Chapter 1 Exercise Solutions

EX 1.1. Describe the hardware components of your personal computer or of a computer in a lab to which you have access. Include the processor type and speed, storage capacities of main and secondary memory, and types of I/O devices. Explain how you determined your answers.

One possible description:

Processor: Intel Celeron D, 2.53 GHz

Main Memory: 2 GB SDRAM

Secondary Memory: 500 GB Ultra ATA Hard Drive

Peripherals: CD/DVD +/- RW, keyboard, mouse, 17" flat screen monitor, HP LaserJet printer

To find the processor and memory information, I accessed the System Information from the control panel. To find the I/O devices, I looked in the device manager.

EX 1.2. Why do we use the binary number system to store information on a computer?

Devices that store and move information are less expensive and more reliable if they have to represent only one of two possible values or states.

EX 1.3. How many unique items can be represented with each of the following?

a. 1 bit

2 items

b. 3 bits

8 items

c. 6 bits

64 items

d. 8 bits

256 items

e. 10 bits

1024 items

f. 16 bits

16,348 items

EX 1.4. If a picture is made up of 128 possible colors, how many bits would be needed to store each pixel of the picture? Why?

Seven bits are needed to represent each pixel if each pixel can have up to 128 possible colors. This is because there are 128 distinct permutations of 7 bits.

EX 1.5. If a language uses 240 unique letters and symbols, how many bits would be needed to store each character of a document? Why?

Eight bits are needed to store each character of a document written in a language of 240 unique characters and symbols. Seven bits would be sufficient if there were only 128 different characters to represent. Eight bits is sufficient for 256 different characters.

Because 240 is greater than 128, but not greater than 256, at least 8 bits are needed if all characters are represented by the same number of bits.

EX 1.6. How many bits are there in each of the following? How many bytes are there in each?

a. 12 KB

12 KB = 12 x 1024 bytes = 12,288 bytes = 98,304 bits

b. 5 MB

5 MB = 5 x 1,048,576 bytes = 5,242,880 bytes = 41,943,040 bits

c. 3 GB

3 GB = 3 x 1,703,741,824 bytes = 5,111,225,472 bytes = 40,889,803,776 bits

d. 2 TB

2 TB = 2 x 1,099,511,627,776 bytes = 2,199,023,255,552 bytes = approximately 1.76 x 10^{13} bits

EX 1.7. Explain the difference between random-access memory (RAM) and read-only memory (ROM).

Both RAM and ROM are random access devices. RAM (Random Access Memory) can be written to and read from, but ROM (Read-Only Memory) can only be read from.

EX 1.8. A disk is a random-access device but it is not RAM (random-access memory). Explain.

The data on both can be accessed diretly (without reading intervening data). But RAM typically refers to a set of chips that make up main memory, whereas a disk is considered secondary memory. RAM is volatile, and a disk is not.

EX 1.9. **Determine how your computer, or a computer in a lab to which you have access, is connected to others across a network. Is it linked to the Internet? Draw a diagram to show the basic connections in your environment.**

The computers in our lab are connected to a local area network, which is connected to the Internet. (diagram not provided)

EX 1.10. Explain the differences between a local-area network (LAN) and a wide-area network (WAN). What is the relationship between them?

A LAN is designed to span a short distance and to connect a relatively small number of computers. A WAN connects two or more LANs, typically across longer distances such as throughout a group of buildings.

EX 1.11. What is the total number of communication lines needed for a fully connected point-to-point network of eight computers? Nine computers? Ten computers? What is a general formula for determining this result?

Eight computers: 28 communication lines

Nine computers: 36 communication lines

Ten computers: 45 communication lines

General formula for n computers: n(n-1)/2, which represents the sum of the numbers between 1 and n-1.

EX 1.12. Explain the difference between the Internet and the World Wide Web.

The Internet is a network of networks. The World Wide Web is based on a set of software applications that facilitates sharing of information across a network.

EX 1.13. List and explain the parts of the URLs for:

a. your school

http://www.byu.edu, where http stands for HyperText Transfer Protocol, which determines the way the browser should communicate; the machine referenced is www, a typical reference to a Web server; the domain is byu.edu where byu stands for Brigham Young University, and edu indicates that it is an educational institution.

b. the Computer Science department of your school

http://www.cs.byu.edu, in which cs refers to the subdomain within the larger byu.edu domain. So in this case the www machine refers to the standard web server designated by the cs department.

c. your instructor's Web page

http://www.cs.byu.edu/rpburton/info.html/, which refers to a specific file, rpburton/info.html, located on the computer science web server to be transferred to the user's browser for viewing.

EX 1.14. Give examples of the two types of Java comments and explain the differences between them.

One kind of comment begins with a double slash (//) and continues to the end of the line. A second kind of comment begins following an initiating slash-asterisk (/) and terminates immediately preceding a terminating asterisk-slash (*/). The second type of comment can span multiple lines.*

EX 1.15. Which of the following are not valid Java identifiers? Why?

a. Factorial

Valid

b. anExtremelyLongIdentifierIfYouAskMe

Valid

c. 2ndLevel

Invalid because it begins with a digit

d. level2

Valid

e. MAX_SIZE

Valid

f. highest$

Valid

g. hook&ladder

Invalid because it contains an ampersand (&)

EX 1.16. Why are the following valid Java identifiers not considered good identifiers?

a. q

The identifier `q` is a meaningless name.

b. totVal

The idetnifier `totalValue` would be more meaningful than the abbreviation.

c. theNextValueInTheList

Unnecessarily lengthy; `nextValue` would serve as well.

EX 1.17. Java is case sensitive. What does that mean?

Uppercase characters are considered to be distinct from lowercase letters. Therefore the identifier `HELLO` is distinct from `Hello` which is distinct from `hello`.

EX 1.18. What is a Java Virtual Machine? Explain its role.

A Java Virtual Machine (JVM) is a software interpreter that executes Java bytecode. Since bytecode is a low-level representation of a program, but not tied to any particular hardware architecture, any computer with a JVM can execute Java code, no matter what machine it was compiled on. That makes Java architecture-neutral, and therefore highly portable.

EX 1.19. What do we mean when we say that the English language is ambiguous? Give two examples of English ambiguity (other than the example used in this chapter) and explain the ambiguity. Why is ambiguity a problem for programming languages?

Something is ambiguous if it has two or more possible meanings. For example, the statement, "Mary is the nicest teaching assistant who has helped me all day long" might mean 1) of all the teaching assistants who have helped me today, Mary is the nicest, or 2) of those teaching assistants who have helped me for an entire day, Mary is the nicest. As another example, the statement, "Bananas help those who help themselves" might mean 1) bananas are good for those who attend to their own welfare or 2) bananas are good for those who eat as many bananas as they please. If a programming language statement could be interpreted in two or more ways, it would be impossible to predict with certainty how it would be interpreted and what result would be produced.

EX 1.20. Categorize each of the following situations as a compile-time error, run-time error, or logical error.

a. multiplying two numbers when you meant to add them

A logical error

b. dividing by zero

A run-time error

c. forgetting a semicolon at the end of a programming statement

A compile-time error

d. spelling a word wrong in the output

A logical error

e. producing inaccurate results

A logical error

f. typing a `{` when you should have typed `(`

A compile-time error