coding languages

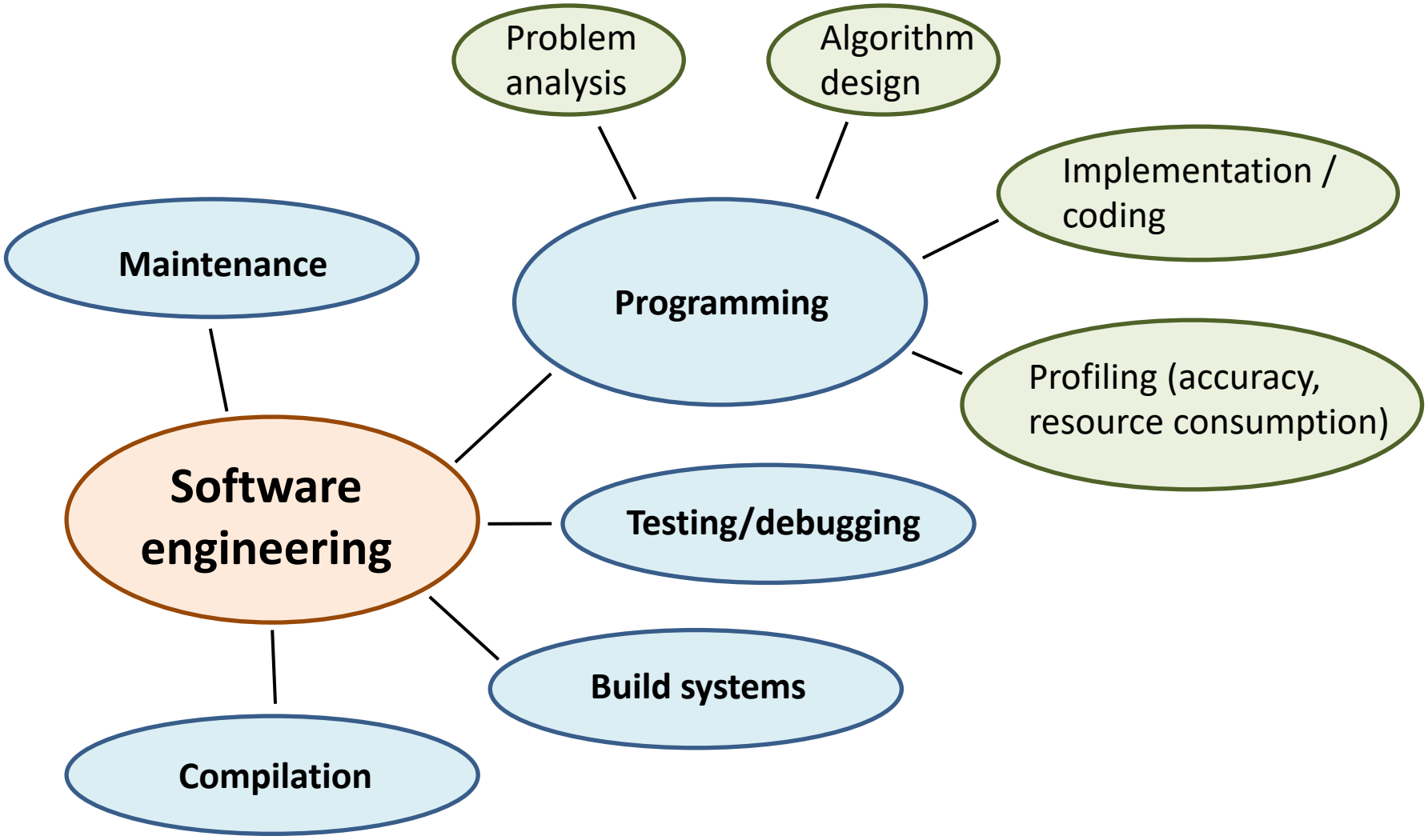
- Hierarchy



Modern coding languages

- Syntactically rich
- Better abstraction ability

What is programming?



Why Learning Programming in C?

- Why C?
  - Popular, early language
    - Permits implementation of sequential programs
  - “Standard” syntax

- Why C++?
  - Popular, higher-level language (Object-oriented)
  - Efficient programs

- Note:

  C and **C++** are now considered **low-level languages** because they have no automatic memory management. The definition of **low level** has changed quite a bit since the inception of **computer** science.

Learning goals

- Cognitive competence:
  - Learn C and C++ features including later standards
  - Learn how to write programs in C/C++, know the syntax
  - Understand various ways of programming such as sequential, object-oriented, recursive, and functional programming
  - Learn about polymorphism and the standard template library
  - Learn about concurrency
  - Learn about cross-compilation, profiling, debugging, and interfacing
  - Get to know a few useful C++ libraries
- Comprehensive qualities:
  - Gain skills in problem solving and modular thinking
  - Valuable practical engineering skills for the efficient solution of real-world problems
  - Know how to analyze simple problems, and design solutions/programs

Lecturers

C

Xu Lan

Tel: (021)20684857

Office: SIST 1C-303D

Email:

xulan1@shanghaitech.edu.cn

C++

Laurent Kneip

Tel: (021)20685359

Office: SIST 1C-303E

Email:

lkneip@shanghaitech.edu.cn

Course Structure

- 15.5 weeks teaching (net)
  - 1 block C (~7 weeks, 14 lectures)
  - 1 block C++ (~9 weeks, 17 lectures)
  - 1 mid-term exam
- 2 lectures / week
  - Monday 8:15-9:55
  - Wednesday 8:15-9:55
  - Room: Teaching Centre 201
- 1 weekly recitation
  - 16 groups of ~20 students

Course Page & Material

- Main course page:
  - https://piazza.com/shanghaitech.edu.cn/spring2022/cs100/resources
  - Will contain
    - Lecture slides (including these slides)
    - Recitation material
    - Announcements
    - Homework
    - Q&A forum
  - **Please enroll by yourself if not already enrolled!**

Tentative curriculum

Chapter	Teaching Contents	Week	Contact Hours	Teaching Modes
Introduction	C syntax, development environment	1	4	Lecture, forum, recitation, homework, quiz, mid-term
Basics	Flow Control, types, arrays, operations	2	4	Lecture, forum, recitation, homework, quiz, mid-term
Code structuring	Procedural abstraction, functions	3	4	Lecture, forum, recitation, homework, quiz, mid-term
Pointers	Pointers, Pointer arithmetic	4	4	Lecture, forum, recitation, homework, quiz, mid-term
Algorithms	Sorting	5	4	Lecture, forum, recitation, homework, quiz, mid-term
I/O	Console I/O, debugging	6	4	Lecture, forum, recitation, homework, quiz, mid-term
Recursion	Recursive programming	7	4	Lecture, forum, recitation, homework, quiz, mid-term

Tentative curriculum

Chapter	Teaching Contents	Week	Contact Hours	Teaching Modes
OO Programming	Object-Oriented language, Composition/Aggregation/ Inheritance, virtualization	8	4	Lecture, forum, recitation, homework, quiz, mid-term
Polymorphism	Polymorphism, templates	9	4	Lecture, forum, recitation, homework, quiz, mid-term
Data structures	STL, vector, list, map	10	4	Lecture, forum, recitation, homework, quiz, mid-term
Concurrency	Processes, threads, hyper-threading, thread synchronization	11	4	Lecture, forum, recitation, homework, quiz, mid-term

Tentative curriculum

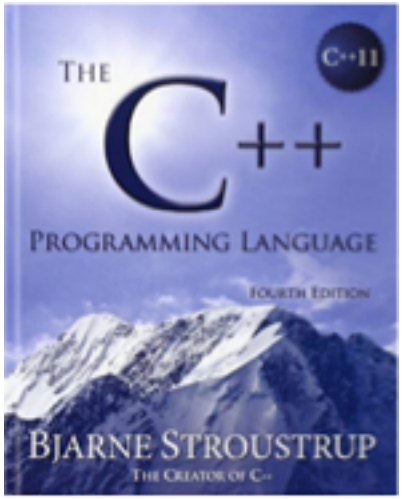
Chapter	Teaching Contents	Week	Contact Hours	Teaching Modes
Standards	Coding standards, Coding patterns	12	4	Lecture, forum, recitation, homework, quiz, mid-term
Code management	CMake, Documentation, Profiling, Debugging	13	4	Lecture, forum, recitation, homework, quiz, mid-term
New standards	R-value references, C++11, C++14, C++17	14	4	Lecture, forum, recitation, homework, quiz, mid-term
Math in C++	Eigen, Ceres	15	4	Lecture, forum, recitation, homework, quiz, mid-term
Interfacing	Interfacing with Matlab and Python	16	4	Lecture, forum, recitation, homework, quiz, mid-term

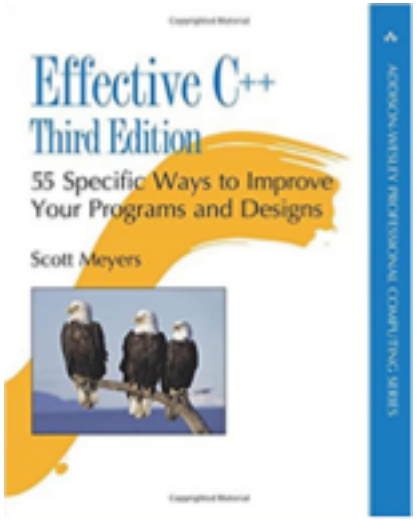
Recommended Literature

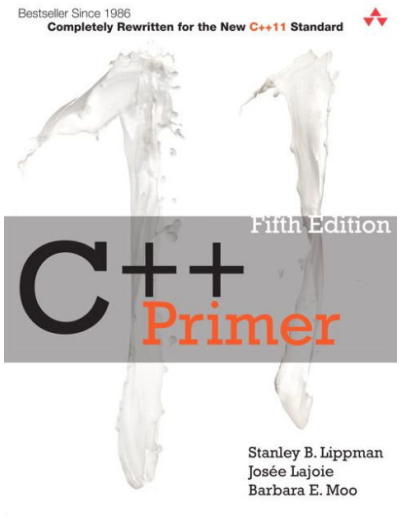
- C
  - *The C Programming Language* (2nd Edition), by Brian W. Kernighan and Dennis M. Ritchie, Prentice Hall, 2014 (available in the library)

Recommended Literature

- C++
  - *The C++ Programming Language*, 4th Edition, Bjarne Stroutrup, Pearson, 2013
  - *Effective C++*, 3rd Edition, Scott Meyers, Addison-Wesley, 2005
  - C++ Primer, Josée Lajoie and Stanley B. Lippman







Recommended Literature

- General note:
  - You are not required to buy those books
  - They are only suggestions in case you feel like buying a book, and some copies should be available in the library
  - Our material aims at being self-contained, and note furthermore that the internet is generally full of valuable resources

Some good addresses

- https://en.cppreference.com/w/
- https://www.cplusplus.com/reference/
- https://stackoverflow.com/

Recitations

- ~14 Units
- 2 Hr/week
- Individual groups of ~20 students, each having a fixed TA throughout the semester
- Recitations are held on a weekly basis, and there will be 16 different groups @ different times
- Enrolment (use wechat to login, vote only once, choose 3!): https://www.wenjuan.com/s/UZBZJvEjfde/
- Enrolment information will also be posted on Piazza https://piazza.com/shanghaitech.edu.cn/spring2022/cs100/home
- **Attendance mandatory!**

Recitations

Recitation content

- A mix of:
  - Revision of the course material
  - Provision of extra examples
  - Introduction of some new material & examples
  - Interactive examples:
    - Students are asked to solve some problems in class
    - Assistance/Answers provided by TAs during recitation
  - Introduction of homework
  - Clarification of general questions related to homework
  - Introduction of homework solutions

- Additional material (i.e. slides) will be posted on Piazza
- Recitations will be starting from 2nd week (21st of February)

Recitation times

- Eight possible times (start/end +/- 10 minutes):
  - Monday: 18h, 19h
  - Tuesday: 18h, 19h
  - Wednesday: 18h, 19h
  - Thursday: 18h, 19h

Homeworks and assessment

Homework assignments

- 8 homeworks:
  - 4 shorter homeworks primarily on C at the beginning
  - 4 longer homeworks towards and after mid-term exam
  - Homeworks are at least bi-weekly
- Makes up for large part of your grade!
- Will be released during lectures
- Solution maybe reviewed during recitations
- Strict deadline (usually ~7-14 days later, 23:59 on the day)!
- Simple late submission policy:
  - 50% penalty if submitted before 23:59 on the day following the deadline
  - 100% penalty if no submission by 23:59 on the day following the deadline

Homework submissions

- Through Online Judge
  - Use of simple OJ, access will be provided in time
  - A git based OJ may be used later if required
    - Introduction to git in first recitation

- **We will check the code manually as well!**

Quizzes

- 2 quizzes
- During regular class, probing class attendance
- Time will not be announced in advance!
- Sickness policy:
  - Requires medical certificate
  - Requires attendance to make-up session (last chance!)

Attendance check of recitations

- We will also probe the attendance of the recitations by collecting signatures.
- We reserve the right to randomly probe recitations to verify that the number of attendees and the number of collected signatures is consistent!

Assessment

- A mix of
  - Regular homeworks: 4x7%+4*11%
=28%+44%
=72%
  - Mid-term exam: 22%
  - In-class quizzes: 4%
  - Recitation attendance checks: 2%

- **<u>No final Exam!</u>**

Communication

- Your primary point of contact
  - Your TA!
  - For all course material/recitation related matters
- Use the Piazza forum!
  - However, no code sharing of homeworks!
  - You may post general questions about language features and behavior or course content
  - We encourage you to first Google yourself, then use either forum or talk to TAs

Communication

- Teacher's contact
  - Prof Xu Lan:
    - Email: xulan1@shanghaitech.edu.cn
    - Office hours: TBD
  - Prof Laurent Kneip:
    - Email: lkneip@shanghaitech.edu.cn
    - Office hours: Mondays, 10 am-12 noon, SIST 1C-303E

Academic Integrity

- Unless explicitly noted, work turned in should reflect your own/independent capabilities
- No cheating
  - Do not share your homework repo/OJ PW under any circumstances! Always protect your homework!
  - No “fake solutions” (**we will check!**)
  - **No plagiarism** (copying of part/complete solution from somewhere else) (**we will check!**)
  - **Serious consequences, including the possibility of being expelled!**