

CS370: Operating Systems

Supplementary Study Guide for Final

Description: Following are some questions to help you study for final. These questions are meant as a starting point for additional studying, not as a complete description of the material to be covered on the exam. The instructor reserves the right to ask questions of sorts not in this list or covering material from lecture or the text that is not specifically addressed by this list.

One important type of question not in this list for which you should be prepared is to provide definitions for important terms and concepts given in lecture or the text. In addition you should be able to solve problems of the type seen in the class, quizzes and homework.

See [the Study Guide for Midterm](#) for chapters 1-7.

Chap 8: Deadlocks

- True or False? The system model for deadlocks first requires a process request a resource, then use the resource, and finally release the resource.
- What are the four necessary conditions for characterizing deadlock?
- Describe one strategy for dealing with deadlocks.
- What is the only reasonable condition that can be used to prevent deadlocks from occurring?
- What is the name of the state of the system if resources can be allocated to all processes in some order and deadlock can still be avoided?
- What is the name of the classic deadlock avoidance algorithm?
- True or False? The wait-for graph can only be used for deadlock detection when there is a single instance of each type.
- Provide at least one method for recovering from deadlock.

Chap 9: Main Memory

- What two registers can be used to provide a simple form of memory protection?
- List the three different times at which address binding may occur.
- True or False? An address generated by the CPU is also referred to as a physical address
- What is the hardware device that maps virtual to physical addresses?
- What are the three strategies for selecting a free hole from the set of available holes?
- What are the two forms of fragmentation?
- What are the two parts of an address generated by the CPU?
- What does each entry in the page table contain?
- True or False? Fragmentation can still occur in paging systems.
- What is the term that describes when a page number is not present in the TLB?
- If a page offset is 13 bits, how large (in bytes) is the page?
- How many entries are in a two-level page table with a 20-bit page number?
- What is an alternative to hierarchical paging for large (> 32bits) address sizes?
- True or False? IA-32 address translation involves both paging and segmentation.
- True or False? In practice, all 64 bits are used with IA-64 addressing.
- What are the three components of a 32-bit ARM address?

Ch 10: Virtual memory

- True or False? A program does not need to be stored in memory in its entirety.

- True or False? A physical address space is at least as large as a virtual address space.
- When does a page fault occur?
- True or False? In a pure demand paged system a page is never brought into memory until it is needed.
- What system call initiates copy on write?
- What is the simplest page replacement algorithm
- What is the name of the page replacement algorithm that operates by replacing the page that will not be used for the longest period of time?
- What page replacement algorithm could be implemented using a stack or counters?
- True or False? Approximation algorithms are almost always used when implementing LRU.
- What is the fundamental difference between global and local page replacement?
- What term is used to describe the situation where a process spends more time paging than executing?
- What term is used to describe the set of pages a process is currently referencing?
- True or False? With pure demand paging, the page fault rate is initially very high.
- True or False? Shared memory is typically not implemented using memory mapping.
- What is the TLB reach of a system with 4 KB page sizes and 32 entries in the TLB?
- True or False? 4 KB is a typical page size.
- True or False? Some systems support page sizes up to 4 MB.

Ch 11: Mass Storage

- True or False? Magnetic disks provide the almost all of secondary storage for modern computer systems.
- True or False? Solid state disks have the same characteristics as traditional hard disks.
- What is the term for the smallest unit of transfer between a disk?
- What are the two ways a computer can access disk storage?
- List the three general disk scheduling algorithms.
- What disk scheduling algorithm is typically used with SSDs?
- What must be done to a disk before it can be used for storage?
- Where does the Windows system place its boot code?
- What are the fundamental reasons RAID is used?
- How does parity help reconstruct a corrupted block?
- How is redundancy used in HDFS name nodes and data nodes?

Ch 13: File System Interface

- List at least three attributes of a file.
- List at least three operations that made be performed on a file.
- What are the two fundamental ways of accessing a file?
- What is a volume?
- What is the most common way of structuring directories?
- True or False? UNIX systems allow acyclic-graph directories.
- If a mount point is /home and the device jane/programs is mounted on the mount point, what is the complete path name to access the programs directory?
- Name one type of remote file system.
- What are the three general classifications of users in connection with each file.

Ch 14, 15: File System Implementation

- True or False? Disk blocks are made up of one or more sectors.
- What is the name of the standard Linux file system?
- What is the UNIX term for a file control block?
- True or False? UNIX treats a directory exactly the same as a file.
- What does the acronym VFS refer to?
- What are the two general approaches for implementing a directory?
- Provide at least two different approaches for allocating disk blocks to files. 12.
- True or False? The UNIX inode is an example of linked allocation.
- What would the bit vector appear as if blocks 0, 3, 4, and 6 were free?
- True or False? If a system crashes, all transactions in the log file were not completed to the file system.
- How is HDFS different from the traditional file system?
- How does MapReduce approach help Big data applications?

Ch 18: Virtual Machines, containers, datacenters

- Describe the two types of traditional virtualization.
- Describe the four virtualization-like execution environments and why they are not “true” virtualization.
- Describe how memory mapping works in a virtualized system.
- Why can VMMs not implement trap-and-emulate-based virtualization on some CPUs? Lacking the ability to trap-and-emulate, what method can a VMM use to implement virtualization?
- Why is live migration possible in virtual environments but much less possible for a native operating system?
- How are containers implemented?
- What advantages do containers offer over virtual machines?
- Why are data centers increasingly being used?

Ch 14, 15: Security & Protection

- What is the most common technique for security attacks?
- What are the four levels where security measures must be taken?
- Provide examples of at least three program threats.
- What is the most common approach for authenticating a user?
- What does a firewall do?
- True or False? Policies determine how something will be done, mechanisms describe what will be done.
- What principle dictates that programs and users be given just enough privileges to perform their tasks?
- What does each row and column represent in an access matrix?
- What is the benefit of using role-based access control?

Be sure to read over the summary section. Be sure to review the figures in the text and slides.

Acknowledgement: Many of these review questions have been taken from the textbook Silberschatz & Galvin, Operating System Concepts.