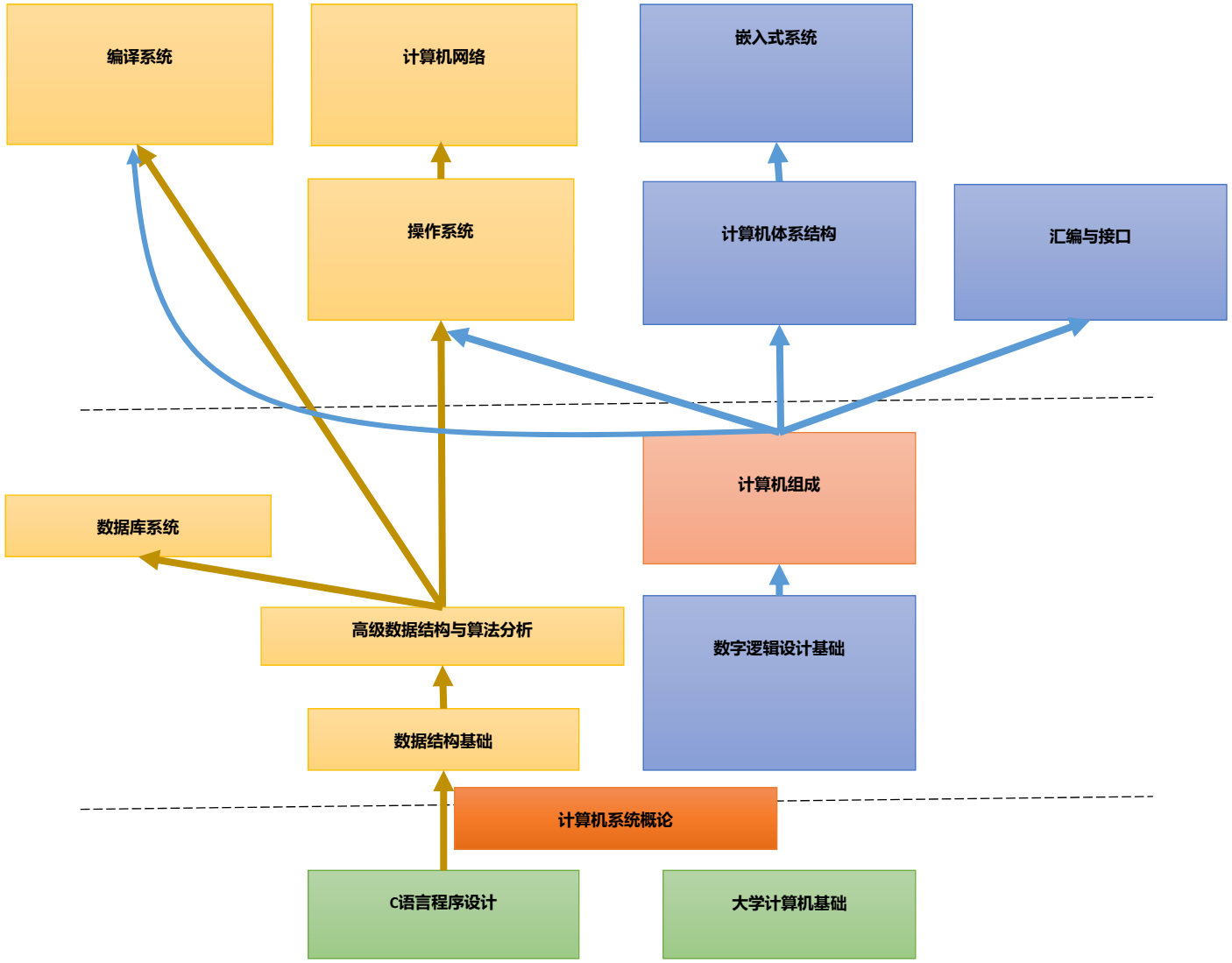
System I

Introduction

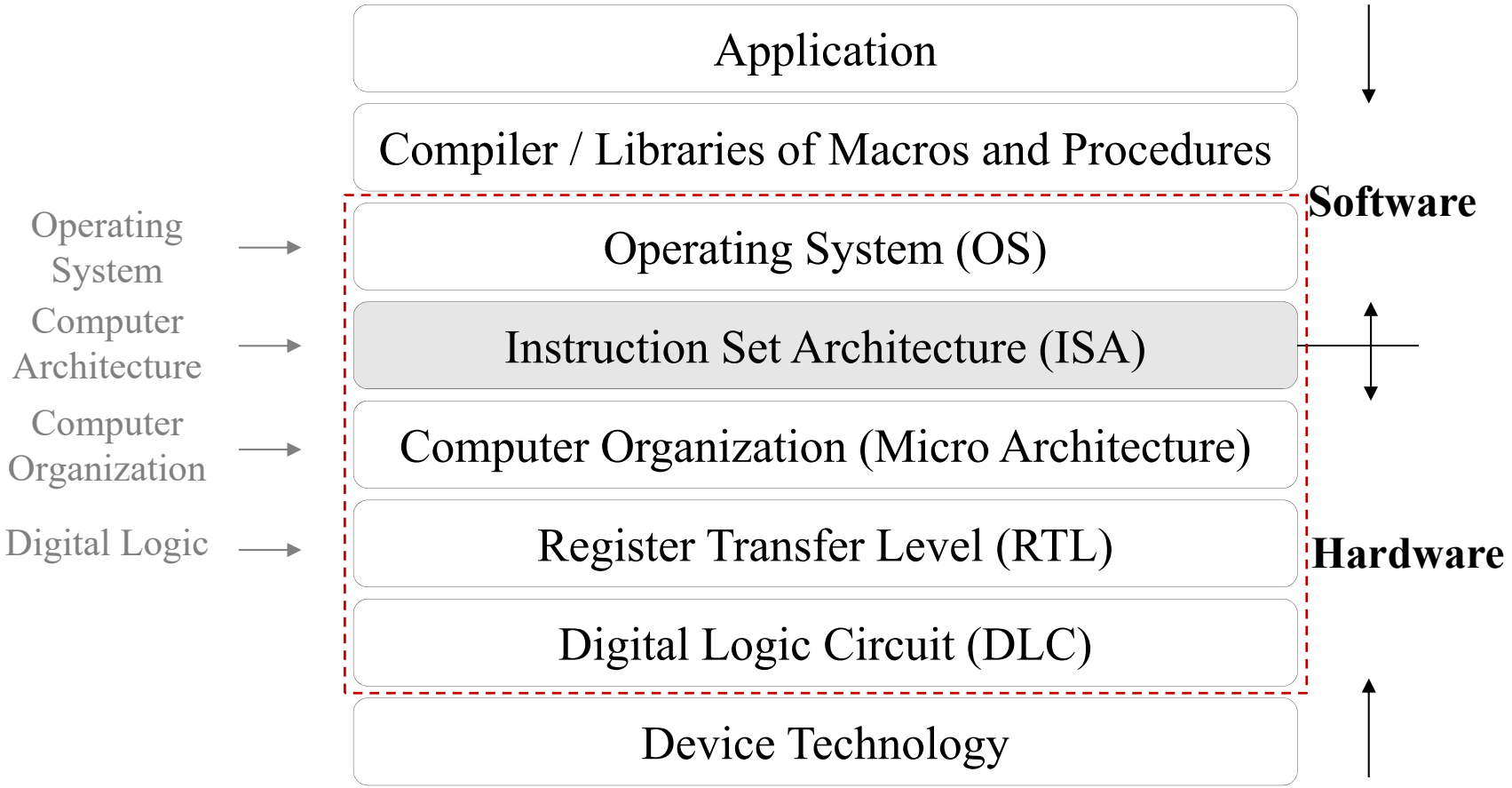
Haifeng Liu

Zhejiang University

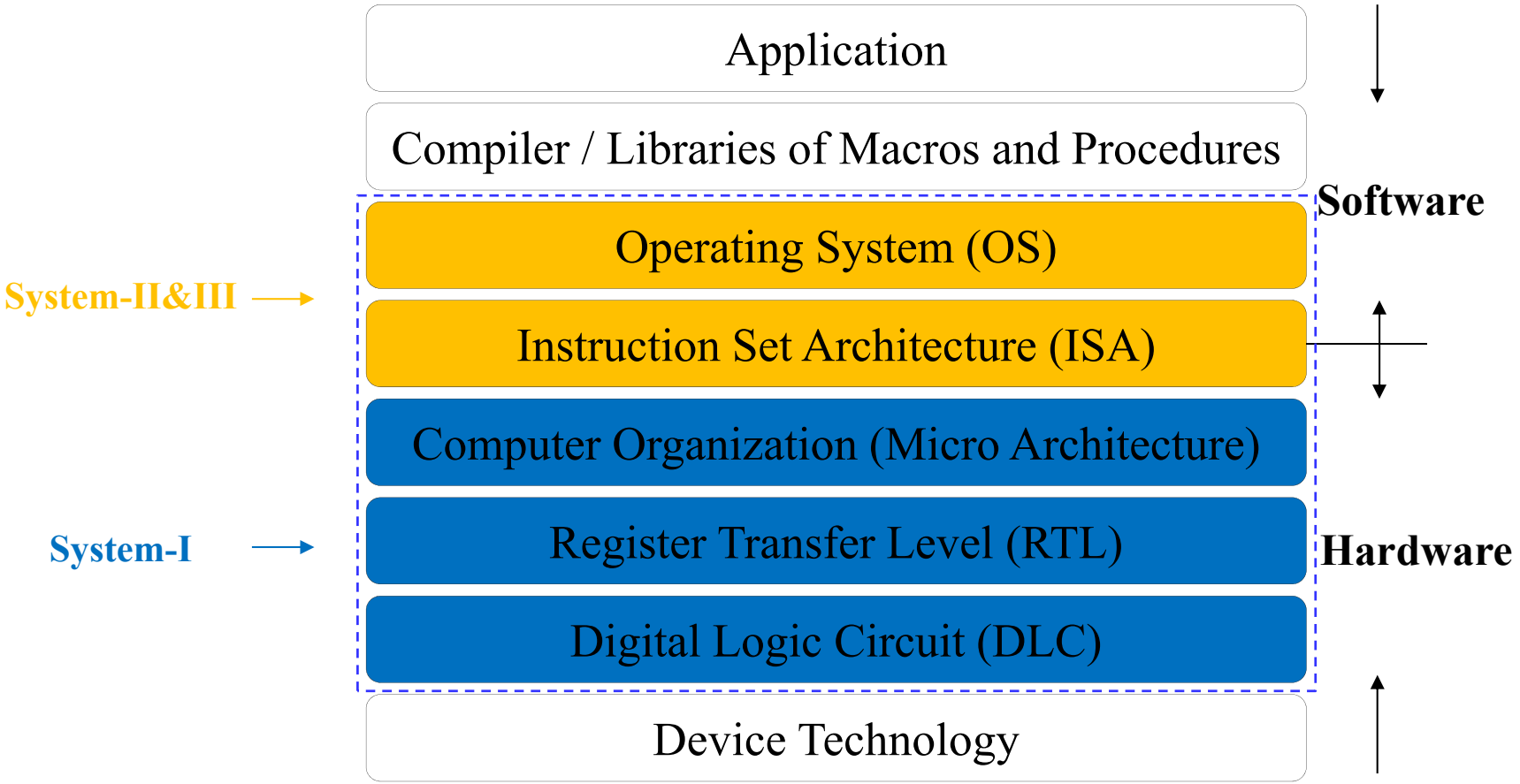
Computer Courses Organization



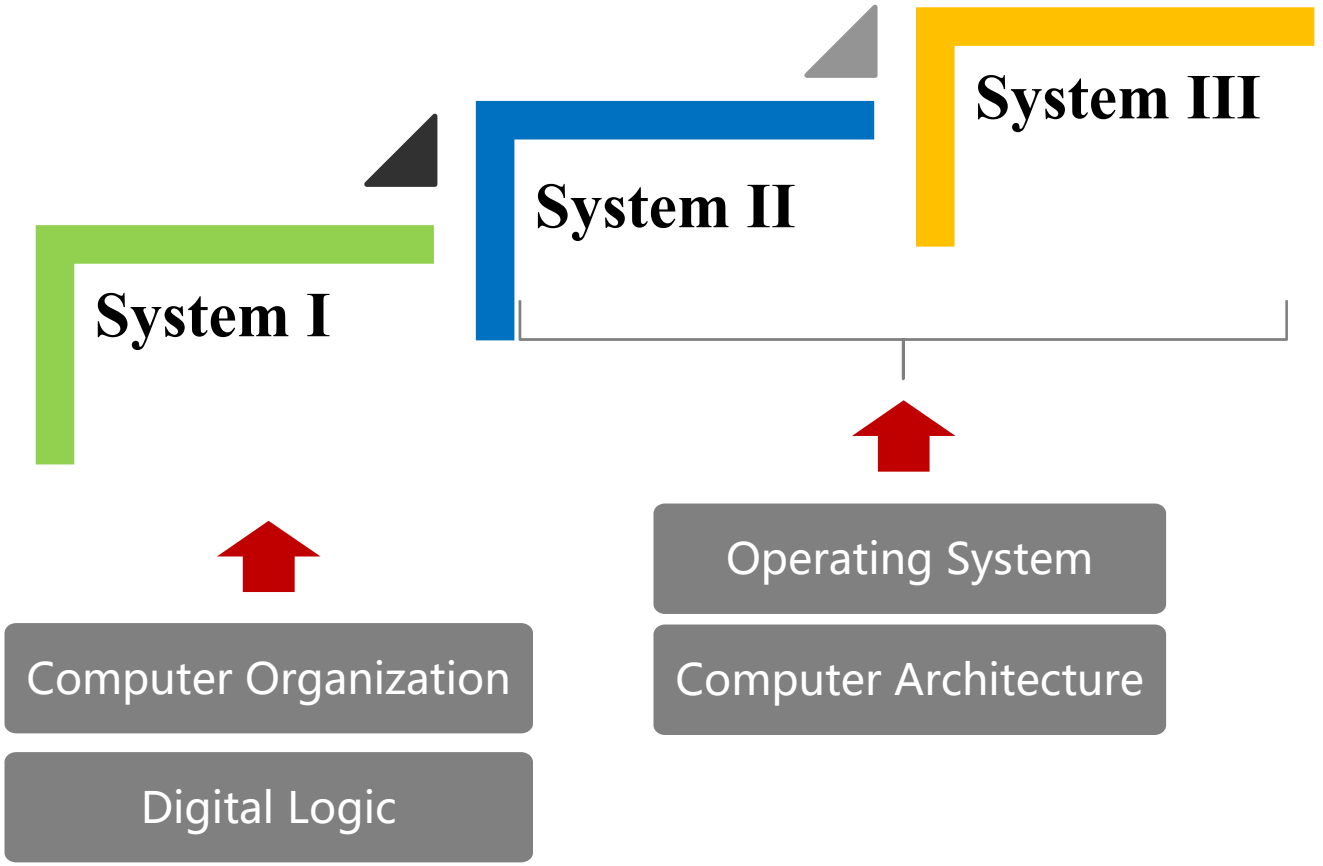
Abstract Layers of A COMPUTER SYSTEM

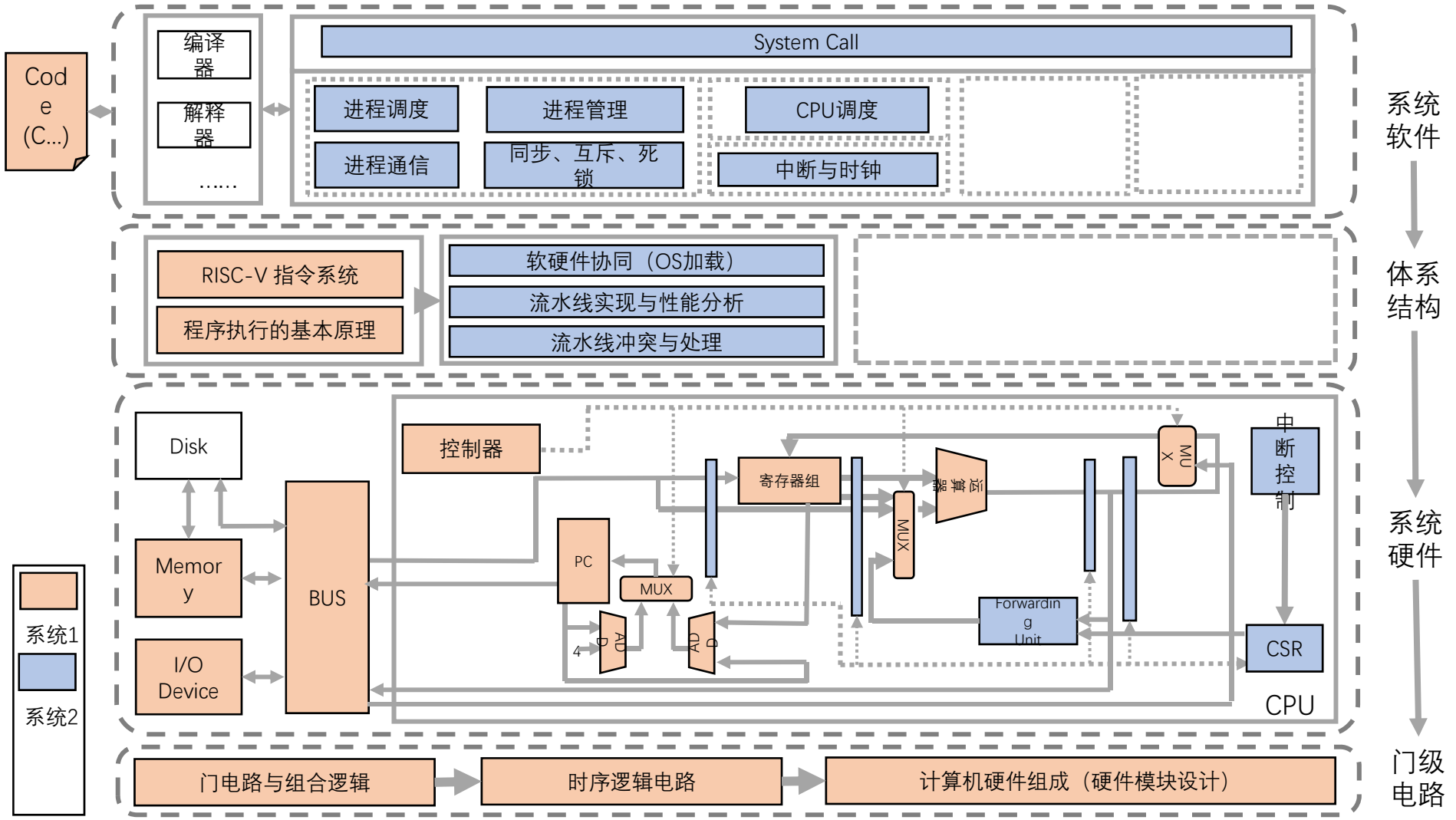


Covered in System Courses



System Courses




Code
(C...)
编译器
解释器
……
System Call
进程调度
进程管理
CPU调度
进程通信
同步、互斥、死锁
中断与时钟
RISC-V 指令系统
程序执行的基本原理
软硬件协同（OS加载）
流水线实现与性能分析
流水线冲突与处理
Disk
Memory
I/O Device
BUS
控制器
寄存器组
PC
MUX
ALU
Forwarding Unit
CSR
中断控制
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时序逻辑电路
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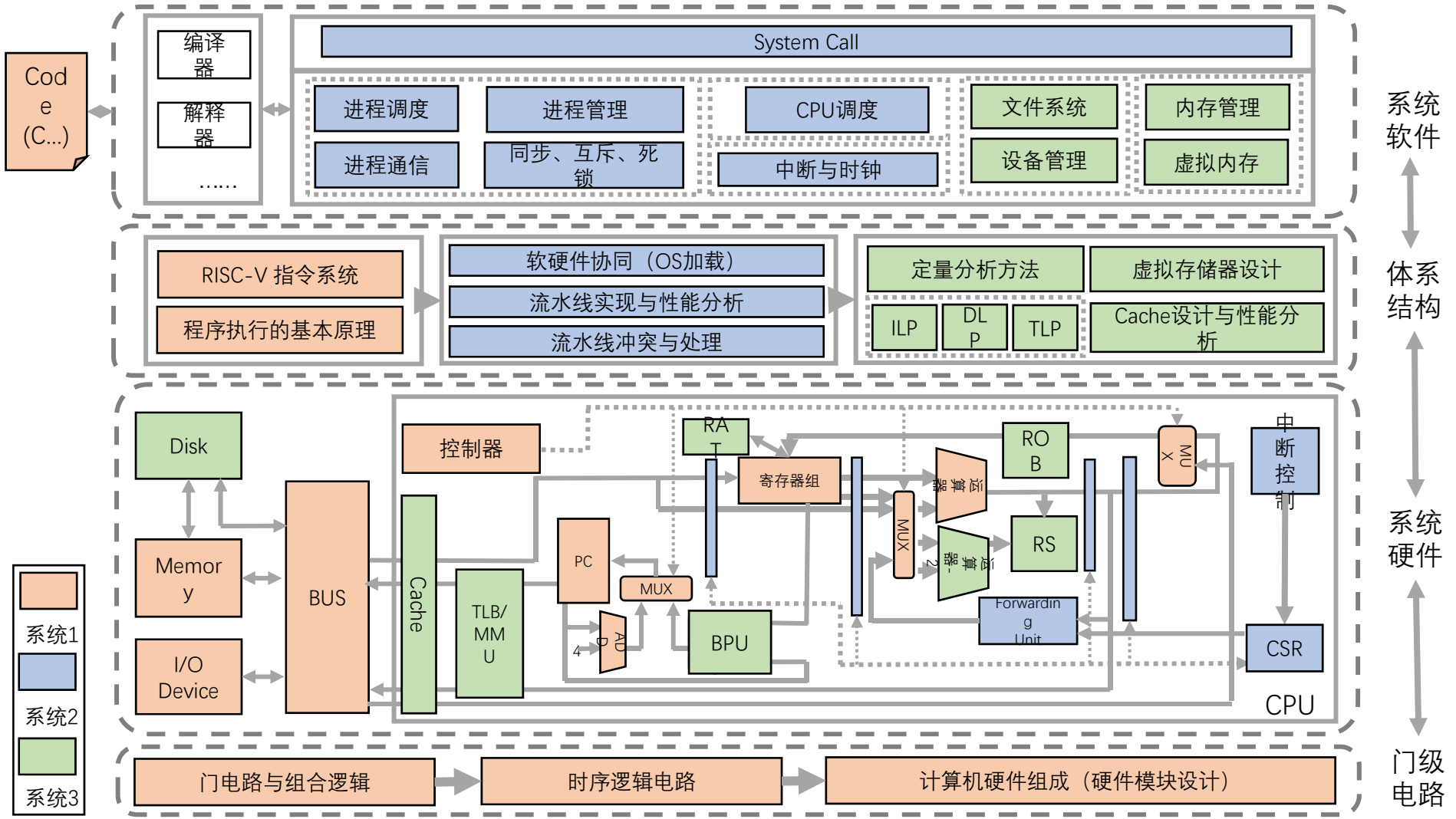
系统软件
体系结构
系统硬件
门级电路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ILP
DLP
TLP
Cache设计与性能分析
Disk
Memory
I/O Device
BUS
Cache
TLB/MMU
控制器
PC
MUX
ADD 4
BPU
RAT
寄存器组
运算器
MUX
运算器
ROB
RS
Forwarding Unit
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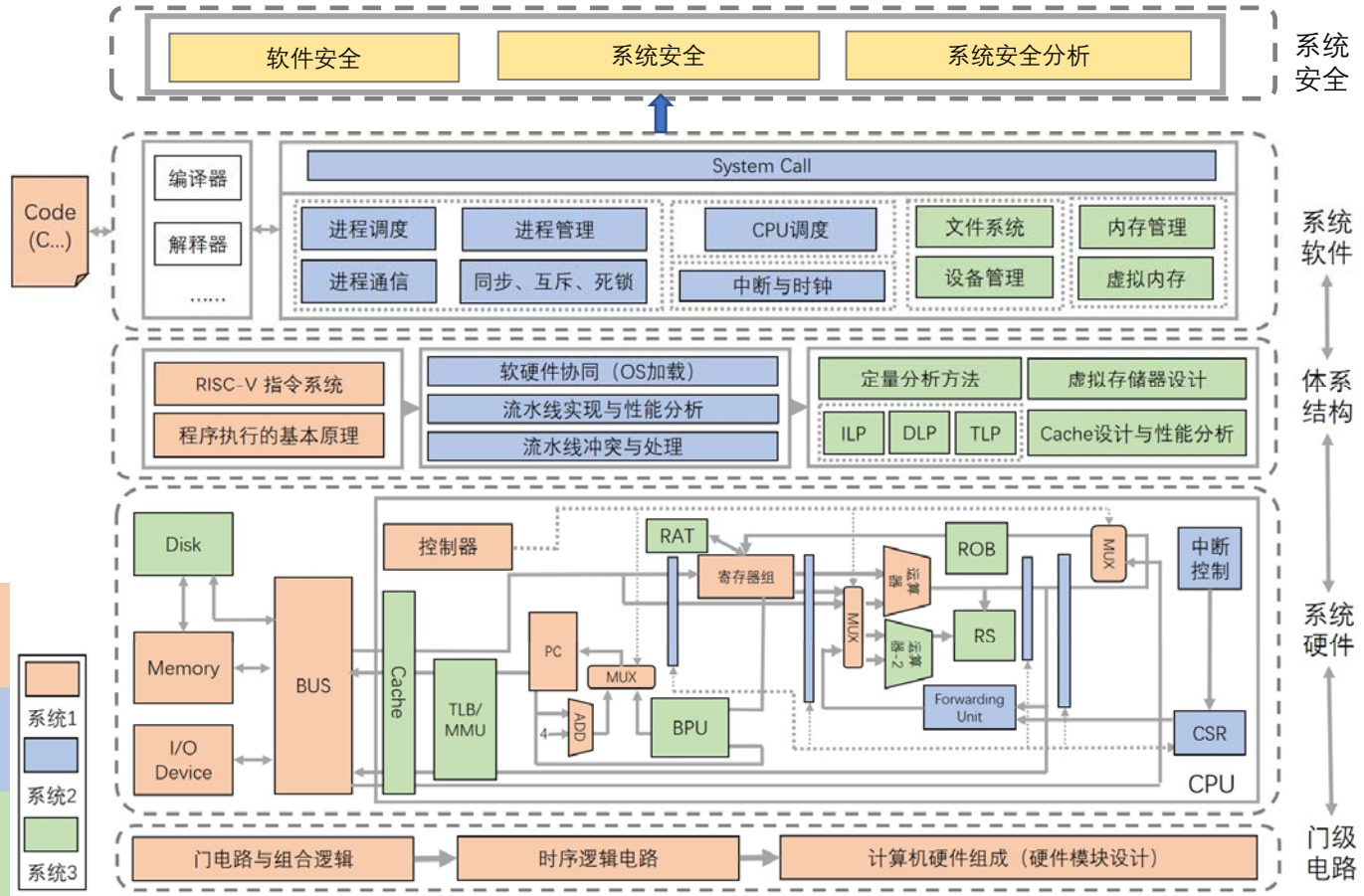
RISC-V单周期CPU
(简单指令)

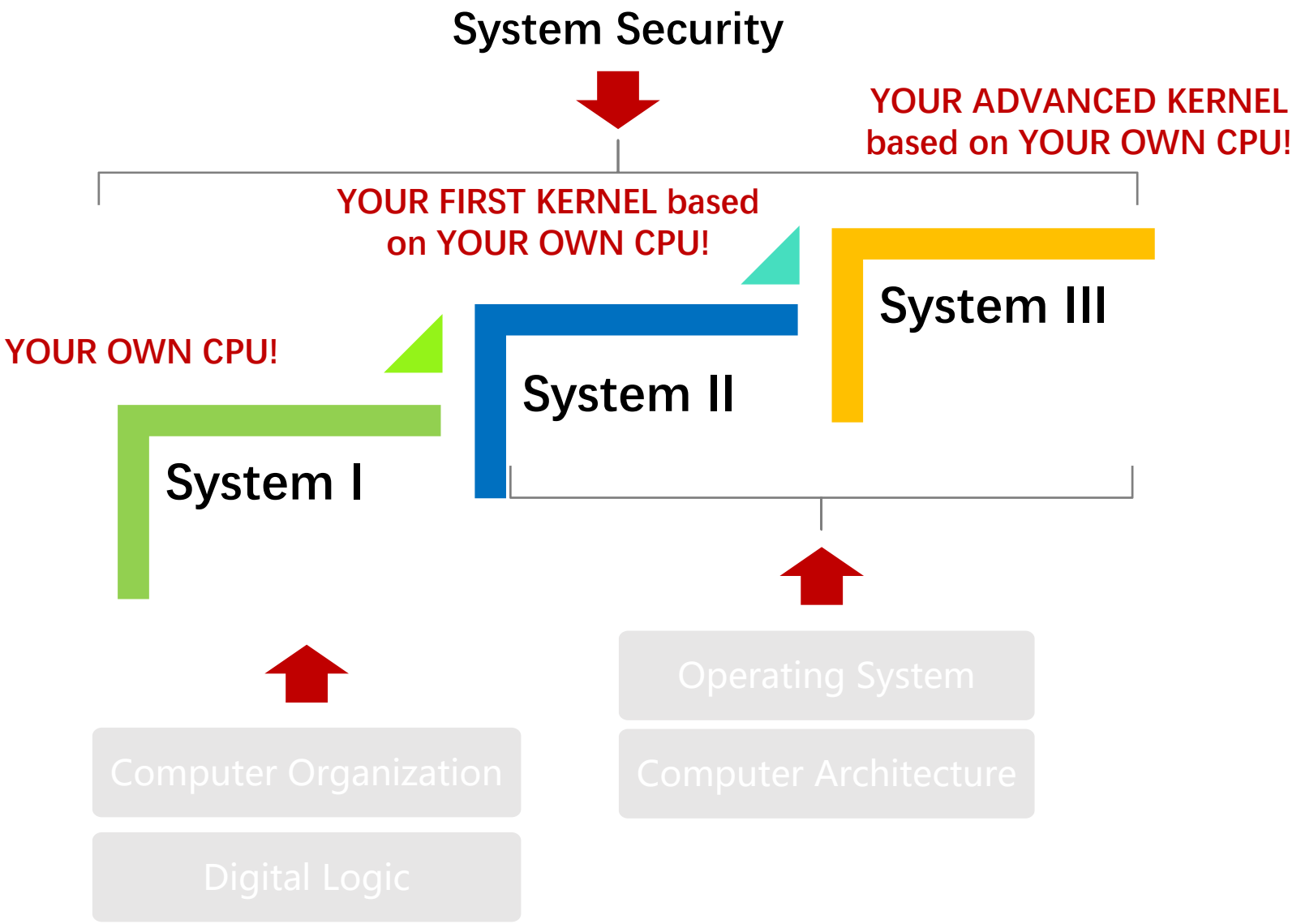
RISC-V流水线CPU
(简单指令)+简易

RISC-V CPU
(基本指令)+kernel

系统1
系统2
系统3



System Courses



Why Take System Courses?

- **Basic knowledge needed for many other areas of CS**
  - **Compiler**
  - **Parallel Computing**
  - **…**

- **Understand where the world is going**
  - **Delve into the underlying implementation**
  - **Address bug or performance issues**
  - **Become more effective programmers**

The Mysteries of Computing will be revealed!

Course Objective

- **Understand the HW / SW interface**
  - **How a processor works**
  - **How a computer is organized**
- **Establish a foundation for building applications**
  - **How to write a good program**
    - **Good = correct, fast, and secure**
  - **How to understand where the world is going**
- **Understand technology (past, present, future)**

Course Topics

- **Information Representation ~ 1 weeks**
- **Foundations of Digital Logic ~ 2 week**
- **Combinational Logic Circuit ~ 1 week**
- **Computational Operations & Units ~ 2 week**
- **Sequential Logic Circuit ~ 2 week**

- **Instruction Set Architecture (ISA) ~ 1 weeks**
- **Assembly Language ~ 2 weeks**
- **CPU Design ~ 2 weeks**
- **Performance and others ~ 1 weeks**

实验课	预期发布时间	预期持续时间
setup：一些介绍		
Lab0-1：SPICE+LogSim	第一周	1 week
Lab0-2：Vivado	第二周	2 week
Lab1-1：多路选择器	第四周	1 week
Lab1-2：七段数码管	第五周	1 week
Lab2-1：全加减法器	第六周	1 week
Lab3-1：有限状态机	第七周	1 week
Lab3-2：计数器/定时器	第八周	1 week
Lab3-3：乘法器	第九周	2 week
Lab4-1：卷积加速器 （bonus）		
Lab4-2：串口（bonus）	第十周	2 week
Lab5-1：汇编语法	第十一周	1 week
Lab5-2：汇编调试	第十二周	1 week
Project：SCPU	第十三周	4 week

Prerequisites

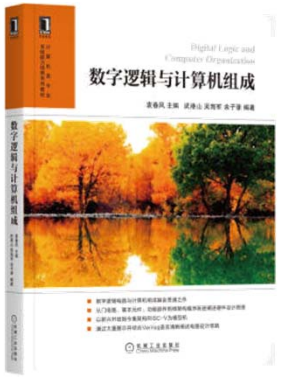
- **Courses**
  - **C Programming Language - required**
  - **Assembly Language - optional**

- **Skills**
  - **Basic programming experience**
  - **The more, the better**

Course Material

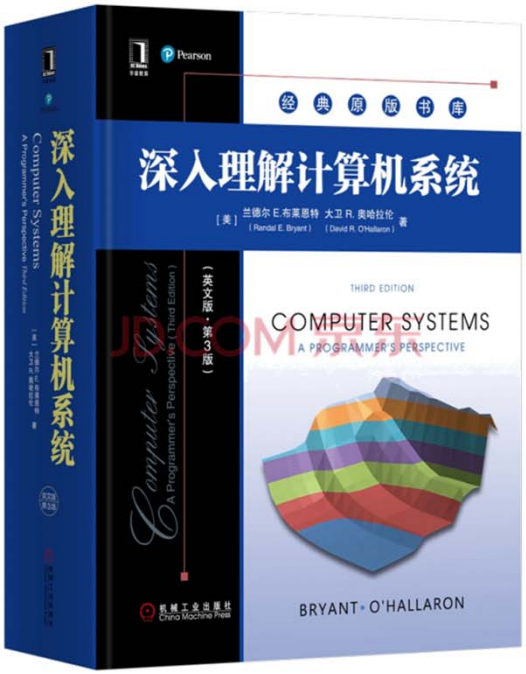
- **Lecture Notes**
  - **Will be posted**

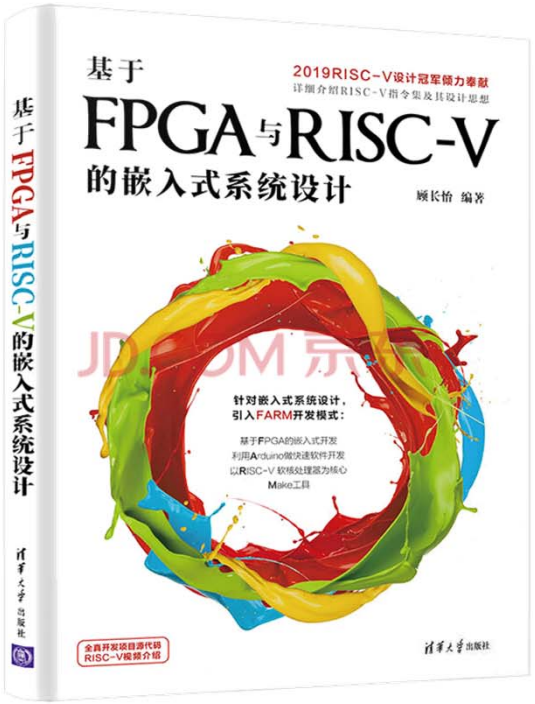
- **Textbook**
  - **Logic and Computer Design Fundamentals**
    - **Fifth Edition**



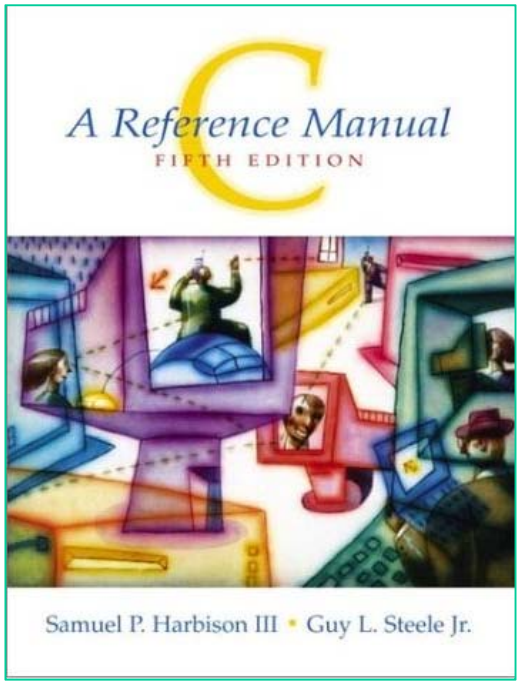
- **References**
  - 《数字逻辑与计算机组成》
    - 编者：袁春风、武港山、吴海军、余子濠
  - **Computer Organization and Design**
    - **RISC-V Edition 1st Edition**

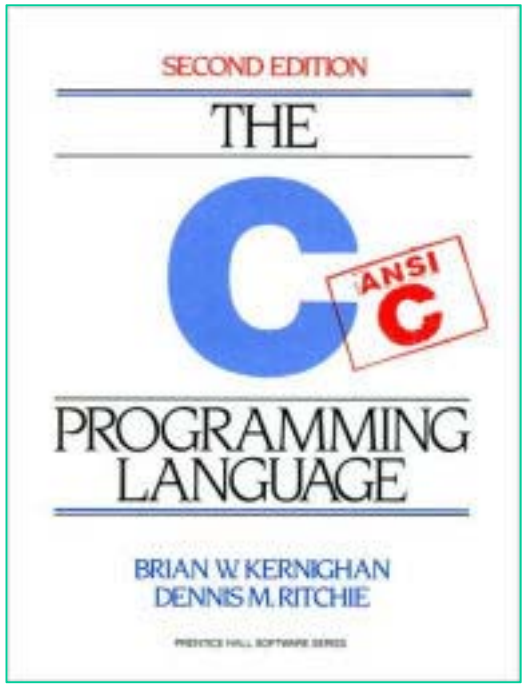
Some Other References (Optional)

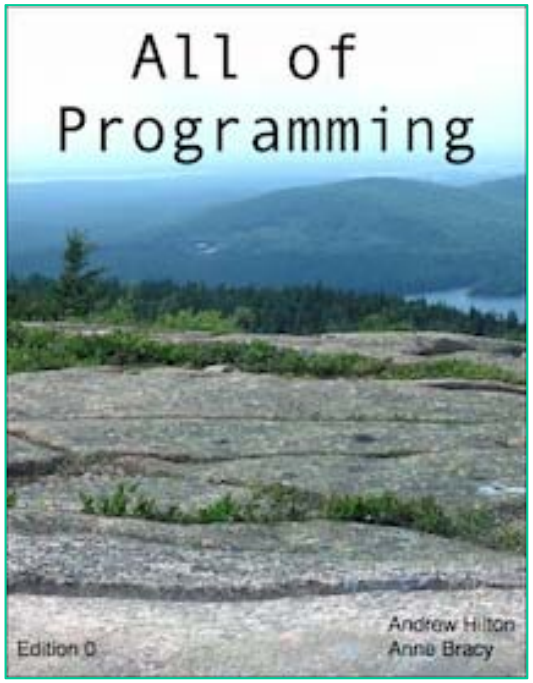




C Resources (Optional)







Class Grading

- **Class participation, Assignment, quiz** **15%**
- **Lab** **50%**
  - **Lab 1 – 组合逻辑模块 (10%)**
  - **Lab 2 - ALU (10%)**
  - **Lab 3 – 时序逻辑模块 (10%)**
  - **Lab 4 – bonus**
  - **Lab 5 – 汇编 (10%)**
  - **Lab 6 – 单周期 (10%)**
- **Final Exam** **35%**

Course Policies

- **Academic integrity**
  - **We will strictly enforce the university, college, and department policies against academic dishonesty**
  - **Plagiarism in any form will not be tolerated!**
- **Unless otherwise noted, assignment and lab reports should reflect your independent capabilities**
  - **If unsure, note / cite sources and help**
- **Late work penalized 5%/day**
  - **No penalty for documented emergency or by prior arrangement in special circumstances**