

Introduction to Computers, the Internet and the Web

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The chief merit of language is clearness.

—Galen

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

—Henry David Thoreau

He had a wonderful talent for packing thought close, and rendering it portable.

—Thomas B. Macaulay

Man is still the most extraordinary computer of all.

—John F. Kennedy

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 elements of 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.

*****Instructor's Manual*****

Self-Review Exercises

- 1.1** Fill in the blanks in each of the following:
- a) Computers process data under the control of sequences of instructions called computer _____.
ANS: programs.
 - b) _____ is a type of computer language that uses Englishlike abbreviations for machine-language instructions.
ANS: Assembly language.
 - c) _____ languages are most convenient to the programmer for writing programs quickly and easily.
ANS: High-level.
 - d) The only language a computer can directly understand is that computer's _____.
ANS: machine language.
 - e) The programs that translate high-level language programs into machine language are called _____.
ANS: compilers.
 - f) 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.
 - g) C is widely known as the development language of the _____ operating system.
ANS: UNIX
- 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 1.9):
- 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.

Solutions

- 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 process of instructing the computer to solve a problem is called _____.

ANS: computer programming.

- b) What type of computer language uses Englishlike abbreviations for machine-language instructions? _____.

ANS: assembly language.

- c) The level of computer language at which it's most convenient to write programs quickly and easily is _____.

ANS: high-level language.

- d) The only language that a computer directly understands is called that computer's _____.

ANS: machine language.

- e) Web 2.0 embraces an _____—a design that encourages user interaction and community contributions.

ANS: architecture of participation.

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

- 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.

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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:

1.9 (*Internet in Industry and Research*) Figure 1.1 provides examples of how computers and the Internet are being used in industry and research. Find three additional examples and describe how each is using the Internet and the web.

ANS: Answers will vary.

1.10 (*Cloud Computing*) Describe three benefits of the cloud computing model.

ANS: Answers will vary. Information is accessed via the Internet and available on demand—rather than having it stored on your personal computer. Cloud storage or processing services are generally more cost effective, allowing you to increase or decrease resources to meet your needs at any given time, rather than purchasing expensive hardware to ensure that you have enough storage and processing power to meet your needs at their peak levels. Software offered as a service in the cloud allows businesses to easily manage customer information and access it from their computers or mobile devices. These applications are often less expensive and shift the burden of managing the applications from the business to the service provider, saving businesses additional money. Another benefit of using software in the cloud is that it ensures everyone within the business is working on the same version of the software at all times.

1.11 (*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.

1.12 (*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 Exercises

1.13 (*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/

and Carbon Footprint

www.carbonfootprint.com/calculator.aspx

provide carbon footprint calculators. Test-drive these calculators to estimate 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.

1.14 (*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 support.com/bmi/. 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, use the web to research the formulas for calculating BMI.

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” 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.

1.16 (*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.

1.17 (*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.

1.18 (*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.

1.19 (*Making a Difference Projects*) The following is a list of just a few worldwide organizations that are working to make a difference. Visit these sites and our Making a Difference Resource Center at www.deitel.com/makingadifference. Prepare a top 10 list of programming projects that you think could indeed “make a difference.”

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- www.imaginecup.com/
The *Microsoft Image Cup* is a global competition in which students use technology to try to solve some of the world's most difficult problems, such as environmental sustainability, ending hunger, emergency response, literacy and combating HIV/AIDS. Visit www.imaginecup.com for more information about the competition and to learn about the projects developed by previous winners. You can also find several project ideas submitted by worldwide charitable organizations. For additional ideas for programming projects that can make a difference, search the web for “making a difference” and visit the following websites:
- www.un.org/millenniumgoals
The United Nations Millennium Project seeks solutions to major worldwide issues such as environmental sustainability, gender equality, child and maternal health, universal education and more.
- www.ibm.com/smarterplanet/
The IBM® Smarter Planet website discusses how IBM is using technology to solve issues related to business, cloud computing, education, sustainability and more.
- www.gatesfoundation.org/Pages/home.aspx
The Bill and Melinda Gates Foundation provides grants to organizations that work to alleviate hunger, poverty and disease in developing countries. In the United States, the foundation focusses on improving public education, particularly for people with few resources.
- www.nethope.org/
NetHope is a collaboration of humanitarian organizations worldwide working to solve technology problems such as connectivity, emergency response and more.
- www.rainforestfoundation.org/home
The Rainforest Foundation works to preserve rainforests and to protect the rights of the indigenous people who call the rainforests home. The site includes a list of things you can do to help.
- www.undp.org/
The United Nations Development Programme (UNDP) seeks solutions to global challenges such as crisis prevention and recovery, energy and the environment and democratic governance.
- www.unido.org
The United Nations Industrial Development Organization (UNIDO) seeks to reduce poverty, give developing countries the opportunity to participate in global trade, and promote energy efficiency and sustainability.
- www.usaid.gov/
USAID promotes global democracy, health, economic growth, conflict prevention, humanitarian aid and more.
- www.toyota.com/ideas-for-good/
Toyota's Ideas for Good website describes several Toyota technologies that are making a difference—including their Advanced Parking Guidance System, Hybrid Synergy Drive®, Solar Powered Ventilation System, T.H.U.M.S. (Total Human Model for Safety) and Touch Tracer Display. You can participate in the Ideas for Good challenge by submitting a short essay or video describing how these technologies can be used for other good purposes.

ANS: Answers will vary.