

CS302: Operating Systems

Spring 2021 Prof. Yinqian Zhang

Time: Wed 14:00 – 15:50

Location: Room 101, Lychee Hill 1

TA Teams

- 王伟力 (W 1-101)
- 李倩 (W 1-102)
- 邓楠 (W 6-409)
- 陈毅铭 (W 6-406)
- 李浩南 (W 6-408)
- 刘昊天 (W 6-402)
- 张超祖 (T 6-409)
- 孙挺 (T 6-408)
- 王晨旭 (T 202)
- 向隆 (Project 1)
- 邓森 (Project 2)

Why are you here?

- The other class is full.....
- This is a mandatory course.....
- I want to learn operating systems!
 - To work for tech giants
 - To do research in systems, security, databases
 - To prepare entrance exams for grad schools in China

Who are you?

- Volunteers for self introduction?
 - Use three bullet points?
- An English/Chinese speaker?
- A C programmer?
- Sophomore?
 - Please drop this course if you are.

What is an operating system?

- It is not an “~~operation~~” system
- Abstraction of hardware
 - Making sense of bits of 1s and 0s
- Software that supports applications
 - Managing resources, resolving conflicts, handling faults, preventing attacks, etc.
- Examples & analogies

Welcome to CS302

✧ We will study Operating Systems

- ✧ Concepts & Practice
- ✧ Overview, Process, Memory, Storage

✧ Topics

- ✧ Process concepts, scheduling, synchronization, deadlocks
- ✧ Multi-thread programming
- ✧ Memory hierarchy and memory management
- ✧ File systems, Disk allocation, scheduling
- ✧ I/O
- ✧ Security

Prerequisites

✧ C Programming

- ✧ All course projects will use C or C++
- ✧ Linux kernel is written by C
- ✧ We have tutorial for C today, so don't worry!

✧ Data structure and algorithm analysis

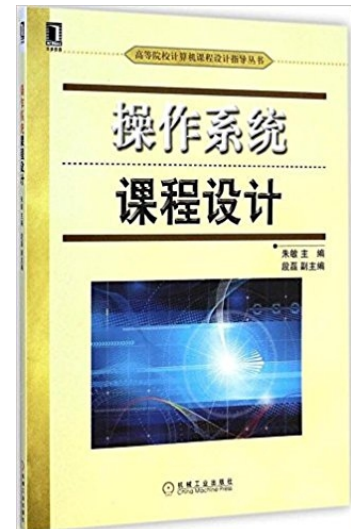
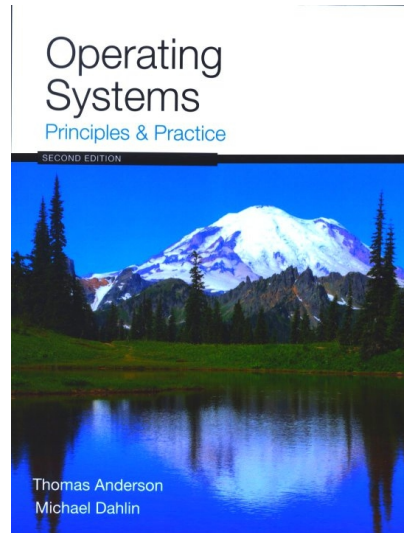
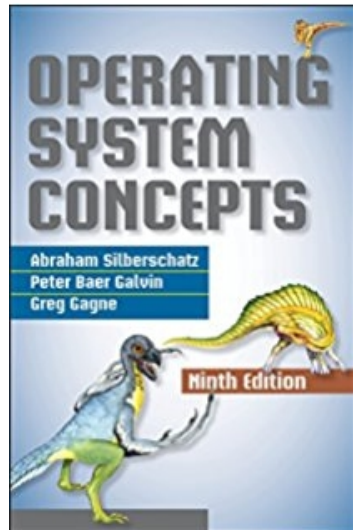
- ✧ It helps you to understand OS concepts, e.g., LRU
- ✧ It assists you to design efficient OS components

✧ Computer Organization Principle

- ✧ How do computers work?
- ✧ Hardware and software collaboration

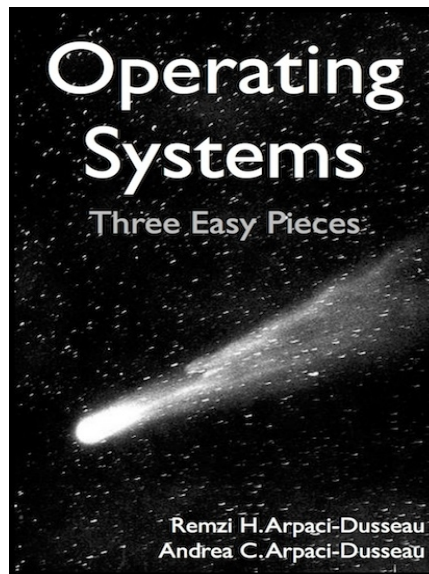
Reference Books

- ✧ **Operating System Concepts**, 9th Edition, Abraham Silberschatz et. al.
- ✧ **Operating Systems Principles & Practice**, 2nd Edition, Thomas Anderson et. al.
- ✧ **操作系统课程设计**, 机械工业出版社, 朱敏, 唐博等



Reference Books (cont'd)

- ✧ **Operating Systems: Three Easy Pieces**, Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau
- ✧ Freely available online:
<http://pages.cs.wisc.edu/~remzi/OSTEP/>



How do you understand better

- ✧ Lectures (2 hours)
 - ✧ Get the main ideas and concepts
 - ✧ Try to be active and THINK about the questions
- ✧ Tutorial / Lab (2 hours)
 - ✧ Tutorial is helping you to understand concepts in lectures.
 - ✧ Do the lab exercises / projects
 - ✧ Do not be shy to ask questions
- ✧ After class
 - ✧ Read chapters in the reference books
 - ✧ Review slides

Assessment (tentative)

- ✧ Continuous Assessment: 66%
 - ✧ Class participations: 10%
 - ✧ Lab exercises: 20%
 - ✧ Project: 36%

- ✧ Exam: 34%
 - ✧ Mid-term Examination: 14%
 - ✧ Final Examination: 20%

Assessment (cont'd)

✧ Class participation

- ✧ Both lecture and lab are taken into account
- ✧ The easiest part in all assessments

✧ Lab exercise

- ✧ Once per week, you need submit your report for each lab
- ✧ 100 points for each lab

✧ Project

- ✧ Project 1: an individual coding project on Pintos, 18%
- ✧ Project 2: an open-ended group project, 18%

✧ Examination

- ✧ Two examinations: Mid-term, Final
- ✧ Mid-term: 14%, Final: 20%
- ✧ Several Questions of Final is the same as Mid-term

More about Projects

- ✧ Two projects will be released at:
 - ✧ Week 2, and Week 7, respectively.
- ✧ Deadlines of projects are:
 - ✧ Week 11, and Week 15, respectively
- ✧ Project 1: individual project
 - ✧ Extend the Pintos kernel
 - ✧ TAs will inject baseline (BASE) solutions
 - ✧ Grading rule:
 - ✧ Better than BASE: 40-100 points, Otherwise, less than 40 points
 - ✧ Both open test cases and hidden test cases

Project 2

- ✧ An open-ended group project
 - ✧ Choose a topic that is relevant to this course (management of processes, memory, file systems, etc.)
 - ✧ One-to-one guidance (once per week)
 - ✧ Example topics will be provided
 - ✧ Examples:
 - ✳ Extension of an open-source project for improvements
 - ✳ (Re-)Implementation of a published research project
 - ✳ A project in “National Operating System Design Competition for College Students”
 - ✧ **Team size:** at most 3 students per group, assigned by email application.

Project 2 (cont'd)

- ✧ An open-ended group project
 - ✧ National Operating System Design Competition for College Student
 - ✧ <https://os.educg.net/>
 - ✧ More detailed info can be found here:
<https://github.com/oscomp/os-competition-info>

Project 2 (cont'd)

- ✧ An open-ended group project
 - ✧ **Bonus points:** up to 10%
 - ✱ If your project can be open sourced with full documentation
 - ✱ Or, if your project can lead to a paper submission
 - ✱ Or, if your project is good enough to be judged by external developers/researchers
 - ✱ How many bonus points you can get depends on your awesomeness!

Grading Policy

- ✧ Later policy:
 - ✧ No late submission allowed
- ✧ Guidelines on collaboration
 - ✧ Write up the assignment **ON YOUR OWN**
 - ✧ If you discuss with your classmates on assignments, make sure you throw away written work from the discussion
- ✧ Zero tolerance on plagiarism
 - ✧ Software will be used to detect plagiarism cases!
 - ✧ Serious cases will be reported to university
 - ✧ Sign cheating agreement with CSE Department in next week

Tentative Schedule

No.	Topic
1	Introduction
2	OS Structures
3	Processes
4	Threads
5	Synchronization
6	Scheduling
7	Main Memory

No.	Topic
8	Virtual Memory
9	Storage Structure
10	I/O
11	File System I
12	File System II
13	Linux System
14	Advanced topics

Course Materials

- ✧ Blackboard
- ✧ Please check course website regularly
 - ✧ Announcement
 - ✧ Lecture slides
 - ✧ Tutorial / lab exercises
 - ✧ Solutions

Warning

TOUGH

- ✧ CS302 is **tough**
 - ✧ **And it should be**
- ✧ No spoon-feeding
 - ✧ **No tips, no cheat-sheet, close-book exam**
 - ✧ **Programs must pass test cases to gain scores**
- ✧ CUHK suggestion: don't take too many other courses when you take this course
- ✧ **Exams cover EVERYTHING in this course**

Previous statistics

How can I be excellent?

- ✧ Sum of 2 Projects $> 180 \rightarrow$ A- or A or A+
- ✧ Sum of 2 Projects $= 200 \rightarrow$ A+
- ✧ Sum of 10 Labs $> 950 \rightarrow$ A+

Previous statistics

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- ✧ Sum of 10 Labs $> 950 \rightarrow$ A+

How can I fail this course?

- ✧ Class Attendance Part $< 8 / 10 \rightarrow$ Fail
- ✧ One Project Missing \rightarrow Fail
- ✧ Sum of 2 Projects $\leq 86 \rightarrow$ Fail

Previous statistics

How can I be excellent?

- ✧ Sum of 2 Projects $> 180 \rightarrow A^-$ or A or A+
- ✧ Sum of 2 Projects = 200 $\rightarrow A^+$
- ✧ Sum of 10 Labs $> 950 \rightarrow A^+$

How can I fail this course?

- ✧ Class Attendance Part $< 8 / 10 \rightarrow \text{Fail}$
- ✧ One Project Missing $\rightarrow \text{Fail}$
- ✧ Sum of 2 Projects $\leq 86 \rightarrow \text{Fail}$

How hard about examinations?

- ✧ Average of Exam 1 $\rightarrow 52.9$
- ✧ Average of Exam 3 $\rightarrow 53.6$

Acknowledgements

- ✧ Some notes and examples are extracted from
 - ✧ Dr. Eric Lo's offering in CUHK,
 - ✧ Dr. Ion Stoica in Berkeley
 - ✧ Dragon book course materials
- ✧ **Prof. Bo Tang teaching in Room 102!**