

Lecture Note 0: Course Introduction

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(본 교재는 2025년도 과학기술정보통신부 및 정보통신기획평가원의 'SW중심대학사업' 지원을 받아 제작 되었습니다.)

How to access lecture contents?

■ Lecture site

The screenshot shows the home page of Jongmoo Choi's website. The browser address bar shows the URL `embedded.dankook.ac.kr/~choijm/`. The page features a header with the name "Jongmoo Choi" and a profile picture. To the right of the photo, it lists his title as "Professor (Ph.D.)" and his affiliation with the Department of Software at Dankook University. Contact information, including email, office location, and phone numbers, is provided. Below the profile information, there are sections for "Contents" (with links to Curriculum Vitae, Publication Lists, Course Information, Projects, Photographs, and Personal Interests) and "Events" (listing several research papers and their acceptance dates with links). At the bottom, there is a "Curriculum Vitae" section with a link to the Department of Computer Science and Engineering at Dankook University.

(home page)

The screenshot shows the "Course Information" page for the Operating System course. The browser address bar shows the URL `embedded.dankook.ac.kr/~choijm/course/course.html`. The page has a "Course Information" header and a "Contents" section with two main items: "2025년 1학기: 운영체제 (Operating System)" and "Previous Lecture Information". Below this, there is a section titled "운영체제 (Operating System)" which contains several sub-sections: "강의 자료 (Lecture Notes)" listing 10 lecture notes (LN 0 to LN 9) with their topics and corresponding OSTEP chapters; "강의 교재" (Lecture Textbook) listing the main textbook "Operating systems: Three Easy Pieces"; "강의 관련 자료" (Lecture Related Materials) listing five references on operating system concepts and design principles; "설계 실습 관련 자료" (Design Lab Related Materials) listing GitHub links for 2025, 2024, and 2022; and "오픈 소스 관련 자료" (Open Source Related Materials) listing open source OSes and a quick guide to GDB.

(lecture page)

What is Operating System?

■ Definition (from wikipedia.org)

From Wikipedia, the free encyclopedia

An **operating system (OS)** is system software that manages computer hardware and software resources, and provides common services for computer programs.

Time-sharing operating systems schedule tasks for efficient use of the system and may also include accounting software for cost allocation of processor time, mass storage, peripherals, and other resources.

For hardware functions such as input and output and memory allocation, the operating system acts as an intermediary between programs and the computer hardware,^{[1][2]} although the application code is usually executed directly by the hardware and frequently makes system calls to an OS function or is interrupted by it. Operating systems are found on many devices that contain a computer – from cellular phones and video game consoles to web servers and supercomputers.

As of September 2024, Android is the most popular operating system with a 46% market share, followed by Microsoft Windows at 26%, iOS and iPadOS at 18%, macOS at 5%, and Linux at 1%. Android, iOS, and iPadOS are mobile operating systems, while Windows, macOS, and Linux are desktop operating systems.^[3] Linux distributions are dominant in the server and supercomputing sectors. Other specialized classes of operating systems (special-purpose operating systems),^{[4][5]} such as embedded and real-time systems, exist for many applications. Security-focused operating systems also exist. Some operating systems have low system requirements (e.g. light-weight Linux distribution). Others may have higher system requirements.

Some operating systems require installation or may come pre-installed with purchased computers (OEM-installation), whereas others may run directly from media (i.e. live CD) or flash memory (i.e. USB stick).

Definition and purpose

Operating systems

```
graph TD; User[User] <--> Application[Application]; Application <--> OS[Operating system]; OS <--> Hardware[Hardware];
```

Common features

- Process management
- Interrupts
- Memory management
- File system
- Device drivers
- Networking
- Security
- Input/output

V · T · E

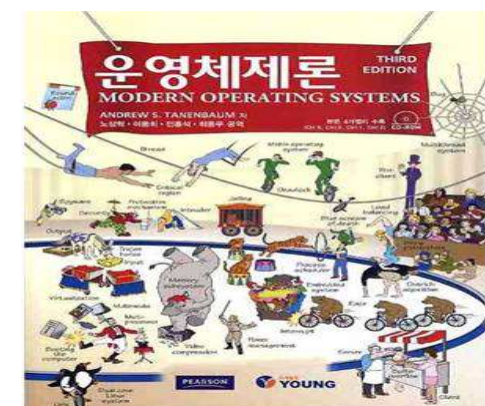
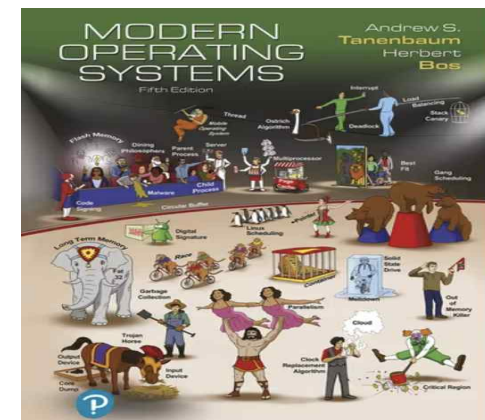
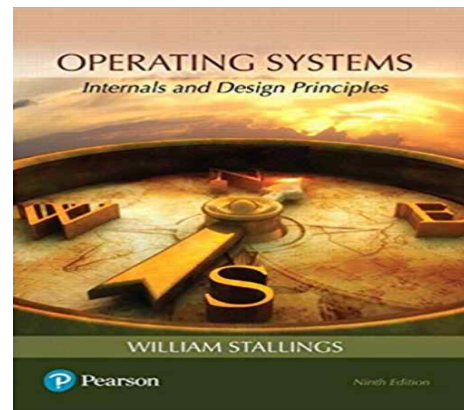
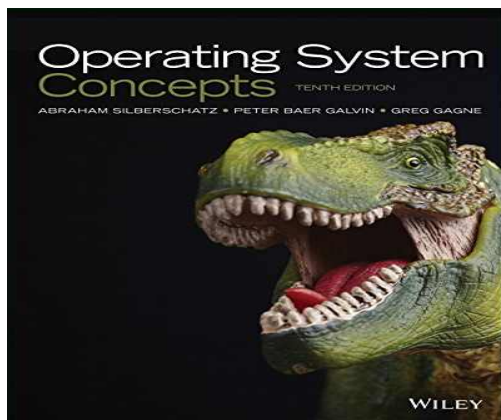
Course Objectives

- Understand the **definition**, role and goal of OS
 - ✓ Resource manager, computing environments, ...
- Know the existing operating systems
 - ✓ UNIX, Windows, Apple OS X, Linux, Android, iOS, WebOS, Mach, ...
- Learn the **internal structure** of OS
 - ✓ Process, Virtual memory, File system, Driver, Protocol, Interrupt, ...
- Comprehend the **policies** and **mechanisms** used by OS
 - ✓ CPU scheduling, Demand paging, LRU, inode, System call, ...
- Grasp the idea of abstraction
 - ✓ Information Hiding, Illusion, Interface, Layered architecture, ...
- **Demonstrate** what we have learned
 - ✓ Lab. project



Traditional Textbook

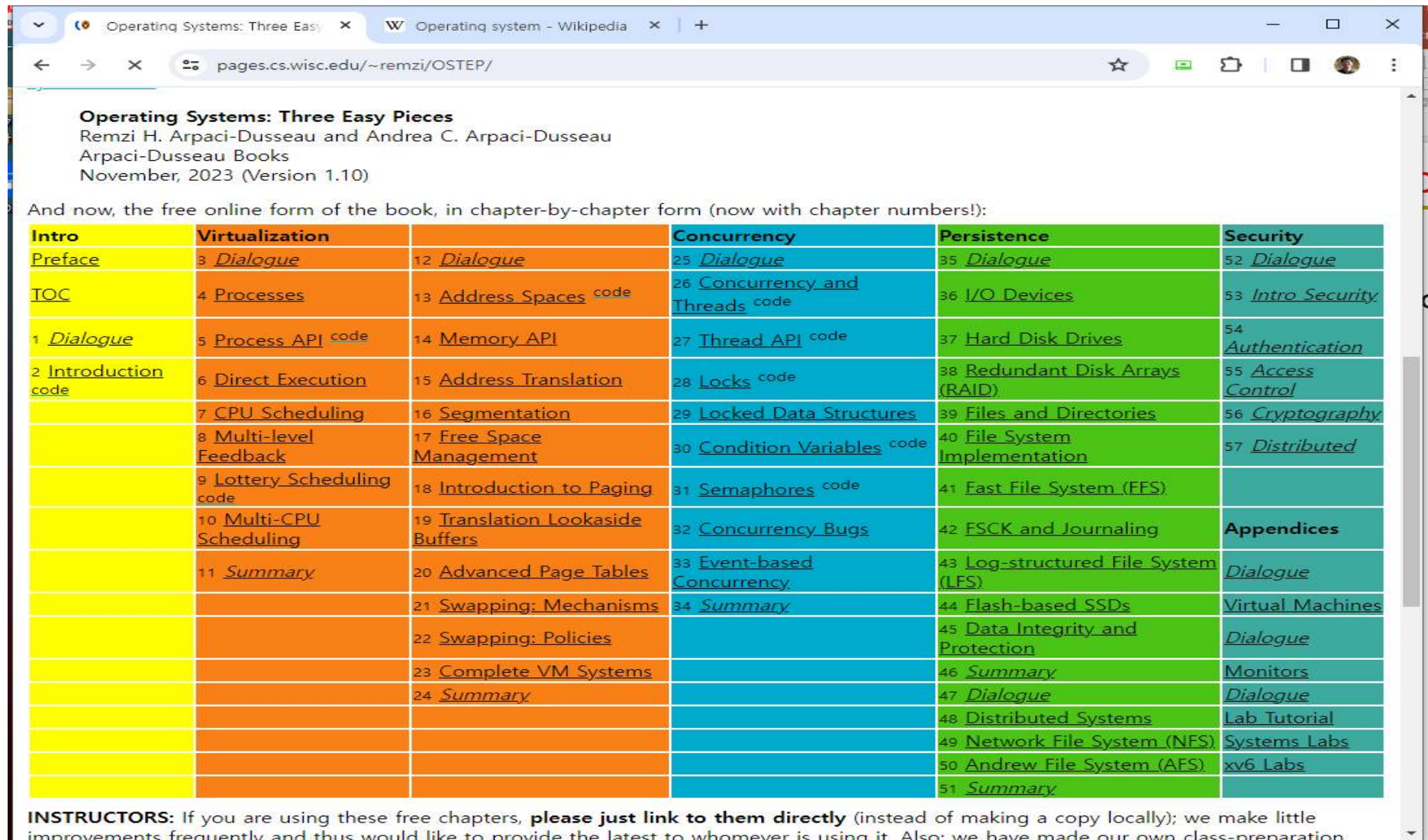
- Three representative textbooks for operating system course
 - ✓ Operating Systems Concepts, by A. Silberschatz, P. Galvin and G. Gagne
 - ✓ Operating Systems: Internals and Design Principles, by W. Stalling
 - ✓ Modern Operating Systems, by A. Tanenbaum and H. Bos



Textbook in this course

■ Remzi's OSTEP (OS Three Easy Pieces)

✓ <http://pages.cs.wisc.edu/~remzi/OSTEP/>



Operating Systems: Three Easy Pieces
Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau
Arpaci-Dusseau Books
November, 2023 (Version 1.10)

And now, the free online form of the book, in chapter-by-chapter form (now with chapter numbers!):

Intro	Virtualization		Concurrency	Persistence	Security
Preface	3 <i>Dialogue</i>	12 <i>Dialogue</i>	25 <i>Dialogue</i>	35 <i>Dialogue</i>	52 <i>Dialogue</i>
TOC	4 <i>Processes</i>	13 <i>Address Spaces</i> <code></code>	26 <i>Concurrency and Threads</i> <code></code>	36 <i>I/O Devices</i>	53 <i>Intro Security</i>
1 <i>Dialogue</i>	5 <i>Process API</i> <code></code>	14 <i>Memory API</i>	27 <i>Thread API</i> <code></code>	37 <i>Hard Disk Drives</i>	54 <i>Authentication</i>
2 <i>Introduction</i> <code></code>	6 <i>Direct Execution</i>	15 <i>Address Translation</i>	28 <i>Locks</i> <code></code>	38 <i>Redundant Disk Arrays (RAID)</i>	55 <i>Access Control</i>
	7 <i>CPU Scheduling</i>	16 <i>Segmentation</i>	29 <i>Locked Data Structures</i>	39 <i>Files and Directories</i>	56 <i>Cryptography</i>
	8 <i>Multi-level Feedback</i>	17 <i>Free Space Management</i>	30 <i>Condition Variables</i> <code></code>	40 <i>File System Implementation</i>	57 <i>Distributed</i>
	9 <i>Lottery Scheduling</i> <code></code>	18 <i>Introduction to Paging</i>	31 <i>Semaphores</i> <code></code>	41 <i>Fast File System (FFS)</i>	
	10 <i>Multi-CPU Scheduling</i>	19 <i>Translation Lookaside Buffers</i>	32 <i>Concurrency Bugs</i>	42 <i>FSCK and Journaling</i>	Appendices
	11 <i>Summary</i>	20 <i>Advanced Page Tables</i>	33 <i>Event-based Concurrency</i>	43 <i>Log-structured File System (LFS)</i>	<i>Dialogue</i>
		21 <i>Swapping: Mechanisms</i>	34 <i>Summary</i>	44 <i>Flash-based SSDs</i>	<i>Virtual Machines</i>
		22 <i>Swapping: Policies</i>		45 <i>Data Integrity and Protection</i>	<i>Dialogue</i>
		23 <i>Complete VM Systems</i>		46 <i>Summary</i>	<i>Monitors</i>
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				48 <i>Distributed Systems</i>	<i>Lab Tutorial</i>
				49 <i>Network File System (NFS)</i>	<i>Systems Labs</i>
				50 <i>Andrew File System (AFS)</i>	<i>xv6 Labs</i>
				51 <i>Summary</i>	

INSTRUCTORS: If you are using these free chapters, please just link to them directly (instead of making a copy locally); we make little improvements frequently and thus would like to provide the latest to whomever is using it. Also: we have made our own class-preparation

Textbook in this course

■ TOC (Table of Contents) of OSTEP

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Reference

■ Linux Kernel Internals (리눅스 커널 내부 구조)

- ✓ 1장. 리눅스 소개
- ✓ 2장. 리눅스 커널 구조
- ✓ 3장. 태스크 관리
- ✓ 4장. 메모리 관리
- ✓ 5장. 파일시스템과 가상 파일시스템
- ✓ 6장. 인터럽트와 트랩 그리고 시스템 호출
- ✓ 7장. 리눅스 모듈 프로그래밍
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- ✓ 10장. 운영체제 관련 실습
- ✓ 부록1. 리눅스와 가상화 그리고 XEN
- ✓ 부록2. MTD와 YAFFS



Teaching Method

■ Mainly Lecturing

- ✓ Discussion (Q&A) during the course is quite important

■ Homework

- ✓ Reading assignment
 - 1 or 2 times
- ✓ Lab. Project (Programming or Analysis)
 - Lab1: scheduling
 - Lab2: concurrency
 - Lab3: file system
 - Lab4: virtual memory



■ Grading

- ✓ Exam(50%) + Lab. Project/Assignment (40%) + Attendance/Discussion (10%) → can be changed later
- ✓ **Absence more than 5 times** or **Mid and Final Exam. score below 20** or **No lab. Project** → F
- ✓ Roughly, 20% students are expected to get the A grade.

Discussion



• Any questions? Feel free to ask at our class or send an email to me: choijm@dankook.ac.kr



Quiz for this Lecture

Quiz

- ✓ 1. What are the differences between Operating System (e.g. MS Windows or Linux) and Application (e.g. MS Word or Chrome)? Explain the difference using the word “mode”.
- ✓ 2. What are three pieces of Operating System?
- ✓ 3. There is a Confucian philosopher, Xunzi, in Chapter 1, “A Dialogue on the Book”, of the OSTEP. Explain what he said.



(Source: Google Image)

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2 A DIALOGUE ON THE BOOK

Professor: Excellent query! Well, each person needs to figure this out on their own, of course, but here is what I would do: go to class, to hear the professor introduce the material. Then, at the end of every week, read these notes, to help the ideas sink into your head a bit better. Of course, some time later (that, before the exam!), read the notes again to firm up your knowledge. Of course, your professor will no doubt assign some homeworks and projects, so you should do those; in particular, doing projects where you write real code to solve real problems is the best way to put the ideas within these notes into action. As Confucius said...

Student: Oh, I know! I hear and I forget. I see and I remember. I do and I understand. Or something like that.

Professor: (surprised) How did you know what I was going to say?!

Student: It seemed to follow. Also, I am a big fan of Confucius, and an even bigger fan of Xunzi, who actually is a better source for this quote³.

Professor: (stunned) Well, I think we are going to get along just fine! Just fine indeed.

Student: Professor – just one more question, if I may. What are these dialogues for? I mean, isn't this just supposed to be a book? Why not present the material directly?

Professor: Ah, good question, good question! Well, I think it is sometimes useful to pull yourself outside of a narrative and think a bit; these dialogues are those times. So you and I are going to work together to make sense of all of these pretty complex ideas. Are you up for it?

Student: So we have to think? Well, I'm up for that. I mean, what else do I have to do anyhow? It's not like I have much of a life outside of this book.

Professor: Me neither, sadly. So let's get to work!

³According to <http://www.bareillypopik.com> (on, December 19, 2012, entitled "Tell me and I forget; teach me and I may remember; involve me and I will learn.") Confucian philosopher Xunzi said "Not having heard something is not as good as having heard it; having heard it is not as good as having seen it; having seen it is not as good as knowing it; knowing it is not as good as putting it into practice." Later on, the wisdom got attached to Confucius for some reason. Thanks to Jiao Dong (Kajigas) for telling us!

OPERATING SYSTEMS [VERSION 1.10] WWW.OSTEP.ORG

사사

- 본 교재는 2025년도 과학기술정보통신부 및 정보통신기획평가원의 ‘SW중심대학사업’ 지원을 받아 제작 되었습니다.
- 본 결과물의 내용을 전재할 수 없으며, 인용(재사용)할 때에는 반드시 과학기술정보통신부와 정보통신기획평가원이 지원한 ‘SW중심대학’의 결과물이라는 출처를 밝혀야 합니다.

IITP 정보통신기획평가원
디지털인재양성단 SW인재팀

