

# Introduction to Computers, the Internet and the Web

# 1



## Objectives

In this chapter, you'll learn:

- Basic computer concepts.
- The different types of programming languages.
- The history of the C programming language.
- The purpose of the C Standard Library.
- The basics of object technology.
- A typical C program-development environment.
- To test-drive a C application in Windows, Linux and Mac OS X.
- Some basics of the Internet and the World Wide Web.

## Self-Review Exercises

### 1.1 Fill in the blanks in each of the following statements:

- a) Computers process data under the control of sets of instructions called \_\_\_\_\_.

ANS: programs.

- b) The key logical units of the computer are the \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_.

ANS: input unit, output unit, memory unit, central processing unit, arithmetic and logic unit, secondary storage unit.

- c) The three types of languages discussed in the chapter are \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_.

ANS: machine languages, assembly languages, high-level languages.

- d) The programs that translate high-level-language programs into machine language are called \_\_\_\_\_.

ANS: compilers.

- e) \_\_\_\_\_ is an operating system for mobile devices based on the Linux kernel and Java.

ANS: Android.

- f) \_\_\_\_\_ software is generally feature complete, (supposedly) bug free and ready for use by the community.

ANS: Release candidate.

- g) The Wii Remote, as well as many smartphones, use a(n) \_\_\_\_\_ which allows the device to respond to motion.

ANS: acceleromoter.

- h) C is widely known as the development language of the \_\_\_\_\_ operating system.

ANS: UNIX.

- i) \_\_\_\_\_ is the new programming language for developing iOS and Mac apps.

ANS: Swift.

### 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 automatically executes before the translation phase begins.

ANS: preprocessor.

- c) The two most common kinds of preprocessor directives are \_\_\_\_\_ and \_\_\_\_\_.

ANS: including other files in the file to be compiled, performing various text replacements.

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

ANS: linker.

- e) The \_\_\_\_\_ program transfers the executable image from disk to memory.

ANS: loader.

### 1.3 Fill in the blanks in each of the following statements (based on Section 1.8):

- 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) In object-oriented programming languages, we create \_\_\_\_\_ to house the set of methods that perform tasks.

ANS: classes.

- c) With \_\_\_\_\_, new classes of objects are derived by absorbing characteristics of existing classes, then adding unique characteristics of their own.

ANS: inheritance.

- d) The size, shape, color and weight of an object are considered \_\_\_\_\_ of the object's class.

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

- a) The logical unit that receives information from outside the computer for use by the computer is the \_\_\_\_\_.

ANS: input unit.

- b) The process of instructing the computer to solve a problem is called \_\_\_\_\_.

ANS: computer programming.

- c) \_\_\_\_\_ is a type of computer language that uses Englishlike abbreviations for machine-language instructions.

ANS: assembly language.

- d) \_\_\_\_\_ is a logical unit that sends information which has already been processed by the computer to various devices so that it may be used outside the computer.

ANS: output unit.

- e) \_\_\_\_\_ and \_\_\_\_\_ are logical units of the computer that retain information.

ANS: memory unit, secondary storage unit.

- f) \_\_\_\_\_ is a logical unit of the computer that performs calculations.

ANS: ALU.

- g) \_\_\_\_\_ is a logical unit of the computer that makes logical decisions.

ANS: ALU.

- h) \_\_\_\_\_ languages are most convenient to the programmer for writing programs quickly and easily.

ANS: high-level.

- i) The only language a computer can directly understand is that computer's \_\_\_\_\_.

ANS: machine language.

- j) The \_\_\_\_\_ is a logical unit of the computer that coordinates the activities of all the other logical units.

ANS: CPU.

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

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- a) \_\_\_\_\_ is now used to develop large-scale enterprise applications, to enhance the functionality of web servers, to provide applications for consumer devices and for many other purposes.

ANS: Java

- b) \_\_\_\_\_ initially became widely known as the development language of the UNIX operating system.

ANS: C.

- c) The \_\_\_\_\_ programming language was developed by Bjarne Stroustrup in the early 1980s at Bell Laboratories.

ANS: C++.

### 1.7 Discuss the meaning of each of the following names:

- a) `stdin`

ANS: `stdin` (the standard input stream), which is normally the keyboard, but `stdin` can be connected to another stream.

- b) `stdout`

ANS: Data is often output to `stdout` (the standard output stream), which is normally the computer screen, but `stdout` can be connected to another stream.

- c) `stderr`

ANS: The standard error stream is referred to as `stderr`. The `stderr` stream (normally connected to the screen) is used for displaying error messages. It's common to route regular output data, i.e., `stdout`, to a device other than the screen while keeping `stderr` assigned to the screen so that the user can be immediately informed of errors.

### 1.8 Why is so much attention today focused on object-oriented programming?

ANS: Object-oriented programming helps you write reusable software components that model items in the real world. Using a modular, object-oriented design-and-implementation approach can make software-development groups more productive.

### 1.9 (*Internet Negatives*) Besides their numerous benefits, the Internet and the web have several downsides, such as privacy issues, identity theft, spam and malware. Research some of the negative aspects of the Internet. List five problems and describe what could possibly be done to help solve each.

ANS: Answers will vary.

### 1.10 (*Watch as an Object*) You are probably wearing on your wrist one of the 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), messages, encapsulation and information hiding.

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 `AlarmClock` could inherit the basic features in 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 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 in-



terface 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.

## Making a Difference

Throughout the book we've included Making a Difference exercises in which you'll be asked to work on problems that really matter to individuals, communities, countries and the world.

**1.11 (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

<http://www.terrapass.com/carbon-footprint-calculator-2/>

and Carbon Footprint

<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, use the web to research the formulas for calculating carbon footprints.

**1.12 (Test-Drive: Body Mass Index Calculator)** Obesity 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 <http://www.nhlbi.nih.gov/guidelines/obesity/BMI/bmicalc.htm>. Use it to calculate your own BMI. An exercise in Exercise 2.32 will ask you to program your own BMI calculator. To prepare for this, use the web to research the formulas for calculating BMI.

**1.13 (Attributes of Hybrid Vehicles)** In this chapter you learned some basics of classes. Now you'll "flesh 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. Some common attributes include city-miles-per-gallon and highway-miles-per-gallon. Also list the attributes of the batteries (type, weight, etc.).

**1.14 (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" with "spouse," "man" with "person," "daughter" with "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 4, 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.

**1.15 (Privacy)** Some online e-mail services save all e-mail correspondence for some period of time. Suppose a disgruntled employee were to post all of the e-mail correspondences for millions of people, including yours, on the Internet. Discuss the issues.

**1.16 (Programmer Responsibility and Liability)** As a programmer in industry, you may develop software that could affect people's health or even their lives. Suppose a software bug in one of your programs causes a cancer patient to receive an excessive dose during radiation therapy and that the person is severely injured or dies. Discuss the issues.

**1.17** (2010 “Flash Crash”) An example of the consequences of our excessive dependence on computers was the so-called “flash crash” which occurred on May 6, 2010, when the U.S. stock market fell precipitously in a matter of minutes, wiping out trillions of dollars of investments, and then recovered within minutes. Research online the causes of this crash and discuss the issues it raises.