



CHAPTER 5

EXERCISES AND ANSWERS

Computer Science Illuminated, Seventh Edition

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Answers are in blue.

For Exercises 1–16, match the power of ten to its name or use.

- A. 10^{-12}
- B. 10^{-9}
- C. 10^{-6}
- D. 10^{-3}
- E. 10^3
- F. 10^6
- G. 10^9
- H. 10^{12}
- I. 10^{15}

- 1. Nano-
B
- 2. Pico-
A
- 3. Micro-
C
- 4. Milli-
D
- 5. Tera-
H
- 6. Giga-
G
- 7. Kilo-
E
- 8. Mega-
F
- 9. Often used to describe processor speed.
G
- 10. Often used to describe size of memory.
F
- 11. Used in relation to Internet speeds.
E
- 12. Latin for "thousandth."
D
- 13. Italian for "little."
A
- 14. Peta-
I

- 15. Roughly equivalent to 2^{10} .
E
- 16. Roughly equivalent to 2^{50} .
I

For Exercises 17–23, match the acronym with its most accurate definition.

- A. CD-ROM
- B. CD-DA
- C. CD-R
- D. DVD
- E. CD-RW
- F. DL DVP
- G. Blu-Ray

- 17. Format using two layers.
F
- 18. Data is stored in the sectors reserved for timing information in another variant.
A
- 19. Can be read many times, but written after its manufacture only once.
C
- 20. Can be both read from and written to any number of times.
E
- 21. Format used in audio recordings.
B
- 22. A new technology storing up to 50 GB.
G
- 23. The most popular format for distributing movies.
D

Exercises 24–66 are problems or short answer exercises.

- 24. Define the following terms:
 - A. Core 2 processor
Core 2 is a popular central processing unit made by Intel.
 - B. Hertz
A hertz is a unit of frequency equal to one cycle per second.

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- C. Random-access memory
Random-access memory is memory in which each word has an address by which the word can be directly accessed.
25. What does *FSB* stand for?
FSB stands for front-side bus, the primary connection between main memory and input/output devices.
26. What does it mean to say that a processor is 1.4 GHz?
The speed of the processor is 1,400,000,000 cycles per second.
27. What does it mean to say that memory is 133 MHz?
Saying that memory is 133 MHz means that the memory can be accessed at 133,000,000 cycles per second.
28. How many bytes of memory are there in the following machines?
- A. 512 MB machine
 $512 * 2^{20}$
- B. 2 GB machine
 $2 * 2^{30}$
29. Define *RPM* and discuss what it means in terms of speed of access to a disk.
RPM stands for *revolutions per minute*. This is a measure of how fast a disk revolves. Data can only be accessed when the reading head is over the data. Therefore, the *RPM* indicates how fast each piece of data can be accessed.
30. What is the stored-program concept and why is it important?
The stored-program concept means that data and instructions are both logically the same and can both be stored in memory. The von Neumann architecture is built around this principle. It is important because the human does not have to execute instructions from without the machine; instructions can be stored in memory and executed in sequence, referencing the data values it needs on which to operate.
31. What does “units that process information are separate from the units that store information” mean in terms of computer architecture?
This expression means that memory is separate from the central processing unit.
32. Name the components of a von Neumann machine.
Memory, arithmetic/logic unit, input/output units, and the control unit
33. What is the addressability of an 8-bit machine?
8
34. What is the function of the ALU?
The ALU performs basic arithmetic operations (addition, subtraction, multiplication, and division) and logical operations (AND, OR, NOT).
35. Which component in the von Neumann architecture would you say acts as the stage manager? Explain.
The computer component that acts as the stage manager is the control unit. It controls the actions of the other components in order to execute instructions in sequence.
36. Punched cards and paper tape were early input/output mediums. Discuss their advantages and disadvantages.
Punched cards and paper tape used for input were prepared on separate machines and then read into the computer. Input from cards and paper tape is slow, but they provided a permanent record of the input. When used for output, cards and paper tape had to be transferred to another device to get a human-readable copy of the information; however, the output could be stored permanently on cards and paper tape.
37. What is an instruction register, and what is its function?
The instruction register is a special register in the control unit. It holds the instruction being executed.
38. What is a program counter, and what is its function?
The program counter is a special register in the control unit. It holds the address of the next instruction to be executed.
39. List the steps in the fetch–execute cycle.
Fetch the next instruction from the address in the program counter.
Decode the instruction.
Execute the instruction.
40. Explain what is meant by “fetch an instruction.”
The control unit goes to the address named in the program counter, makes a copy of the contents of that address, puts the copy into the instruction register, and increments the program counter.
41. Explain what is meant by “decode an instruction.”
The control unit determines what the instruction is and accesses any memory locations that contain operands for the instruction.
42. Explain what is meant by “execute an instruction.”
Signals are sent to the arithmetic/logic unit to carry out the processing.
43. Compare and contrast RAM and ROM memory.
RAM is an acronym for random-access memory; ROM is an acronym for read-only memory. Both RAM and ROM are random access; that is, each cell in memory is directly accessible. The cells in RAM can be both read from and written to. The cells in ROM can only be read from. The bit pattern in ROM is determined at the time of manufacture or burned when the computer is assembled. Once ROM has been burned (written), it cannot be changed. Another major difference is that RAM is volatile and ROM is not. This means that RAM does not maintain its bit patterns when the power is turned off, but ROM does.
44. What is a secondary storage device, and why are such devices important?
Because RAM is volatile and ROM cannot be changed, there must be places to store data and programs outside of the computer’s main memory. Such places are called secondary storage devices.
45. Discuss the pros and cons of using magnetic tape as a storage medium.
Magnetic tape is a cheap medium for storing great quantities of data. However, data items cannot be directly addressed on tape. To reach a data object, all information recorded before the one you want must be read and discarded.
46. What are the four measures of a disk drive’s efficiency?
Seek time, latency, access time, and transfer rate
47. Define what is meant by a block of data.
The information stored in a sector.

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48. What is a cylinder?
A cylinder is a set of concentric tracks—that is, tracks that line up under one another.
49. Define the steps that a hard disk drive goes through to transfer a block of data from the disk to memory.
To access a block of data, the read/write head moves to the proper track, waits until the proper sector rotates beneath it, and then accesses the data.
50. Distinguish between a compact disk and a magnetic disk.
Data is stored optically on a compact disk and magnetically on a magnetic disk. Rather than having a series of concentric tracks, a compact disk has one track that spirals from inside out. Both disks have the track broken into sectors. The density at which the data is packed varies in a magnetic disk, but does not in a compact disk. The rotation speed of a magnetic disk reader is constant, but the rotation speed of a compact disk varies depending on the position of the laser beam.
51. Describe a parallel architecture that uses synchronous processing.
There are multiple processors applying the same program to multiple data sets.
52. Describe a parallel architecture that uses pipeline processing.
Multiple processors are arranged in tandem. Each processor contributes one part of the overall processing.
53. How does a shared memory parallel configuration work?
Multiple processors do different processing with different data but communicate through the use of shared global memory.
54. How many different memory locations can a 16-bit processor access?
 2^{16} different memory locations.
55. Why is a faster clock not always better?
A faster clock consumes more power, which can cause a circuitry overload.
56. Why is a larger cache not necessarily better?
As a cache gets bigger, accesses to its data become slower.
57. In the ad, why is the 1080p specification for the screen not entirely true?
The high-definition television standard has 1080 horizontal lines of display elements. The screen in the ad is 768 high, meaning that 1080 lines are compressed into 768 lines.
58. Keep a diary for a week of how many times the terms *hardware* and *software* appear in television commercials.
No answer expected.
59. Take a current ad for a laptop computer and compare that ad with the one shown at the beginning of this chapter.
Answer varies with each student.
60. What is the common name for the disk that is a secondary storage device?
Although there are a variety of disks that are secondary storage devices, the hard disk drive is the one that comes with the machine.
61. To what does the expression *pixels* refer?
The distance between the dots on the screen.
62. What is a GPU?
A GPU is a graphics processor.
63. If a battery in a laptop is rated for 80 WHr, and the laptop draws 20 watts, how long will it run?
4 hours
64. What is the difference between 1K of memory and 1K transfer rate?
1K of memory is 1024 bytes of memory; 1K transfer rate is 1000/bits per some time measure.
65. Compare and contrast a CD-ROM and a flash drive.
A CD-ROM is a compact disc that, when written upon, cannot be changed. A CD-ROM is good for permanent storage and for transmitting data to another machine. A flash drive uses flash memory that can be erased and rewritten. It also is good for permanent storage, but is much more flexible, as it can be used to store corrected data as well as for transmitting data to another machine.
66. Giga- can mean both 10^9 and 2^{30} . Explain to which each refers. Can this cause confusion when reading a computer advertisement?
Time is expressed in decimal units, so giga- means 10^9 when referring to time. Memory is expressed in powers of 2, so giga means 2^{30} when referring to memory. Because 10^9 and 2^{30} are not the same value, this can be confusing.