

Chapter 1

Multiple Choice Questions

1. In what way is an operating system like a government?
- A) It seldom functions correctly.
 - B) It creates an environment within which other programs can do useful work.
 - C) It performs most useful functions by itself.
 - D) It is always concerned primarily with the individual's needs.

Ans: B

Section 1.1

Difficulty: Easy

2. Which of the following components of a computer system defines the ways to use system resources to solve computing problems?

- A) application programs
- B) operating system
- C) computer hardware
- D) computer logo

Ans: A

Difficulty: Easy

Feedback: 1.1

3. _____ operating systems are designed primarily to maximize resource utilization.

- A) PC
- B) Handheld computer
- C) Mainframe
- D) Network

Ans: C

Feedback: 1.1.1

Difficulty: Easy

4. Which of the following programs runs all the time on the computer?

- A) compiler
- B) assembler
- C) text editor
- D) kernel

Ans: D

Difficulty: Easy

Feedback: 1.1.3

5. Which of the following will trigger an interrupt?

- A) kernel function
- B) software execution
- C) CPU execution
- D) I/O completion

Ans: D

Difficulty: Easy

Feedback: 1.2.1

6. Which of the following is NOT secondary storage device?

- A) random access memory
- B) solid state disks
- C) optical disk
- D) magnetic tape

Ans: A

Difficulty: Easy

Feedback: 1.2.2

7. Which of the following contains the addresses of all the service routines?

- A) page table
- B) interrupt vector
- C) system call table
- D) file descriptor table

Ans: B

Difficulty: Easy

Feedback: 1.2.1.1

8. Which of the following stage triggers the CPU switch from user program to interrupt processing?

- A) I/O request
- B) transfer done
- C) interrupt signaled
- D) interrupt handled

Ans: C

Difficulty: Medium

Feedback: 1.2.1.1

9. The device controller _____ an interrupt by asserting a signal on the interrupt request line.

- A) raises
- B) catches
- C) dispatches
- D) clears

Ans: A

Difficulty: Easy

Feedback: 1.2.1.2

10. The CPU catches the interrupt and _____ it to the interrupt handler

- A) raises
- B) catches
- C) dispatches
- D) clears

Ans: C

Difficulty: Easy

Feedback: 1.2.1.2

11. Which of the following clears the interrupt by servicing the device?

- A) interrupt request line
- B) interrupt-controller hardware
- C) interrupt vector
- D) interrupt service routine

Ans: D

Difficulty: Medium

Feedback: 1.2.1.1

12. Which of the following is nonvolatile?

- A) register
- B) cache
- C) main memory
- D) hard-disk drive

Ans: D

Difficulty: Easy

Feedback: 1.2.2

13. Which of the following is tertiary storage medium?

- A) register
- B) magnetic tapes
- C) main memory
- D) hard-disk drive

Ans: B

Difficulty: Easy

Feedback: 1.2.2

14. Which of the following is the denotation of 1024^3 bytes?

- A) KB
- B) MB
- C) GB
- D) TB

Ans: C

Difficulty: Easy

Feedback: 1.2.2

15. Which of the following storage medium is the slowest regarding access speed?

- A) cache
- B) solid state drive
- C) register
- D) main memory

Ans: B

Difficulty: Easy

Feedback: 1.2.2

16. Which of the following is the definition of processor?
- A) the hardware that executes instructions
 - B) a physical chip that contains one or more CPUs
 - C) the basic computation unit of the CPU
 - D) including multiple computing cores on the same CPU

Ans: B

Difficulty: Medium

Feedback: 1.3.2

17. Where is the location of L1 cache?
- A) inside CPU core
 - B) inside processor but outside CPU core
 - C) inside main memory
 - D) inside registers

Ans: A

Difficulty: Medium

Feedback: 1.3.2

18. Which of the following is loosely coupled?
- A) multiprocessor systems
 - B) single-processor system
 - C) multi-core processor
 - D) clustered system

Ans: D

Difficulty: Easy

Feedback: 1.3.3

19. Which of the following technology reduces the overhead for bulk data movement?
- A) Direct Memory Access (DMA)
 - B) Non-uniform Memory Access (NUMA)
 - C) Symmetric Multiprocessing (SMP)
 - D) Storage Area Network (SAN)

Ans: A

Difficulty: Easy

Feedback: 1.2.3

20. The two separate modes of operating in a system are

- A) supervisor mode and system mode
- B) kernel mode and privileged mode
- C) physical mode and logical mode
- D) user mode and kernel mode

Ans: D

Difficulty: Medium

Feedback: 1.5.1

21. Which of the following principles is used for adding and removing items from a stack?

- A) first in first out (FIFO)
- B) last in first out (LIFO)
- C) random order
- D) round robin

Ans: B

Difficulty: Easy

Feedback: 1.9.1

22. Which of the following principles is used for adding and removing items from a queue?

- A) first in first out (FIFO)
- B) last in first out (LIFO)
- C) random order
- D) round robin

Ans: A

Difficulty: Easy

Feedback: 1.9.1

23. Which of the following are used by Linux kernel as data structures?

- A) Lists, Stacks, and Queues
- B) Trees
- C) Hash Functions and Maps
- D) Bitmaps
- E) All of the above

Ans: E

Difficulty: Easy

Feedback: 1.9

24. Which of the following computing environments place rigid time requirements on the operation of a processor or the flow of data?

- A) traditional computing
- B) real-time embedded system
- C) client-server computing
- D) peer-to-peer computing

Ans: B

Difficulty: Easy

Feedback: 1.10.6

25. Which of the following statements is false?

- A) Mobile devices must be concerned with power consumption.
- B) Mobile devices can provide features that are unavailable on desktop or laptop computers.
- C) The difference in storage capacity between a mobile device and laptop is shrinking.
- D) Mobile devices usually have fewer processing cores than a standard desktop computer.

Ans: C

Difficulty: Medium

Feedback: 1.11.2

Essay Questions

1. Computer systems can be divided into four approximate components. What are they?

Ans: Hardware, operating system, application programs, and users.

Feedback: 1.1

Difficulty: Easy

2. Explain why an operating system can be viewed as a resource allocator.

Ans: A computer system has many resources that may be required to solve a problem: CPU time, memory space, file-storage space, I/O devices, and so on. The operating system acts as the manager of these resources. Facing numerous and possibly conflicting requests for resources, the operating system must decide how to allocate them to specific programs and users so that it can operate the computer system efficiently and fairly.

Feedback: 1.1.2

Difficulty: Medium

3. Distinguish between system and application programs.

Ans: System programs are not part of the kernel, but still are associated with the operating system. Application programs are not associated with the operating of the system.

Feedback: 1.1.3

Difficulty: Easy

4. Why is main memory not suitable for permanent program storage or backup purposes? Furthermore, what is the main disadvantage to storing information on a magnetic disk drive as opposed to main memory?

Ans: Main memory is a volatile memory in that any power loss to the system will result in erasure of the data stored within that memory. While disk drives can store more information permanently than main memory, disk drives are significantly slower.

Feedback: 1.2

Difficulty: Hard

5. Explain the purpose of an interrupt vector.

Ans: The interrupt vector is merely a table of pointers to specific interrupt-handling routines. Because there are a fixed number of interrupts, this table allows for more efficient handling of the interrupts than with a general-purpose, interrupt-processing routine.

Feedback: 1.2.1

Difficulty: Medium

6. What is a bootstrap program, and where is it stored?

Ans: A bootstrap program is the initial program that the computer runs when it is powered up or rebooted. It initializes all aspects of the system, from CPU registers to device controllers to memory contents. Typically, it is stored in read-only memory (ROM) or electrically erasable programmable read-only memory (EEPROM), known by the general term firmware, within the computer hardware.

Feedback: 1.2.1

Difficulty: Medium

7. What role do device controllers and device drivers play in a computer system?

Ans: A general-purpose computer system consists of CPUs and multiple device controllers that are connected through a common bus. Each device controller is in charge of a specific type of

device. The device controller is responsible for moving the data between the peripheral devices that it controls and its local buffer storage. Typically, operating systems have a device driver for each device controller. This device driver understands the device controller and presents a uniform interface for the device to the rest of the operating system.

Feedback: 1.2.1

Difficulty: Medium

8. Describe why direct memory access (DMA) is considered an efficient mechanism for performing I/O.

Ans: DMA is efficient for moving large amounts of data between I/O devices and main memory. It is considered efficient because it removes the CPU from being responsible for transferring data. DMA instructs the device controller to move data between the devices and main memory.

Feedback: 1.2.3

Difficulty: Medium

9. Describe why multi-core processing is more efficient than placing each processor on its own chip.

Ans: A large reason why it is more efficient is that communication between processors on the same chip is faster than processors on separate chips.

Feedback: 1.3.2

Difficulty: Medium

10. Distinguish between uniform memory access (UMA) and non-uniform memory access (NUMA) systems.

Ans: On UMA systems, accessing RAM takes the same amount of time from any CPU. On NUMA systems, accessing some parts of memory may take longer than accessing other parts of memory, thus creating a performance penalty for certain memory accesses.

Feedback: 1.3.2

Difficulty: Medium

11. Why are clustered systems considered to provide high-availability service?

Ans: Clustered systems are considered high-availability in that these types of systems have redundancies capable of taking over a specific process or task in the case of a failure. The redundancies are inherent due to the fact that clustered systems are composed of two or more individual systems coupled together.

Feedback: 1.3.3

Difficulty: Medium

12. Describe the differences between physical, virtual, and logical memory.

Ans: Physical memory is the memory available for machines to execute operations (i.e., cache, random access memory, etc.). Virtual memory is a method through which programs can be executed that requires space larger than that available in physical memory by using disk memory as a backing store for main memory. Logical memory is an abstraction of the computer's different types of memory that allows programmers and applications a simplified view of memory and frees them from concern over memory-storage limitations.

Feedback: 1.4

Difficulty: Medium

13. Describe the operating system's two modes of operation.

Ans: In order to ensure the proper execution of the operating system, most computer systems provide hardware support to distinguish between user mode and kernel mode. A mode bit is added to the hardware of the computer to indicate the current mode: kernel (0) or user (1). When the computer system is executing on behalf of a user application, the system is in user mode. However, when a user application requests a service from the operating system (via a system call), it must transition from user to kernel mode to fulfill the request.

Feedback: 1.5.1

Difficulty: Medium

14. Explain cache coherency.

Ans: In multiprocessor environments, two copies of the same data may reside in the local cache of each CPU. Whenever one CPU alters the data, the cache of the other CPU must receive an updated version of this data. Cache coherency involves ensuring that multiple caches store the most updated version of the stored data.

Feedback: 1.8.3

Difficulty: Medium

15. Explain the difference between protection and security.

Ans: Protection is concerned with controlling the access of processes or users to the resources of the computer system. The role of security is to defend the system from internal or external attacks.

Feedback: 1.9

Difficulty: Medium

16. Explain the difference between singly, doubly, and circularly linked lists.

Ans: A singly linked list is where each item points to its successor. A doubly linked list allows an item to point to its predecessor or successor. A circularly linked list is the where the last element points back to the first.

Feedback:1.10.1

Difficulty: Easy

17. What two operating systems currently dominate mobile computing?

Ans: Apple's iOS and Google's Android

Feedback:1.11.2

Difficulty: Easy

18. Distinguish mobile computing from traditional desktop computing.

Ans: Mobile computing takes place on handheld devices and tablets. Because these devices are portable and lightweight, they typically do not have the processing power and storage capacity of desktop systems. However, features such as GPS and accelerometers have allowed mobile devices to provide functionality that is unavailable to desktop systems.

Feedback: 1.11.2

Difficulty: Medium

19. Describe the compute-server and file-server types of server systems.

Ans: The compute-server system provides an interface to which a client can send a request to perform an action (for example, read data from a database); in response, the server executes the action and sends back results to the client. The file-server system provides a file-system interface where clients can create, update, read, and delete files. An example of such a system is a Web server that delivers files to clients running Web browsers.

Feedback: 1.10.3

Difficulty: Medium

20. Describe cloud computing.

Ans: Cloud computing is a type of computing that delivers computing, storage, and application services across a network. Cloud computing often uses virtualization to provide its functionality. There are many different types of cloud environments, as well as services offered. Cloud computing may be either public, private, or a hybrid of the two. Additionally, cloud computing may offer applications, platforms, or system infrastructures.

Feedback: 1.10.7

Difficulty: Hard

True/False Questions

1. There is no universally accepted definition of an operating system.

Ans: True

Feedback: 1.1.3

Difficulty: Medium

2. Solid state disks are generally faster than magnetic disks.

Ans: True

Feedback: 1.5.5

Difficulty: Easy

3. Solid state disks are considered volatile storage.

Ans: False

Feedback: 1.2.2

Difficulty: Medium

4. Virtually all modern operating systems provide support for SMP

Ans: True

Feedback: 1.3.2

Difficulty: Easy

5. MapReduce is a system which allows for parallel processing of data across nodes in the cluster.

Ans: Yes

Feedback:1.4

Difficulty: Medium

6. A system call runs in kernel mode only.

Ans: Yes

Feedback:1.4.2

Difficulty: Easy

7. A system call is triggered by hardware.

Ans: False

Feedback: 1.5.1

Difficulty: Easy

8. The process runs with effective UID all the time until the process is stopped.

Ans: No

Feedback:1.6

Difficulty: Medium

9. On UNIX, the *setuid* attribute on a program causes that program to run with the user ID of the current user's ID.

Ans: No

Feedback:1.6

Difficulty: Medium

10. VMware is a virtual machine manager when it manages guest operating systems.

Ans: Yes

Feedback:1.7

Difficulty: Easy

11. Skype uses a hybrid peer-to-peer approach.

Ans: Yes

Feedback: 1.10.4

Difficulty: Easy

12. Processors for most mobile devices run at a slower speed than a processor in a desktop PC.

Ans: True

Feedback: 1.10.2

Difficulty: Medium