1.40 If your program needs to read data from a file, but the file does not exist, an error would occur when running this program. What kind of error is this?

1.41 Suppose you write a program for computing the perimeter of a rectangle and you mistakenly write your program so that it computes the area of a rectangle. What kind of error is this?

1.42 Identify and fix the errors in the following code:

```
1  int Main()
2  {
3    cout << 'Welcome to C++!;
4    return 0;
5  )
```

KEY TERMS

assembler 30
assembly language 29
bit 24
block 35
block comment 35
bus 22
byte 24
cable modem 28
central processing unit (CPU) 23
comment 35
compile error 41
compiler 30
console 34
console input 34
console output 35
dot pitch 28
digital subscriber line (DSL) 28
encoding scheme 24
hardware 22
header file 34
high-level language 30
integrated development environment (IDE) 39
interpreter 30
keyword (or reserved word) 35
library 34
line comment 35
linker 38
logic error 42
low-level language 30
machine language 29
main function 35
memory 25
modem 28
motherboard 23
namespace 34
network interface card (NIC) 28
object file 38
operating system (OS) 32
paragraph comment 35
pixel 28
preprocessor 38
program 22
programming 22
runtime error 42
screen resolution 28
software 22
source code 30
source program 30
statement 30
statement terminator 35
storage device 25
stream insertion operator 35
syntax error 41

Note

The key terms above are defined in this chapter. Supplement I.A, Glossary, lists all the key terms and descriptions used in the book, organized by chapters.

Chapter Summary

1. A computer is an electronic device that stores and processes data.
2. A computer includes both *hardware* and *software*.
3. Hardware is the physical aspect of the computer that can be touched.
4. Computer *programs*, known as *software*, are the invisible instructions that control the hardware and make it perform tasks.
5. Computer *programming* is the writing of instructions (i.e., code) for computers to perform.
6. The *central processing unit* (*CPU*) is a computer's brain. It retrieves instructions from *memory* and executes them.
7. Computers use zeros and ones because digital devices have two stable states, referred to by convention as zero and one.
8. A *bit* is a binary digit 0 or 1.
9. A *byte* is a sequence of 8 bits.
10. A kilobyte is about 1,000 bytes, a megabyte about 1 million bytes, a gigabyte about 1 billion bytes, and a terabyte about 1,000 gigabytes.
11. Memory stores data and program instructions for the CPU to execute.
12. A memory unit is an ordered sequence of bytes.
13. Memory is volatile, because information is lost when the power is turned off.
14. Programs and data are permanently stored on *storage devices* and are moved to memory when the computer actually uses them.
15. *Machine language* is a set of primitive instructions built into every computer.
16. *Assembly language* is a *low-level programming language* in which a mnemonic is used to represent each machine-language instruction.
17. *High-level languages* are English-like and easy to learn and program.
18. A program written in a high-level language is called a *source program*.
19. A *compiler* is a software program that translates the source program into a *machine-language program*.
20. The *operating system* (*OS*) is a program that manages and controls a computer's activities.

21. C++ is an extension of C. C++ added a number of features that improved the C language. Most important, it added the support of using classes for object-oriented programming.

22. C++ source files end with the .cpp extension.

23. `#include` is a preprocessor directive. All preprocessor directives begin with the symbol `#`.

24. The `cout` object along with the stream insertion operator (`<<`) can be used to display a string on the console.

25. Every C++ program is executed from a main function. A function is a construct that contains statements.

26. Every statement in C++ must end with a semicolon (`;`), known as the *statement terminator*.

27. In C++, a comment is preceded by two slashes (`//`) on a line, called a *line comment*, or enclosed between `/*` and `*/` on one or several lines, called a *block comment* or paragraph comment.

28. Keywords, or reserved words, have a specific meaning to the compiler and cannot be used in the program for other purposes. Examples of keywords are `using`, `namespace`, `int`, and `return`.

29. C++ source programs are case sensitive.

30. You can develop C++ applications from the command window or by using an IDE such as Visual C++ or Dev-C++.

31. Programming errors can be categorized into three types: syntax errors, runtime errors, and logic errors. Errors reported by a compiler are called syntax errors or compile errors. Runtime errors are errors that cause a program to terminate abnormally. Logic errors occur when a program does not perform the way it was intended.

Quiz

Answer the quiz for this chapter online at www.cs.armstrong.edu/liang/cpp3e/quiz.html.

MyProgrammingLab™

Programming Exercises

Note

Solutions to even-numbered exercises are provided on the Companion Website. Solutions to all exercises are provided on the Instructor Resource Website. The level of difficulty is rated easy (no star), moderate (`*`), hard (`**`), or challenging (`***`).

level of difficulty

Sections 1.6–1.9

VideoNote
Display five messages

1.1 (*Display two messages*) Write a program that displays `Introduction to Computers` and `Welcome to Object-Oriented Programming`.

1.2 (*Display five messages*) Write a program that displays `Welcome to C++` five times.

***1.3** (*Display a pattern*) Write a program that displays the following pattern:

```
   *          *********
  ***          *******
 *****          *****
*******          ***
*********          *
```

1.4 (*Print a table*) Write a program that displays the following table:

```
p       p*5     p*10
5       25      50
10      50      100
25      125     250
50      250     500
```

1.5 (*Compute Expressions*) Write a program that displays the result of $\frac{1.2 \times 0.1 + 3.3 \times 0.3}{0.09 + 0.001}$.

1.6 (*Summation of odd numbers*) Write a program that displays the sum of the first ten odd numbers

1.7 (*Approximate π*) π can be computed using the following formula:

$$\pi = \sqrt{6 \times \left(1 + \frac{1}{4} + \frac{1}{9} + \frac{1}{16} + \frac{1}{25} + \ \ldots\ \right)}$$

Write a program that displays the result of $\sqrt{6 \times \left(1 + \frac{1}{4} + \frac{1}{9} + \frac{1}{16} + \frac{1}{25}\right)}$ and $\sqrt{6 \times \left(1 + \frac{1}{4} + \frac{1}{9} + \frac{1}{16} + \frac{1}{25} + \frac{1}{36}\right)}$. Use `1.0` instead of `1` in your program.

1.8 (*Area and perimeter of an equilateral triangle*) Write a program that displays the area and perimeter of an equilateral triangle that has its three sides as `9.2`, using the following formula:

$$area = 1.732 \times (side1)^2 / 4$$

$$perimeter = 3 \times side1$$

1.9 (*Area and perimeter of a square*) Write a program that displays the area and perimeter of a square that has a side of `5.2` using the following formula:

$$area = (side)^2 \text{ and } perimeter = 4 \times side$$

1.10 (*Average sales in grams*) Assume a vendor sells `6` kilograms of grocery in `15` minutes and `30` minutes and 30 seconds. Write a program that displays the average sale in grams per hour (Note that `1` kilogram is `1000` grams).

***1.11** (*Population projection*) The U.S. Census Bureau projects population based on the following assumptions:

- One birth every 7 seconds
- One death every 13 seconds
- One new immigrant every 45 seconds

Write a program that displays the population for each of the next five years. Assume the current population is 312,032,486 and one year has 365 days. *Hint*: In C++, if two integers perform division, the result is the quotient. The fractional part is truncated.

For example, 5 / 4 is 1 (not 1.25) and 10 / 4 is 2 (not 2.5). To get an accurate result with the fractional part, one of the values involved in the division must be a number with a decimal point. For example, 5.0 / 4 is 1.25 and 10 / 4.0 is 2.5.

1.12 (*Average sales in kilograms*) Assume a vendor sells 5553 grams of grocery in 2 hours, 9 minutes and 30 seconds. Write a program that displays the average sale in kilograms per hour (Note that 1 kilogram is 1000 grams).