

# Introduction to Computers, the Internet and the World Wide Web: Solutions

# 1

*The chief merit of language is  
clearness.*

—Galen

*Our life is frittered away by  
detail. ... Simplify, simplify.*

—Henry David Thoreau

*Man is still the most  
extraordinary computer of all.*

—John F. Kennedy

## Objectives

In this chapter you'll learn:

- Basic hardware and software concepts.
- The different types of programming languages.
- A typical C++ program development environment.
- The history of the Internet and the World Wide Web, and the Web 2.0 phenomenon.
- To test-drive C++ applications in GNU C++ on Linux and Microsoft's Visual C++® on Windows®.
- Some basic object technology concepts.

## Self-Review Exercises

- 1.1** Fill in the blanks in each of the following:
- a) The company that popularized personal computing was \_\_\_\_\_.  
**ANS:** Apple.
  - b) The computer that made personal computing legitimate in business and industry was the \_\_\_\_\_.  
**ANS:** IBM Personal Computer.
  - c) Computers process data under the control of sets of instructions called computer \_\_\_\_\_.  
**ANS:** programs.
  - d) The six key logical units of the computer are the \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_ and the \_\_\_\_\_.  
**ANS:** input unit, output unit, memory unit, arithmetic and logic unit, central processing unit, secondary storage unit.
  - e) The three types of languages discussed in the chapter are \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_.  
**ANS:** machine languages, assembly languages, high-level languages.
  - f) The programs that translate high-level language programs into machine language are called \_\_\_\_\_.  
**ANS:** compilers.
  - g) C is widely known as the development language of the \_\_\_\_\_ operating system.  
**ANS:** UNIX.
  - h) The \_\_\_\_\_ language was developed by Wirth for teaching structured programming.  
**ANS:** Pascal.
  - i) The Department of Defense developed the Ada language with a capability called \_\_\_\_\_, which allows programmers to specify that many activities can proceed in parallel.  
**ANS:** multitasking.
  - j) \_\_\_\_\_, or labeling content, is another key part of the collaborative theme of Web 2.0.  
**ANS:** Tagging.
  - k) With Internet applications, the desktop evolves to the \_\_\_\_\_.  
**ANS:** webtop.
  - l) \_\_\_\_\_ involves reworking code to make it clearer and easier to maintain while preserving its functionality.  
**ANS:** Refactoring.
  - m) With \_\_\_\_\_ development, individuals and companies contribute their efforts in developing, maintaining and evolving software in exchange for the right to use that software for their own purposes, typically at no charge.  
**ANS:** open source.
  - n) \_\_\_\_\_ are used to match specific character patterns in text. They can be used to validate data to ensure that it is in a particular format, to replace parts of one string with another, or to split a string.  
**ANS:** Regular expressions.
- 1.2** Fill in the blanks in each of the following sentences about the C++ environment.
- a) C++ programs are normally typed into a computer using a(n) \_\_\_\_\_ program.  
**ANS:** editor.

b) In a C++ system, a(n) \_\_\_\_\_ program executes before the compiler's translation phase begins.

**ANS:** preprocessor.

c) The \_\_\_\_\_ program combines the output of the compiler with various library functions to produce an executable program.

**ANS:** linker.

d) The \_\_\_\_\_ program transfers the executable program from disk to memory.

**ANS:** loader.

**1.3** Fill in the blanks in each of the following statements (based on Section 1.19):

a) Objects have the property of \_\_\_\_\_—although objects may know how to communicate with one another across well-defined interfaces, they normally are not allowed to know how other objects are implemented.

**ANS:** information hiding.

b) C++ programmers concentrate on creating \_\_\_\_\_, which contain data members and the member functions that manipulate those data members and provide services to clients.

**ANS:** classes.

c) Classes can have relationships with other classes. These relationships are called \_\_\_\_\_.

**ANS:** associations.

d) The process of analyzing and designing a system from an object-oriented point of view is called \_\_\_\_\_.

**ANS:** object-oriented analysis and design (OOAD).

e) OOD also takes advantage of \_\_\_\_\_ relationships, where new classes of objects are derived by absorbing characteristics of existing classes then adding unique characteristics of their own.

**ANS:** inheritance.

f) \_\_\_\_\_ is a graphical language that allows people who design software systems to use an industry-standard notation to represent them.

**ANS:** The Unified Modeling Language (UML).

g) The size, shape, color and weight of an object are considered \_\_\_\_\_ of the object.

**ANS:** attributes.

## Exercises

**1.4** Categorize each of the following items as either hardware or software:

a) CPU

**ANS:** hardware.

b) C++ compiler

**ANS:** software.

c) ALU

**ANS:** hardware.

d) C++ preprocessor

**ANS:** software.

e) input unit

**ANS:** hardware.

f) an editor program

**ANS:** software.

**1.5** Why might you want to write a program in a machine-independent language instead of a machine-dependent language? Why might a machine-dependent language be more appropriate for writing certain types of programs?

**ANS:** Machine independent languages are useful for writing programs to be executed on multiple computer platforms. Machine dependent languages are appropriate for writing programs to be executed on a single platform.

**1.6** Fill in the blanks in each of the following statements:

a) Which logical unit of the computer receives information from outside the computer for use by the computer? \_\_\_\_\_.

**ANS:** input unit.

b) The process of instructing the computer to solve specific problems is called \_\_\_\_\_.

**ANS:** computer programming.

c) What type of computer language uses English-like abbreviations for machine language instructions? \_\_\_\_\_.

**ANS:** assembly language.

d) Which logical unit of the computer sends information that has already been processed by the computer to various devices so that the information may be used outside the computer? \_\_\_\_\_.

**ANS:** output unit.

e) Which logical units of the computer retain information? \_\_\_\_\_.

**ANS:** memory unit and secondary storage unit.

f) Which logical unit of the computer performs calculations? \_\_\_\_\_.

**ANS:** arithmetic and logical unit.

g) Which logical unit of the computer makes logical decisions? \_\_\_\_\_.

**ANS:** arithmetic and logical unit.

h) The level of computer language most convenient to the programmer for writing programs quickly and easily is \_\_\_\_\_.

**ANS:** high-level language.

i) The only language that a computer directly understands is called that computer's \_\_\_\_\_.

**ANS:** machine language.

j) Which logical unit of the computer coordinates the activities of all the other logical units? \_\_\_\_\_.

**ANS:** central processing unit.

**1.7** Why is so much attention today focused on object-oriented programming?

**ANS:** Object-oriented programming enables the programmer to build reusable software components that model items in the real world. Building software quickly, correctly, and economically has been an elusive goal in the software industry. The modular, object-oriented design and implementation approach has been found to increase productivity while reducing development time, errors, and cost.

**1.8** Distinguish between the terms fatal error and nonfatal error. Why might you prefer to experience a fatal error rather than a nonfatal error?

**ANS:** A fatal error causes a program to terminate prematurely. A nonfatal error occurs when the logic of the program is incorrect, and the program does not work properly. A fatal error is preferred for debugging purposes. A fatal error immediately lets you know there is a problem with the program, whereas a nonfatal error can be subtle and possibly go undetected.

**1.9** Give a brief answer to each of the following questions:

- a) Why does this text discuss structured programming in addition to object-oriented programming?

**ANS:** Objects are composed in part of structured program pieces.

- b) What kinds of messages do people send to one another?

**ANS:** People send messages through body language, speech, writings, e-mail, telephones, etc.

- c) Objects send messages to one another across well-defined interfaces. What interfaces does a car radio (object) present to its user (a person object)?

**ANS:** Dials and buttons that allow the user to select a station, adjust the volume, adjust bass and treble, play a CD or tape, etc.

**1.10** (*The Watch as an Object*) You are probably wearing on your wrist one of the world's most common types of objects—a watch. Discuss how each of the following terms and concepts applies to the notion of a watch: object, attributes, behaviors, class, inheritance (consider, for example, an alarm clock), encapsulation, interface, information hiding, data members and member functions.

**ANS:** The entire watch is an object that is composed of many other objects (such as the moving parts, the band, the face, etc.) Watch attributes are time, color, band, style (digital or analog), etc. The behaviors of the watch include setting the time and getting the time. A watch can be considered a specific type of clock (as can an alarm clock). With that in mind, it is possible that a class called `Clock` could exist from which other classes such as `watch` and `alarm clock` could inherit the basic features of the clock. The watch is an abstraction of the mechanics needed to keep track of the time. The user of the watch does not need to know the mechanics of the watch in order to use it; the user only needs to know how to read the face of the watch and that the watch keeps the proper time. In this sense, the mechanics of the watch are encapsulated (hidden) inside the watch. The interface to the watch (its face and controls for setting the time) allows the user to set and get the time. The user is not allowed to directly touch the internal mechanics of the watch. All interaction with the internal mechanics is controlled by the interface to the watch. The data members stored in the watch are hidden inside the watch and the member functions (looking at the face to get the time and setting the time) provide the interface to the data.

**1.11** Fill in the blanks in each of the following statements (based on Section 1.17):

- a) The open source database management system used in LAMP development is \_\_\_\_\_.

**ANS:** MySQL

- b) A key advantage of Software as a Service (SaaS) is \_\_\_\_\_.

**ANS:** When the servers are updated, all clients worldwide see the new capabilities; no local installation is needed.

- c) \_\_\_\_\_ are proven architectures for constructing flexible and maintainable object-oriented software.

**ANS:** Design patterns

- d) \_\_\_\_\_ is the most popular open source server-side “scripting” language for developing Internet-based applications.

**ANS:** PHP

## Making a Difference

**1.12** (*Test Drive: Carbon Footprint Calculator*) Some scientists believe that carbon emissions, especially from the burning of fossil fuels, contribute significantly to global warming and that this can be combatted if individuals take steps to limit their use of carbon-based fuels. Organizations and individuals are increasingly concerned about their “carbon footprints.” Websites such as TerraPass

[www.terrapass.com/carbon-footprint-calculator/](http://www.terrapass.com/carbon-footprint-calculator/)

and Carbon Footprint

[www.carbonfootprint.com/calculator.aspx](http://www.carbonfootprint.com/calculator.aspx)

provide carbon footprint calculators. Test drive these calculators to determine your carbon footprint. Exercises in later chapters will ask you to program your own carbon footprint calculator. To prepare for this, research the formulas for calculating carbon footprints.

**1.13** (*Test Drive: Body Mass Index Calculator*) By recent estimates, two-thirds of the people in the United States are overweight and about half of those are obese. This causes significant increases in illnesses such as diabetes and heart disease. To determine whether a person is overweight or obese, you can use a measure called the body mass index (BMI). The United States Department of Health and Human Services provides a BMI calculator at [www.nhlbi.nih.gov/health/heart/heartdisease/overweight/overweight\\_bmi\\_calculator.html](http://www.nhlbi.nih.gov/health/heart/heartdisease/overweight/overweight_bmi_calculator.html). Use it to calculate your own BMI. An exercise in Chapter 2 will ask you to program your own BMI calculator. To prepare for this, research the formulas for calculating BMI.

**1.14** (*Attributes of Hybrid Vehicles*) In this chapter you learned the basics of classes. Now you'll begin "fleshing out" aspects of a class called "Hybrid Vehicle." Hybrid vehicles are becoming increasingly popular, because they often get much better mileage than purely gasoline-powered vehicles. Browse the web and study the features of four or five of today's popular hybrid cars, then list as many of their hybrid-related attributes as you can. For example, common attributes include city-miles-per-gallon and highway-miles-per-gallon. Also list the attributes of the batteries (type, weight, etc.).

**ANS:**

- Manufacturer
- Type of Hybrid—Battery hybrid (Hybrid Electric Vehicles), Plug-in hybrid, Fuel cell etc.
- Driver feedback system—so the driver can monitor fuel efficiency based on their driving
- Energy recovery—for example, regenerative braking
- Carbon footprint—tons of CO<sub>2</sub> per year
- Fuel capacity
- City-miles-per-gallon
- Highway-miles-per-gallon
- Two-mode hybrid propulsion system
- Engine size—V6, V8, etc.
- Vehicle type—SUV, crossover, compact, mid-size, etc.
- Seating capacity
- Horse power
- Drive train (front wheel drive, all wheel drive)
- Top speed
- Torque
- Price

**1.15** (*Gender Neutrality*) Many people want to eliminate sexism in all forms of communication. You've been asked to create a program that can process a paragraph of text and replace gender-specific words with gender-neutral ones. Assuming that you've been given a list of gender-specific words and their gender-neutral replacements (e.g., replace "wife" by "spouse," "man" by "person," "daughter" by "child" and so on), explain the procedure you'd use to read through a paragraph of text and manually perform these replacements. How might your procedure generate a strange term

like “woperchild?” In Chapter 3, you’ll learn that a more formal term for “procedure” is “algorithm,” and that an algorithm specifies the steps to be performed and the order in which to perform them.

**ANS:** Search through the entire paragraph for a word such as “wife” and replace every occurrence with “spouse.” Repeat this searching process for every gender specific word in the list. You could accidentally get a word like “woperchild” if you are not careful about how you perform replacements. For example, the word “man” can be part of a larger word, like “woman.” So, replacing every occurrence of “man” can yield strange results. Consider the process of replacing “man” with “person” then replacing “son” with “child.” If you encounter the word “woman,” which contains the word “man,” you’d replace “man” with “person” resulting in the word “woperson.” In a subsequent pass you’d encounter “woperson” and replace “son” with “child” resulting in the “woperchild.”