

Programming for Semiconductor Engineering:

The First Half: Bare-Metal C

Kong Kritayakirana

BARE METAL CODERS

BAREMETAL-C

MASTER LOW-LEVEL PROGRAMMING



About the instructor

- Name: Kong Kritayakirana kong.k@chula.ac.th
- Education: Ph.D. in EE, Stanford University, 1997
- Industry Experience:
 - Researcher: Hewlett-Packard Laboratories
 - ASIC Design Engineer: Juniper Networks, Inc.
 - Former Senior Advisor: Impact Electronics Siam Co., Ltd.
- Teaching Experience
 - VME, Assumption University
 - ISE, Chulalongkorn University

00 Intro to the first half of the course

- Learning Objectives
 - Modern computers are extremely complex

Approximate Hierarchy

| Endpoints | |
|-----------------------|----------|
| Applications | Software |
| Operating System | |
| Computer Architecture | Hardware |
| Logic Circuits | |
| Semiconductor Devices | |
| Device Physics | |

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Examples

| | |
|-----------------------|-------------------------------------------------------------|
| Endpoints | - Humans, pets, mouse, screen, other computers (networking) |
| Applications | - Chrome, Line, Games, ChatGPT, Web Server |
| Operating System | - Windows, MacOS, Linux |
| Computer Architecture | - CPU, GPU, RAM, Flash, Thumb Drive |
| Logic Circuits | - AND, OR, INV (NOT), Flip-Flops |
| Semiconductor Devices | - CMOS Transistors and wires |
| Device Physics | - Physics and chemistry of those transistors and wires |

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What this course will cover

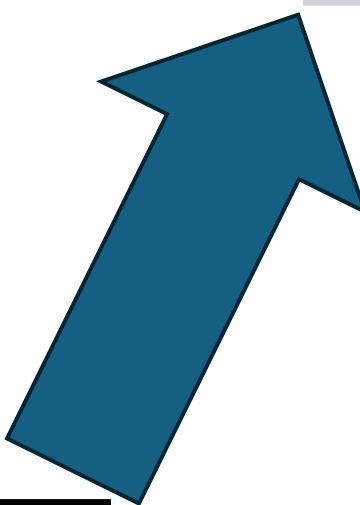
| Endpoints |
|---------------------------|
| Applications 70% |
| Operating System |
| Computer Architecture 15% |
| Logic Circuits 15% |
| Semiconductor Devices |
| Device Physics |

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→ Bridge software and hardware



| Endpoints | |
|---------------------------|----------|
| Applications 70% | Software |
| Operating System | |
| Computer Architecture 15% | Hardware |
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| Device Physics | |

00 Intro to the first half of the course

Slides are divided into 5 categories by symbols on *the top left*:

1. No symbol – teaching material – *covered on exam*
2.  Self study – *covered on exam*
3.  Summary Slide – summarizing what's *covered on exam*
4.  Advanced topics – (optional) read to gain deeper knowledge
5.  Side information – (optional) supplementary materials

00 Intro to the first half of the course

- Learning Objectives
 - Modern computers are extremely complex
 - We will learn some basic logic and computer architecture
 - Learn about a standard software programming language C
 - That can bridge to hardware easily
 - See how software “drives” hardware around
 - See physical lights being turned on or off (albeit in a simulator)
 - See how software “reads” from hardware
 - Read switches and keypads
 - Build a higher-level software concepts
 - Understanding hardware-software interaction facilitates learning

00 Intro to the first half of the course

- Assumptions and philosophy for this course
 - Very little pre-requisite
 - Knowing high-school logic is enough
 - Hope you passed the first programming course
 - **We expect a step-up in academic maturity – no pre-requisite ≠ easy**
 - Work more, earn more.
 - We will give you assignments that take a lot of time. You put in more effort, you earn better grades
 - No hardware design, but if you're interested, let us know
 - Won't need to use SimulIDE to do any hardware design.
 - We will give you all designs you need. You only write C and load into the simulator.
 - Weekly homeworks
 - It's easy to think you understand in class, doing the work proves true understanding.

00 Intro to the first half of the course

Software demo [05-20?]

Remember the 4 symbols:

