Operating System Review

OS2024-SWU-计科中外 34 班

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SWU CIS

2024-12-25

Outline

1. Exam

About Final Exam

- Time ⏰ : **2025-01-06 (09:00 - 11:00)**
- Place 🏠 : **26-0204**
- Scope 📚 : ch1-ch15
- Language ✍️ : English
- 8 pages:
  - Single-Choice Questions(2*10)
  - Multiple-Choice Questions(3*5)
  - True/False Questions(2*5)
  - Short-Answer Questions(4*10)
  - Comprehensive Questions(15)

About lab reports & weekly assignments

- Deadline for Last projects: **2024-12-26**
- Check again for text/figure overlap!
- Final Score: 20%/20%/60%

西南大学学生违纪处分办法(修订)

第三章 违纪行为及处分

第三节 违反教育教学秩序的行为及处分

第三十六条 违反学术诚信的，学校另行规定处理。

第三十七条 买卖论文，代替他人或让他人代替自己撰写论文、作业，抄袭作业，剽窃、侵吞、篡改他人实验数据，篡改、伪造各类学业成绩单、课程修读证明、学业经历、奖学金证书及荣誉证书等，经教育不改或情节恶劣、后果严重的，给予警告及以上处分

2. Info I

Collective informations

Source: Github.

Grade 2019

课程相对比较难，挂科率较高(我从未在考场上见到重修人数比操作系统多的)。多做课后习题，对考试有帮助，关于各个实际使用的操作系统中每个概念的具体实现可以选择性了解，19 级考试中没有，Y 老师也经常跳过不讲

课程实验做出来较为容易，大部分代码老师已经给出。19 级的内容主要集中在进程管理。

19 级，Z 老师讲的比 Y 老师稍好些，布置的作业内容也比较有针对性(但是 Y 老师考前划了重点)。

Y 老师有浓重的重庆口音外带一点口齿不清，外地同学可能需要尽早地开始准备自学；Y 老师上课节奏比较自由，思维比较跳跃，经常跳着小节讲，19 级出现了最后 4 章补课一天从下午讲到晚上

的情况。如果是上 Y 老师的课，上课前最好先预习一遍，做好心理准备；Y 老师上课前或者上课中喜欢抽问，如果希望平时成绩比较高，尽量表现得活跃一点，多回答问题，不然平时成绩可能会出人意料。

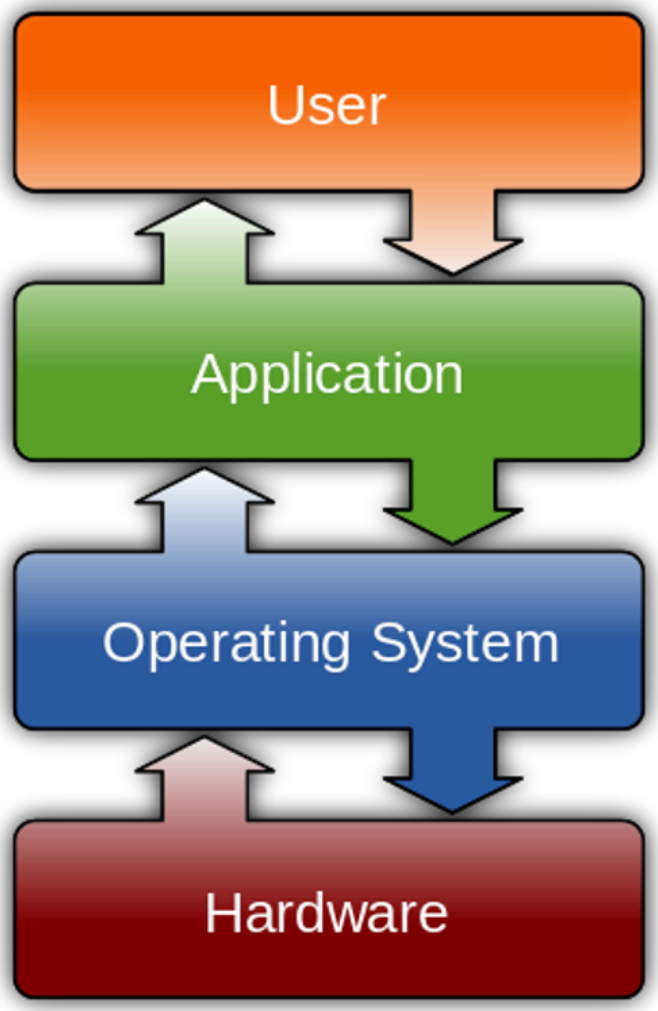
Grade 2022

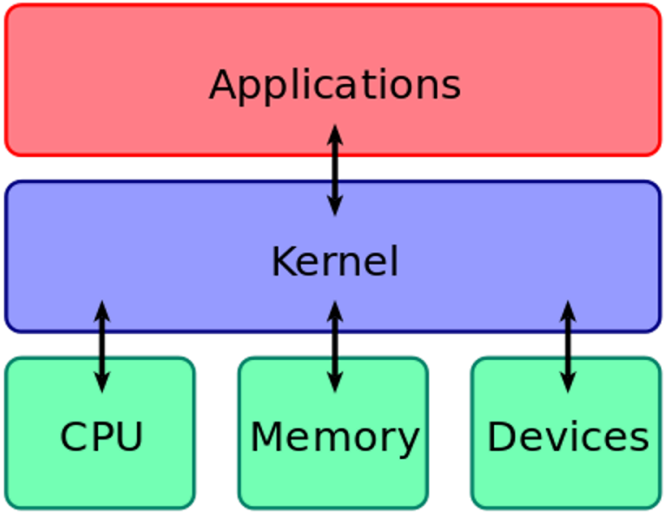
ZHJ 老师是不划重点的，考试重点一般在各类算法（调度、文件分配等）和各类计算（进程等待时间、内存访问时间等）。

ZHJ 老师讲课很好，我认为可以上课认真听他讲课，按照他讲过的内容看书和课件复习。

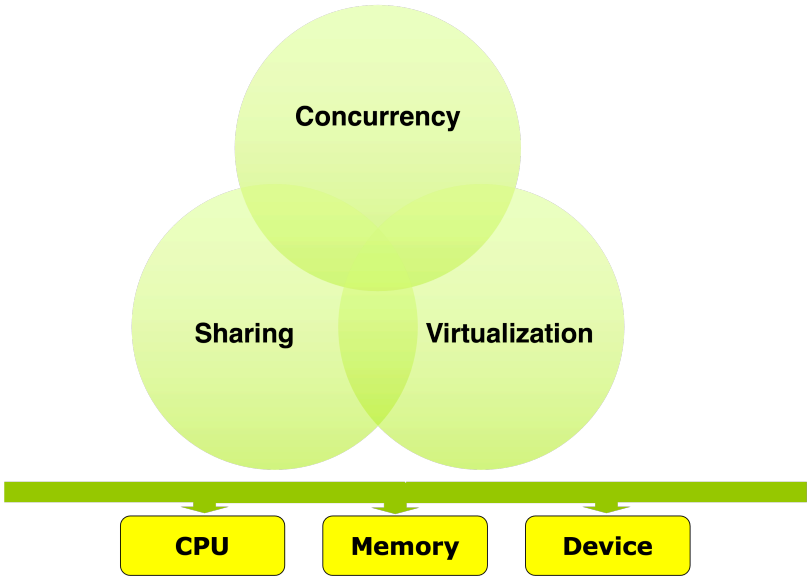
3. Info II

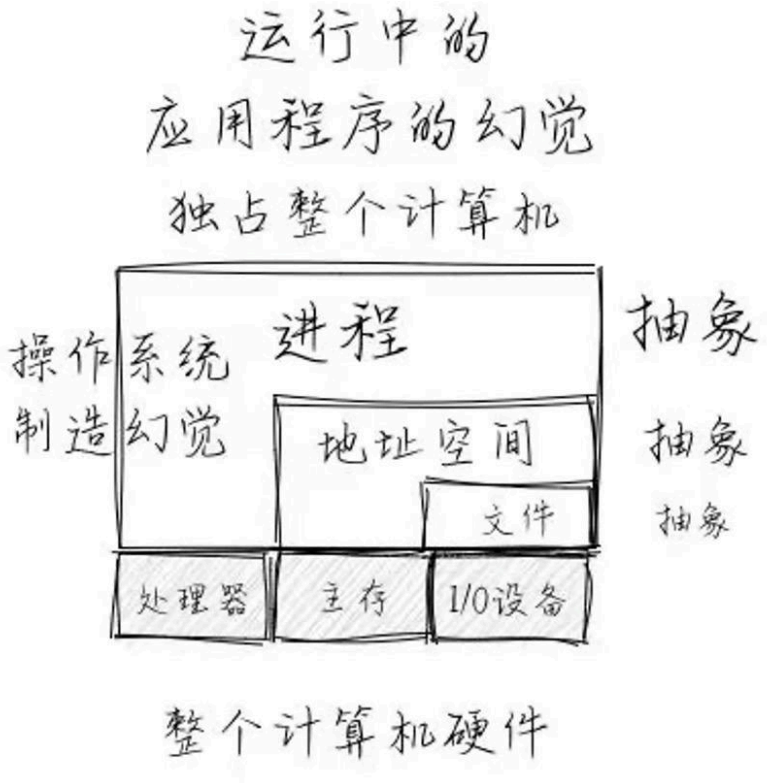
Figures for OS [1]





Figures for OS [1]





4. Info III

review.ppt from [2]

- Hardware (★)
  - Architecture
  - CPU
  - Disk
  - Memory
  - IO
- Interrupt-driven (★★)
  - (1.2.1)
- Multi-programming & time-sharing (★★★)
  - (1.4)

- Dual mode (★★★) 1.5
  - User mode
  - Kernel mode
- OS's Services (★)2.1
- User and OS interface (★★)2.2
  - Command
  - GUI
  - System call (★★) 2.3
    - Types of System calls 2.4 (★★★)
    - System programs 2.5 (★)

- Process concept
  - Process vs program (★★) (3.1.1)
  - Process in memory (★) (3.1.1)
  - Process states (★★★) (3.1.2) e.g.
  - PCB (★★★) (3.1.3) e.g.
- Scheduling
  - Queues (★) (3.2.1)
  - Scheduler (★) (3.2.2)
  - Context switch (★★★) (3.2.3) e.g.
- Process creation & termination
  - fork (★★)
  - exec (★)
  - wait (★)
  - exit (★)
- Shared memory (★)

- 3.4.1
- Message passing (★)
  - 3.4.2
- Socket (★★)
  - 3.6.1
- Pipe (★★)
  - 3.6.3

- Thread vs process (★★★)
  - (4.1)
- Multi-core programming
  - Parallel vs concurrency (★★)
  - Amdahl's Law & speedup (★★)
- Multithreading models
  - 1-1 (★★)
  - m-1 (★★)
  - m-m (★)
- Pthread & Java thread (★)
- Thread pool (★) (4.5.1)

- CPU/IO burst, CPU/IO bound (★) (5.1.1)
- Time for scheduling (★★) (5.1.3)
- Preemptive/non-preemptive scheduling (★★) (5.1.3)
- Scheduling criteria (★★★) (5.2)
- Scheduling algorithm
  - FCFS (★★★)
  - SJF (★★★)
  - Round-robin (★★★)
  - Priority (★★★)
  - Shortest remaining time first (★)
  - Multilevel Queue Scheduling (★)
- e.g. average wait time, average turnaround time, Gantt chart
- Thread scheduling (★) (5.4.1)
  - Contention scope

- Multi-processor scheduling
  - Processor affinity (★★) (5.5.2)
  - NUMA (★) (5.5.2)
  - Load balancing (★★) (5.5.3)
- Real time scheduling
  - Hard/soft real time (★)
  - Deadline, period, rate (★)
  - RM scheduling algorithm (★★)
  - EDF scheduling algorithm (★★)

- Race condition (★★) (6.1)
- Critical section problems (★★) (6.2)
  - Three requirements for the solution
- Peterson's solution (★)
- Atomic instruction (★★)
  - test_and_set
  - compare_and_swap
- Mutex lock (★★★)
  - spinlock
- Semaphore (★★★)
  - Counting
  - Binary
  - wait
  - signal
  - Atomic

  - Waiting list
  - Initialization of mutex lock and semaphores
  - E.g. 同步、互斥问题
- Deadlock & starvation (★) (6.6.3)
- Priority inversion (★) (6.6.4)
- Classic synchronization problems (★★★)
  - Producer-consumer
  - Reader-writer
  - Dining philosopher
  - E.g. 能灵活运用这几个经典问题
- Monitor
  - Structure and properties of monitor (★★) (6.8.1)
  - Use of monitor (★) (6.8.2)

- Necessary conditions for deadlock (★★)
- Resource allocation graph (★★)
  - Cycle and deadlock
- Deadlock prevention (★★)
  - Break four conditions
- Deadlock avoidance (★)
  - Safe/unsafe/deadlock
  - Banker's algorithm
    - Safety algorithm
    - Resource request algorithm
- Deadlock detection (★)
- E.g. 死锁的四个必要条件

- Virtual address space (★★) (9.1)
- Virtual address vs physical address (★) (8.1.3)
- Memory management hardware (★)
  - MMU (8.1.3)
  - Base/limit register (8.1.1)
- Static/dynamic linking (★) (8.1.2, 8.1.4, 8.1.5)
- Memory mapped files & shared memory & memory mapped I/O (★★) (9.7)
- Dynamic memory allocation (★★)
  - Best/worst/first fit (8.3.2)
  - Internal/external fragmentation (8.3.3)
- E.g. 各种适应算法中空闲块的排列方式
- Segmentation (★★) (8.4)
  - Segmentation table, base, limit
- Paging (★★★)

  - Frame, page, page no., frame no., page offset, page size
  - Page table, frame table
  - translation look-aside buffer or associate memory (TLB)
  - TLB miss, TLB hit, hit ratio
  - Effective memory-access time
  - Valid bit, r/w bit
  - E.g. page offset, page size, TLB hit, hit ratio, Effective memory-access time 的计算等
- Hierarchical page table (★★)
- Inverted page table (★★)

- Swapping (★★) (8.2)
- Demand paging (★★★) (9.2)
  - Resident memory
  - Swap space
  - Pure demand paging
  - Page fault
  - Page fault rate
  - Effect access time
  - E.g. Page fault, Page fault rate, Effect access time 等的计算；另外，给出逻辑地址，计算页号，将逻辑地址转换为物理地址等。
- Copy-on-write (★) (9.3)
- Page replacement
  - Victim page, dirty/modify bit (★) (9.4.1)
  - Replacement scope (★) (9.5)

  - Reference string (★★) (9.4.1)
  - FIFO (★★★) (9.4.2)
  - OPT (★★★) (9.4.3)
  - LRU (★★★) (9.4.4)
  - Reference bit, clock algorithm (★★) (9.4.5.2)
  - Page buffering (★) (9.4.7)
- E.g. 给出页面号调用顺序串，按照不同的页面置换算法，计算缺页中断次数和缺页率。注意 Valid bit 的影响。
- Thrashing (★★) (9.6.1 & 9.6.2)
  - Locality
  - Working set window
  - Working set
  - Working set size
- Buddy system (★★) (9.8.1)
- Slab allocator (★) (9.8.2)

- Pre-paging (★) (9.9.1)
- Page size choice (★) (9.9.2)

- File concept (★★)
- Access methods (★★)
- Directory and Disk structure (★★★)
- File-system mounting (★)
- File sharing (★)
- Protection (★★)
- 这一章重点在基本概念，比如 File concept ， Access methods， Access control bits 等。

- File-system structure (★★★)
- File-system implementation (★★★)
- Directory implementation (★★)
- Allocation methods (★★)
- Free-Space management (★★★)
- E.g. 计算磁盘的空间大小、空闲空间管理中各种方法所占空间的计算等。
- E.g. Textbook Fig.11.9 UNIX inode，计算这种文件最多能存储多少字节的内容、存储多少副图像等问题。

- Disk structure (★★★)
- Disk Attachment(★★)
- Disk scheduling(★★★)
- Disk management (★★★)
- RAID structure (★)
- E.g. seek time 计算, 各种 disk scheduling algorithm 中调度顺序与总调度时间计算等。

- I/O Hardware
- Application I/O interface
- Kernel I/O subsystem
- Transforming I/O requests to hardware system
- E.g. DMA、SPOOLing、Buffering 的概念及工作原理等。

5. Info IV

Summary from 2021 Student [3]

1. user mode and kernel mode
2. a process P creates several threads
3. the Dining Philosophers problem
4. the page offset in the logical address
5. the disk space allocated for this file
6. System calls
7. The state transition is possible for a process
8. critical resource and critical section
9. The outer page table and the second-level page table
10. file data organization
11. a single-processor system
12. concurrency and parallelism
13. the TLB and the page table
14. multiprogramming

Concept

15. Metadata
16. The difference between a program and a process
17. Starvation
18. pure demand-paging
19. DMA
20. context switch
21. the effective memory access time
22. the bit map
23. block devices and character devices
24. multithreading models，one-to-one
25. the logical address (in hexadecimal) with a page size of 1024 bytes，computing page offset.
26. What is the seek time?

27. for describing the access control information of a file for different class of users, and each kind of file operation has an associated access control bit

Questions

1. process context and context switch
2. the scheduling algorithm SJF (shortest job first). the scheduling algorithm RR (round-robin) with time quantum X milliseconds, Optimal replacement. average waiting time and the average turnaround time.
3. a demand paging memory management system with TLB. Translate the virtual address XXXXH to the physical address. Computing the access time.
4. FIFO (first-in-first-out) replacement, LRU (least-recently-used) replacement, computing page faults.
5. Disk scheduling algorithm, computing the total distance (in cylinders) that the disk arm moves. FCFS (first-come, first-served) scheduling algorithm, LOOK (i.e. SCAN scheduling without going to the end of the disk) scheduling algorithm

Questions

6. a file system that adopts linked allocation of disk blocks.
7. a process control block (PCB). A PCB contains many pieces of information associated with a specific process. the three main process states.
8. a file system that adopts multi-level indexed allocation of disk blocks

Programming

1. Reader-Writer problem, Producer-consumer problem.

6. Info V

My Suggestions

1. OS concepts
2. OS algorithms
3. Be more careful and cautious

#Thank you & Good Luck !

Reference

Bibliography

[1] SambacFeng, “SWU-SE-HELPER/大二下/操作系统原理/resource/修改版 ppt（可以直接看这个）/review.pptx at main.” 2021.

[2] SambacFeng, “SWU-SE-HELPER/大二下/操作系统原理/exam/review2019.ppt.” 2019.

[3] SambacFeng, “SWU-SE-HELPER/大二下/操作系统原理/exam/2021 年考试重点.docx.” 2021.