Lecture Note 0.
Lecture Overview

August 26, 2021

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Course Objective

- What is System Programming?
  - ✓ Application program vs. System program

```
#include <stdio.h>

int main()
{
    printf("Hello, World₩n");
}
```

- ☞ **How to run this program on CPU?**
- ☞ **What is the role of printf()?**
- ☞ **How the string is displayed on Monitor?**
- ☞ **How this program can be executed with other programs concurrently?**
- ☞ **What are the differences between local and global variables?**
- ☞ **What if we split the string "Hello, World\n" into two strings with two printf()s?**

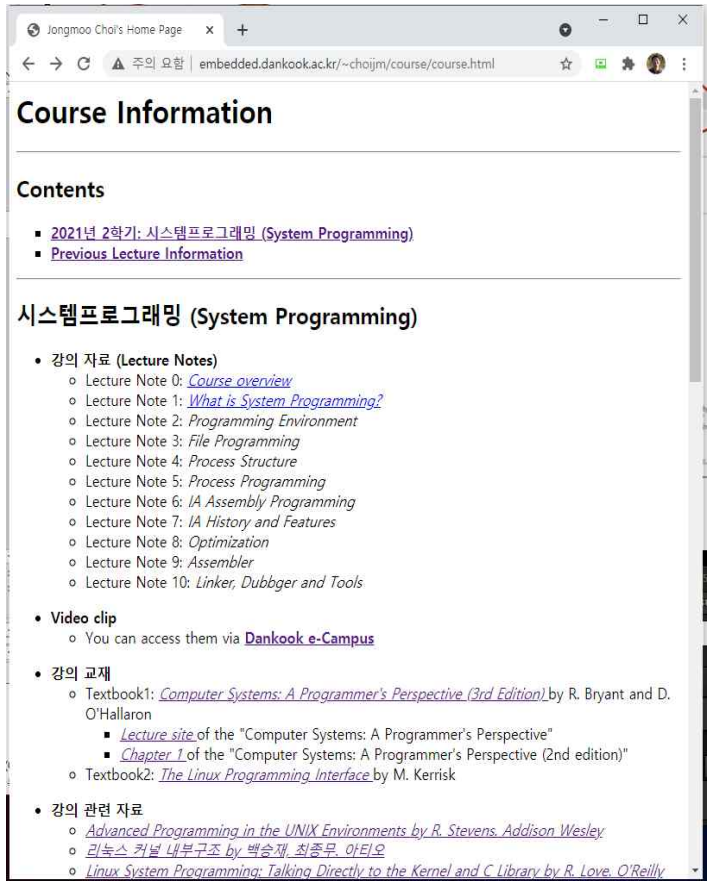
Course Objective

- Understand how software runs on hardware (or how software and hardware are connected)
  - ✓ High-level program for human vs. Binary for CPU
  - ✓ Compiler, Assembler, Linker, Loader, Debugger, Library (dll), …
  - ✓ File system, Device driver
  - ✓ Concept of Process, Scheduling for multiple processes
  - ✓ Memory management (data/stack/heap, virtual memory)
  - ✓ Software-level optimizations: code motion, loop unrolling, …
  - ✓ Hardware-level optimizations: pipeline, cache, …
  - ✓ Recent technologies in Intel CPU

- Grasp the concept of abstraction
  - ✓ Information hiding
  - ✓ Interface vs. Implementation
  - ✓ Layered architecture

Course Content

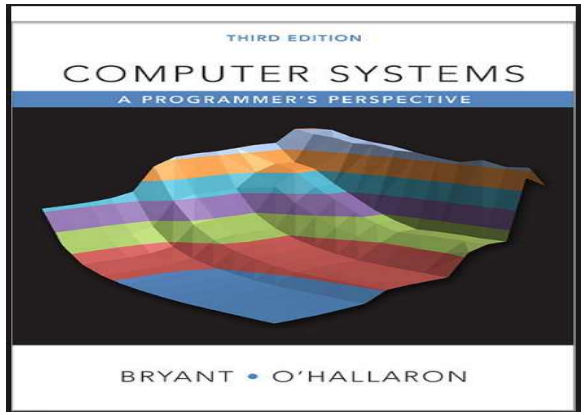
- Lecture Notes
  - ✓ LN0: Course Overview
  - ✓ LN1: What is System Programming?
  - ✓ LN2: Programming Environments
  - ✓ LN3: File Programming
  - ✓ LN4: Process Structure
  - ✓ LN5: Process Programming
  - ✓ LN6: IA Assembly Programming
  - ✓ LN7: IA History and Features
  - ✓ LN8: Optimization Practice
  - ✓ LN9: Assembler
  - ✓ LN10: Linker, Debugger and Tools
  - ✓ LN11: IPC, Signal and Socket

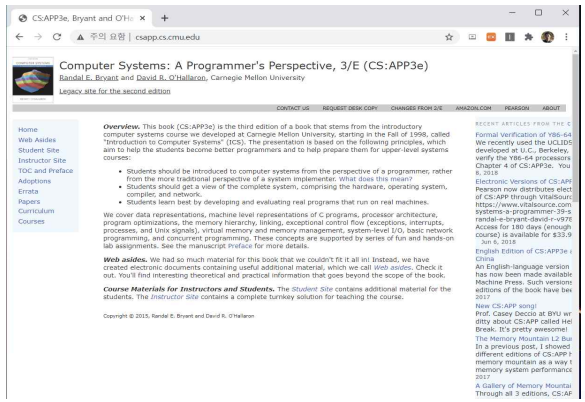


(http://embedded.dankook.ac.kr/~choijm/)

Course Content

- Textbook 1: CSAPP
  - ✓ Computer Systems: A Programmer's Perspective, by R. Bryant and D. O'Hallaron
  - ✓ Contents
    1. A Tour of Computer Systems
    2. Representing and Manipulating Information
    3. Machine-level Representation of Programs
    4. Processor Architecture
    5. Optimizing Program Performance
    6. The Memory Hierarchy
    7. Linking
    8. Exceptional Control Flow
    9. Virtual Memory
    10. System-Level I/O
    11. Network Programming
    12. Concurrent Programming





(http://csapp.cs.cmu.edu/)

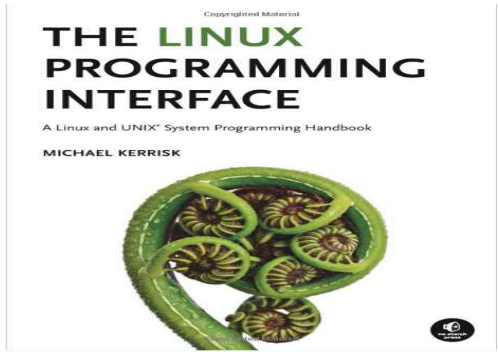
Course Content

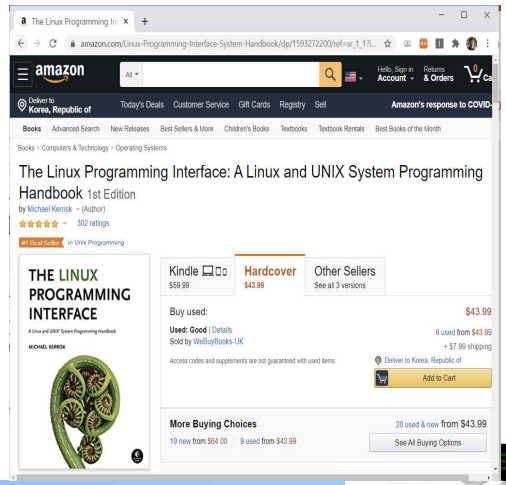
- Textbook 2: LPI
  - ✓ The Linux Programming Interface: A Linux and UNIX System Programming Handbook
    1. History and Standards
    2. Fundamental Concepts
    3. System programming concepts
    4. File I/O: The Universal I/O Model
    5. File I/O: Further Details
    6. Process
    7. Memory Allocation
    8. Users and Groups

    …

    24. Process Creation
    25. Process Termination
    26. Monitoring Child Processes
    27. Program Execution

    … /* total 64 chapters */



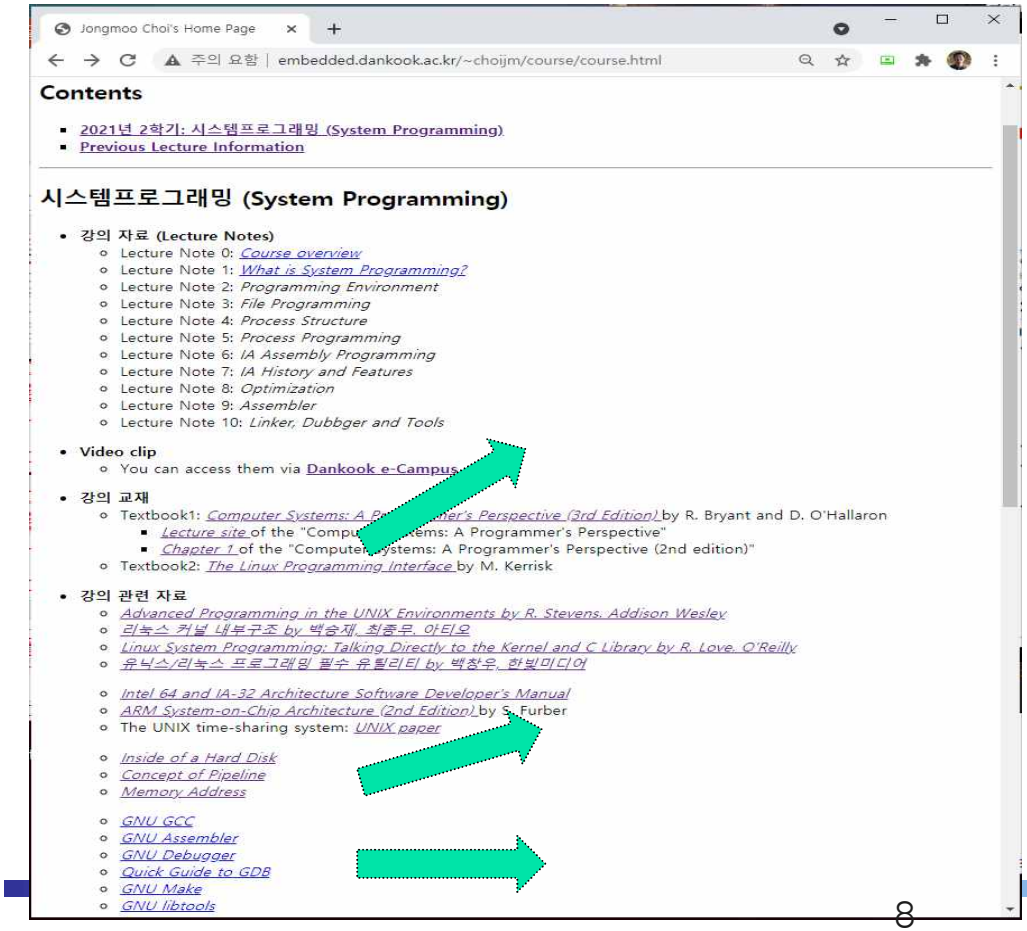


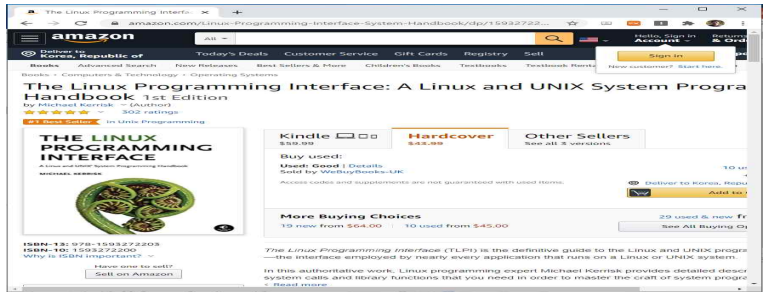
Course Content

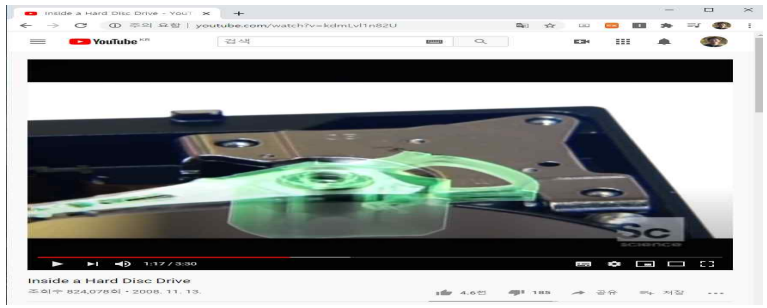
- Relation btw Lecture Notes and Textbooks
  - ✓ LN1. What is System Programming?
    - CSAPP Chapter 1
  - ✓ LN2. Programming Environment
    - LPI Chapter 1, 2, 3
  - ✓ LN3. File Programming
    - LPI Chapter 4, 5 / CSAPP Chapter 10
  - ✓ LN4. Process Structure
    - LPI Chapter 6 / CSAPP Chapter 8, 9
  - ✓ LN5. Process Programming
    - LPI Chapter 24, 25, 27, 29 / CSAPP Chapter 8, 12
  - ✓ LN6. IA assembly Programming
    - CSAPP Chapter 2, 3 / Intel®64 & IA-32 Architectures Software Developer's Manual
  - ✓ LN7. IA History and Features
    - CSAPP Chapter 4 / Intel®64 & IA-32 Architectures Software Developer's Manual
  - ✓ LN8. Optimization Practice
    - CSAPP Chapter 5, 6 / LPI Chapter 23
  - ✓ LN9. Assembler
    - CSAPP Chapter 3, 7
  - ✓ LN10. Linker, Debugger and Tools
    - CSAPP Chapter 7, http://beej.us/guide/bggdb/
  - ✓ LN11. IPC, Signal and Socket
    - LPI Chapter 43, 44, 45 / CSAPP Chapter 11

How to Lecture?

- Off-line case
  - ✓ Mainly teaching (and Q&A)
  - ✓ Using ppt from lecture site (http://embedded.dankook.ac.kr/~choijm/course/course.html)

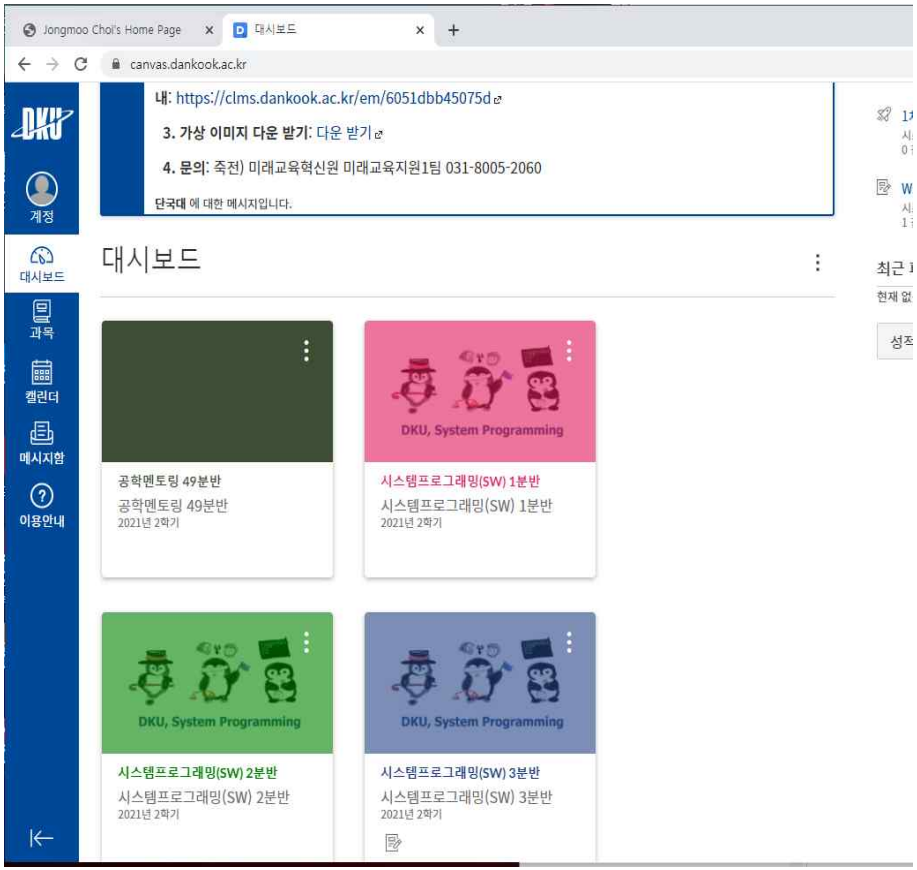


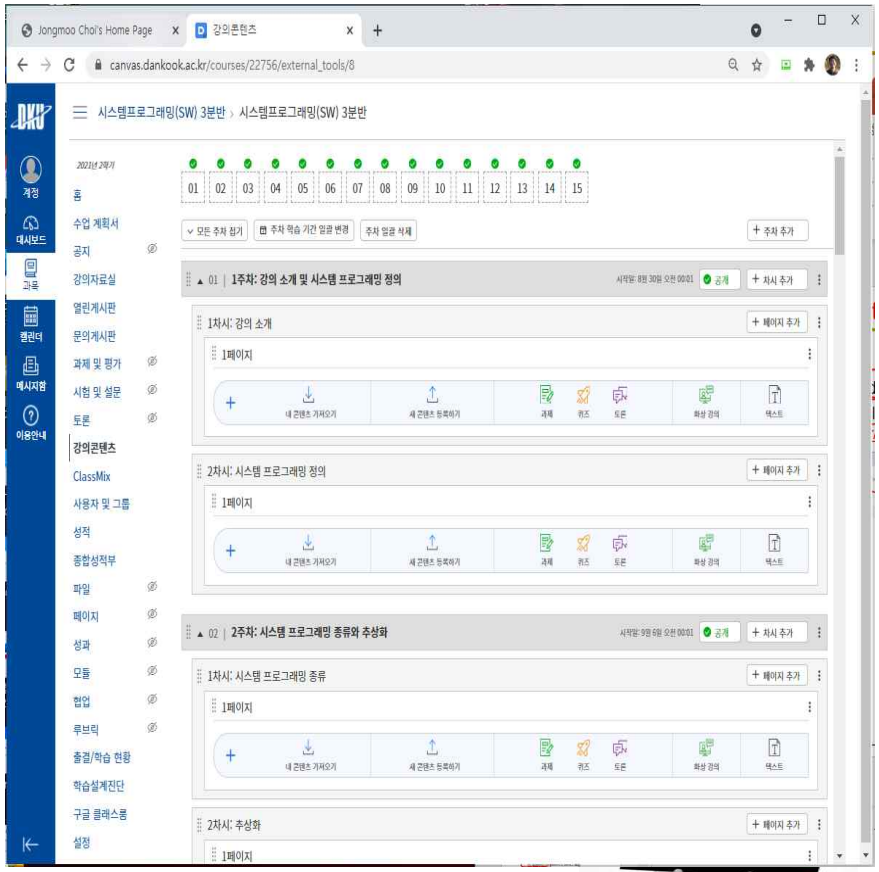




How to Lecture?

- On-line case
  - ✓ Mainly based on lecture video (and Q&A)
  - ✓ Using both ppt and video clip from Dankook LMS site (https://nlms.dankook.ac.kr/)



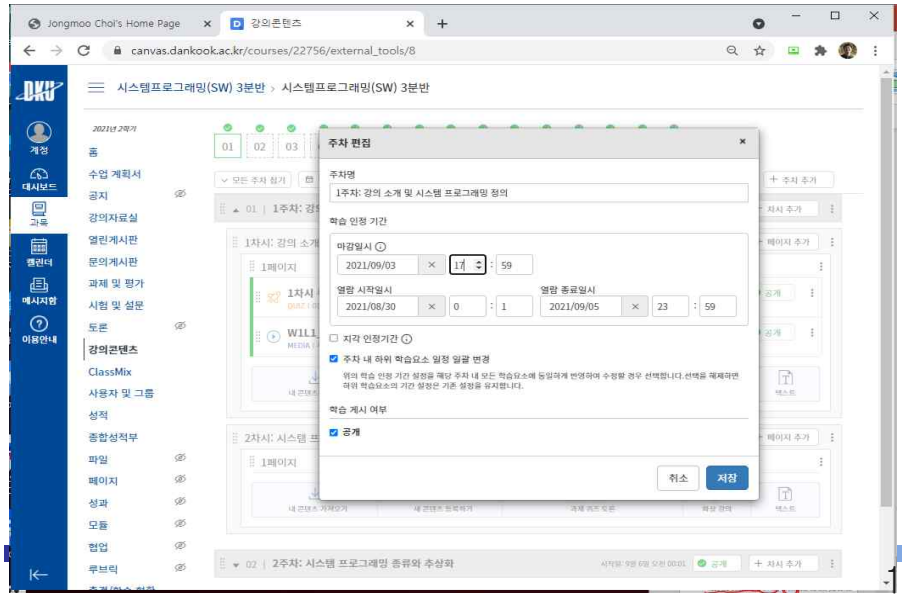


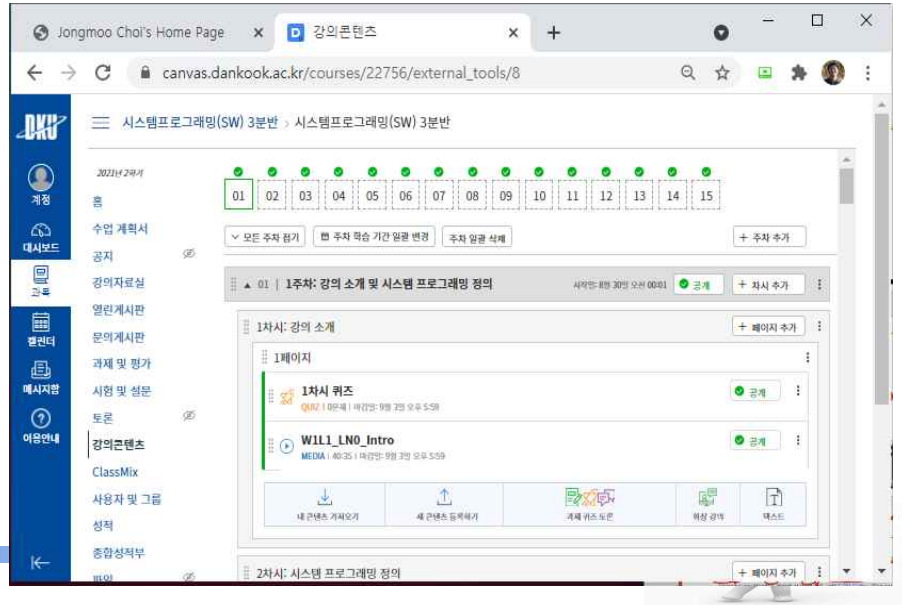
How to Lecture?

- Assignment
  - ✓ Programming Project (3 or 4): Personal (or Team)
    - Make programs in Linux Environment!!
      - Linux Server: 220.149.236.2 (primary), 220.149.236.4 (secondary)
      - TA: Jeyeun Lee (Room 515, SW-ICT Bldg)
    - Program examples
      - Using vi editor, file I/O, process manipulation, shell, assembly, optimization, …
  - ✓ Documentation project (1 or 2): Personal
    - Reading a chapter in our textbooks
      - E.g. Chapter 1 in CSAPP or Chapter 3 in LPI
    - Reading a well-known paper
      - E.g. UNIX paper

How to Study?

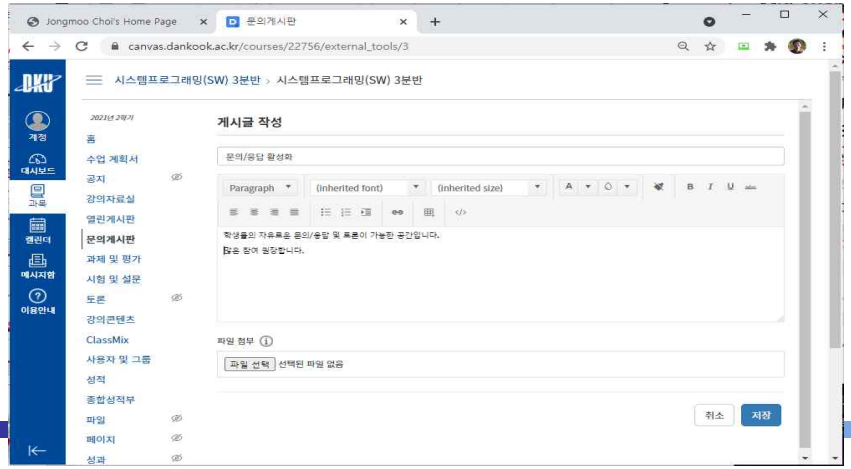
- 4 steps
  - ✓ 1) read ppt first, 2) watch video clips, 3) reply quiz per each video clip, 4) read related chapters in textbooks (CSAPP and LPI)
  - ✓ Two video clips (lesson 1 and lesson 2) per each week
    - Upload every Monday, Watch at least 95% until 6 PM Friday. (Can not access after Sunday)
  - ✓ Quiz per each video clip
    - Reply your answer until 6 PM Friday via LMS (after this time, you can not get a score from this quiz.)

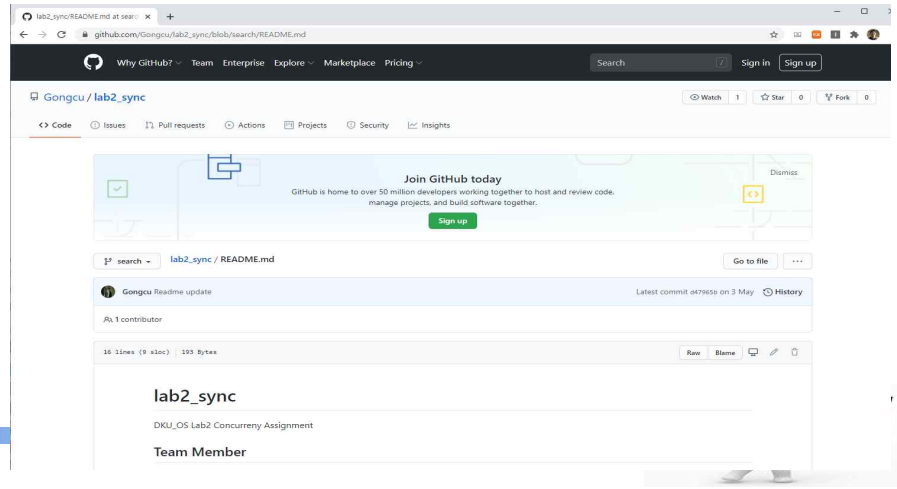




How to Study?

- Evaluation
  - ✓ Mid exam.(25%), Final exam.(25%)
  - ✓ Assignment (25%), Quiz/Attendance (25%)
  - ✓ Can be changed according to status of COVID-19
    - E.g. If you can not take an off-line mid-exam, the percentage can be changed
- Comments for on-line lecturing
  - ✓ Quiz at each video clip is quite important
  - ✓ Online Q&A and Assignments becomes more critical
    - Activity will be considered for your grade.



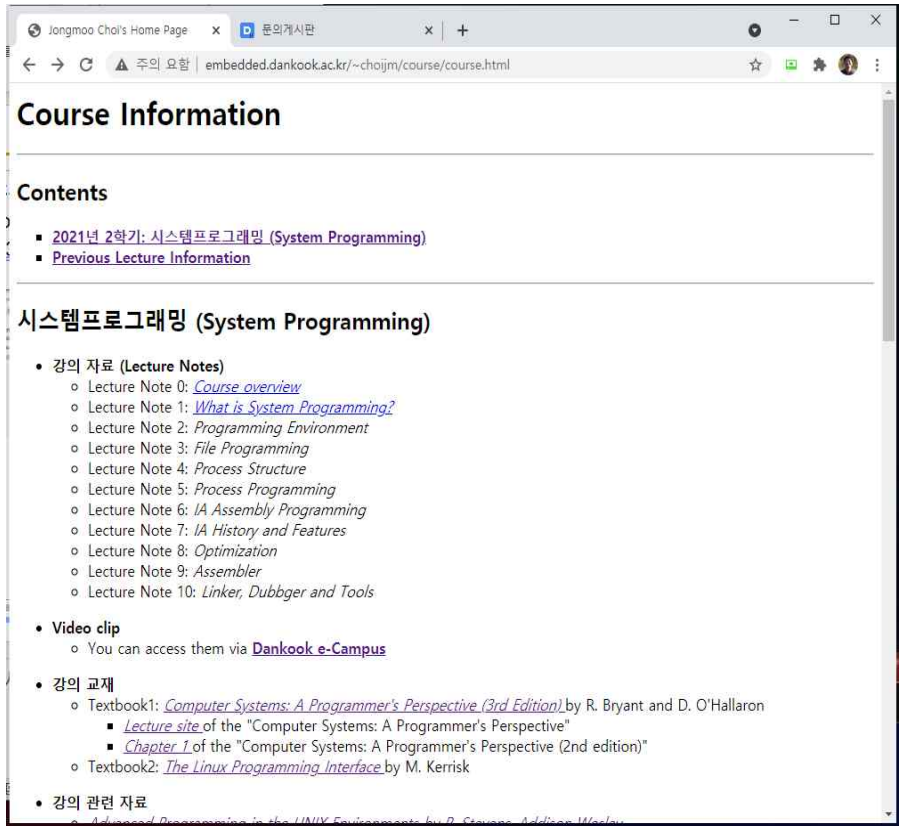


Discussion

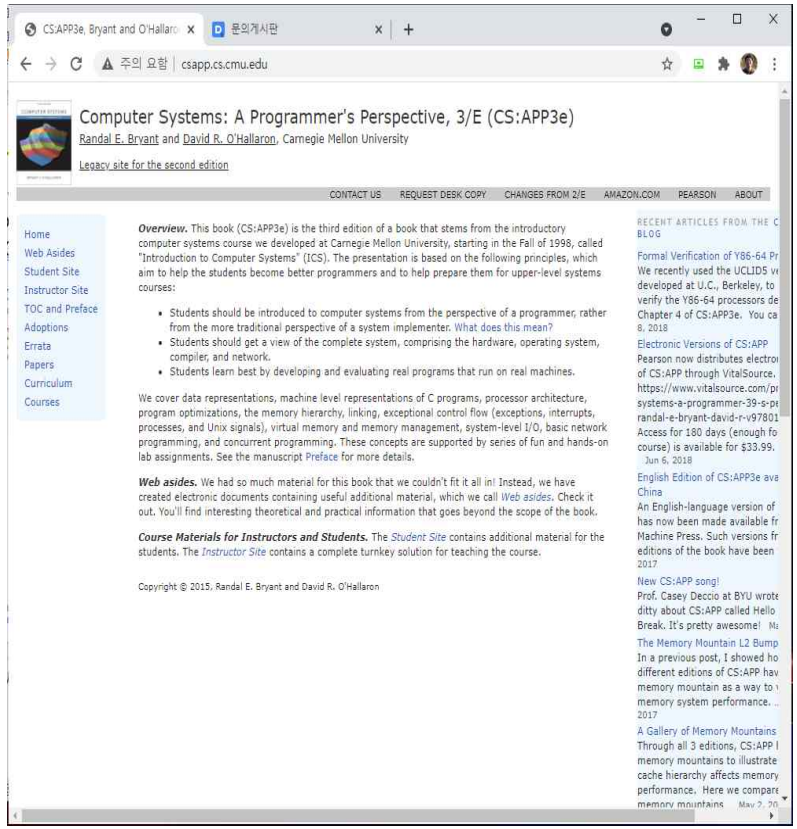
- Q&A
  - ✓ Using bulletin board at LMS site
  - ✓ Using email: choijm@dankook.ac.kr

Quiz for 1st-Week 1st-Lesson

- Find the Dankook University in CSAPP lecture site
  - ✓ Reply where you can find the Dankook University in this site?
  - ✓ Due: until 6 PM Friday of this week(3rd, September)



(http://embedded.dankook.ac.kr/~choijm/course/course.html/)



(http://csapp.cs.cmu.edu/)

Appendix: Good book for Learning Linux

- Linux Kernel Internal (리눅스 커널 내부 구조)
  - ✓ 0장. 운영체제 이야기
  - ✓ 1장. 리눅스 소개
  - ✓ 2장. 리눅스 커널 구조
  - ✓ 3장. 태스크 관리
  - ✓ 4장. 메모리 관리
  - ✓ 5장. 파일 시스템과 가상 파일 시스템
  - ✓ 6장. 인터럽트와 트랩 그리고 시스템 호출
  - ✓ 7장. 리눅스 모듈 프로그래밍
  - ✓ 8장. 디바이스 드라이버
  - ✓ 9장. 네트워킹
  - ✓ 10장. 운영체제 관련 실습
  - ✓ 부록 A. 리눅스와 가상화 그리고 XEN
  - ✓ 부록 B. MTD와 YAFFS
  - ✓ 부록 C: Map of the Linux