COURSE TECHNOLOGY
CENGAGE Learning

Programming Logic and Design

Sixth Edition

Chapter 1

An Overview of Computers and Programming

Objectives

In this chapter, you will learn about:

- Computer systems
- Simple program logic
- The steps involved in the program development cycle
- Pseudocode statements and flowchart symbols
- Using a sentinel value to end a program
- Programming and user environments
- The evolution of programming models

Understanding Computer Systems

- **Computer system**
  - Combination of all the components required to process and store data using a computer
- **Hardware**
  - Equipment associated with a computer
- **Software**
  - Computer instructions
  - Tell the hardware what to do
  - **Programs**
    - Instructions written by programmers

Understanding Computer Systems (continued)

- **Programming**
  - Writing software instructions
- Computer hardware and software accomplish three major operations
  - **Input**
    - **Data items** enter computer
  - **Processing**
    - By **central processing unit (CPU**)
  - **Output**

Understanding Computer Systems (continued)

- **Programming language**
  - Use to write computer instructions
  - Examples
    - Visual Basic, C#, C++, or Java
- **Syntax**
  - Rules governing its word usage and punctuation
- **Computer memory**
  - Computer's temporary, internal storage
  - **Volatile**

Understanding Computer Systems (continued)

- Permanent storage devices
  - **Nonvolatile**
- **Compiler** or an **interpreter**
  - Translates program code into **machine language** (**binary language**)
  - Checks for syntax errors
- Program **executes** or **runs**
  - Input will be accepted, some processing will occur, and results will be output

Understanding Simple Program Logic

- Program with syntax errors cannot execute
- **Logical errors**
  - Errors in program logic
  - Produce incorrect output as a result
- Logic of the computer program
  - Sequence of specific instructions in specific order
- **Variable**
  - Named memory location whose value can vary

Understanding the Program Development Cycle

- **Program development cycle**
  - Understand the problem
  - Plan the logic
  - Code the program
  - Use software (a compiler or interpreter) to translate the program into machine language
  - Test the program
  - Put the program into production
  - Maintain the program

Understanding the Program Development Cycle (continued)

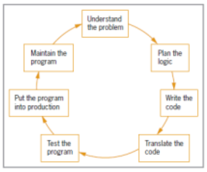


Figure 1-1 The program development cycle

Understanding the Problem

- One of the most difficult aspects of programming
- **Users** or **end users**
  - People for whom program is written
- **Documentation**
  - Supporting paperwork for a program

Planning the Logic

- Heart of the programming process
- Most common planning tools
  - Flowcharts
  - Pseudocode
- **Desk-checking**
  - Walking through a program’s logic on paper before you actually write the program

Coding the Program

- Hundreds of programming languages are available
  - Choose based on features
  - Alike in their basic capabilities
- Easier than planning step

Using Software to Translate the Program into Machine Language

- Translator program
  - Compiler or interpreter
  - Changes the programmer's English-like **high-level programming language** into the **low-level machine language**
- **Syntax error**
  - Misuse of a language's grammar rules
  - Programmer corrects listed syntax errors
  - Might need to recompile the code several times

Using Software to Translate the Program into Machine Language (continued)

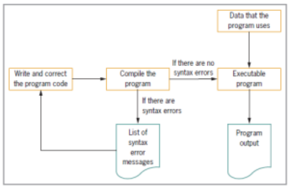

Data that the program uses
Write and correct the program code
Compile the program
If there are no syntax errors
Executable program
If there are syntax errors
List of syntax error messages
Program output

Figure 1-2 Creating an executable program

Testing the Program

- Logical error
  - Use a syntactically correct statement but use the wrong one for the current context
- Test
  - Execute the program with some sample data to see whether the results are logically correct
- Programs should be tested with many sets of data

Putting the Program into Production

- Process depends on program's purpose
  - May take several months
- **Conversion**
  - Entire set of actions an organization must take to switch over to using a new program or set of programs

Maintaining the Program

- **Maintenance**
  - Making changes after program is put into production
- Common first programming job
  - Maintaining previously written programs
- Make changes to existing programs
  - Repeat the development cycle

Using Pseudocode Statements and Flowchart Symbols

- **Pseudocode**
  - English-like representation of the logical steps it takes to solve a problem
- **Flowchart**
  - Pictorial representation of the logical steps it takes to solve a problem

Writing Pseudocode

- Pseudocode representation of a number-doubling problem

```
start
   input myNumber
   set myAnswer = myNumber * 2
   output myAnswer
stop
```

Writing Pseudocode (continued)

- Programmers preface their pseudocode with a beginning statement like `start` and end it with a terminating statement like `stop`
- Flexible because it is a planning tool

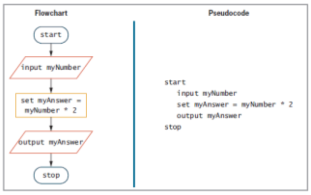
Drawing Flowcharts

- Create a flowchart
  - Draw geometric shapes that contain the individual statements
  - Connect shapes with arrows
- **Input symbol**
  - Indicates input operation
  - Parallelogram
- **Processing symbol**
  - Processing statements such as arithmetic
  - Rectangle

Drawing Flowcharts (continued)

- **Output symbol**
  - Represents output statements
  - Parallelogram
- **Flowlines**
  - Arrows that connect steps
- **Terminal** symbols
  - Start/stop symbols
  - Shaped like a racetrack
  - Also called lozenge

Drawing Flowcharts (continued)



```
start
   input myNumber
   set myAnswer = myNumber * 2
   output myAnswer
stop
```

Figure 1-6 Flowchart and pseudocode of program that doubles a number

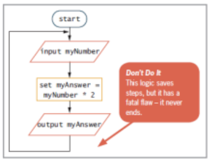
Repeating Instructions

- After the flowchart or pseudocode has been developed, the programmer only needs to:
  - Buy a computer
  - Buy a language compiler
  - Learn a programming language
  - Code the program
  - Attempt to compile it
  - Fix the syntax errors
  - Compile it again
  - Test it with several sets of data
  - Put it into production

Repeating Instructions (continued)

- **Loop**
  - Repetition of a series of steps
- **Infinite loop**
  - Repeating flow of logic with no end

Repeating Instructions (continued)



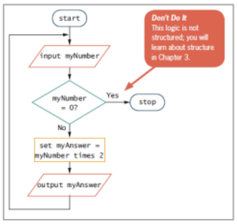
Don't Do It
This logic saves steps, but it has a fatal flaw – it never ends.

Figure 1-8 Flowchart of infinite number-doubling program

Using a Sentinel Value to End a Program

- **Making a decision**
  - Testing a value
  - **Decision symbol**
    - Diamond shape
- **Dummy value**
  - Data-entry value that the user will never need
  - **Sentinel value**
- **eof** ("end of file")
  - Marker at the end of a file that automatically acts as a sentinel

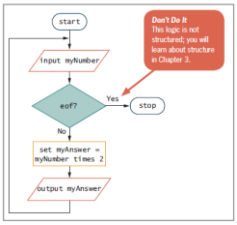
Using a Sentinel Value to End a Program (continued)



Don't Do It
This logic is not structured; you will learn about structure in Chapter 3.

Figure 1-9 Flowchart of number-doubling program with sentinel value of 0

Using a Sentinel Value to End a Program (continued)



Don't Do It
This logic is not structured; you will learn about structure in Chapter 3.

Figure 1-10 Flowchart using eof

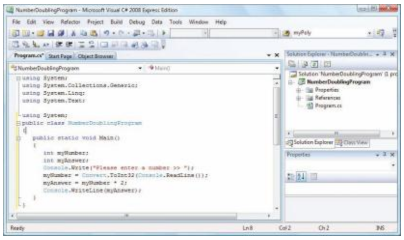
Understanding Programming and User Environments

- Many options for programming and user environments

Understanding Programming Environments

- Use a keyboard to type program statements into an editor
  - Plain **text editor**
    - Similar to a word processor but without as many features
  - Text editor that is part of an **integrated development environment (IDE)**
    - Software package that provides an editor, compiler, and other programming tools

Understanding Programming Environments (continued)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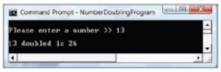
```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;

using System;
public class NumberDoublingProgram
{
    public static void Main()
    {
        int myNumber;
        int myAnswer;
        Console.Write("Please enter a number >> ");
        myNumber = Convert.ToInt32(Console.ReadLine());
        myAnswer = myNumber * 2;
        Console.WriteLine(myAnswer);
    }
}
```

Figure 1-12 A C# number-doubling program in Visual Studio

Understanding User Environments

- **Command line**
  - Location on your computer screen at which you type text entries to communicate with the computer's operating system
- **Graphical user interface (GUI)**
  - Allows users to interact with a program in a graphical environment

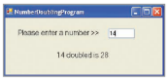
Understanding User Environments (continued)



```
Please enter a number >> 13
13 doubled is 26
```

Figure 1-13 Executing a number-doubling program in a command-line environment

Understanding User Environments (continued)



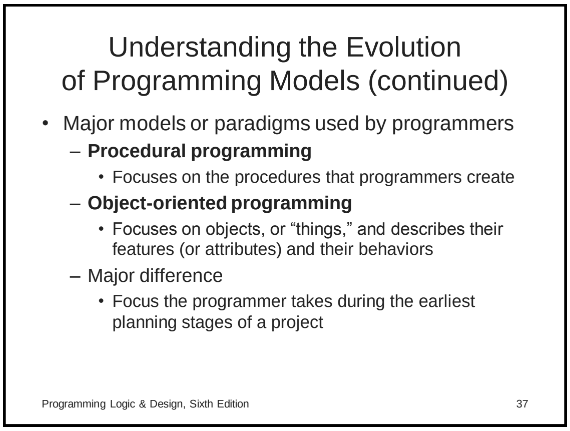
Please enter a number >> 14

14 doubled is 28

Figure 1-14 Executing a number-doubling program in a GUI environment

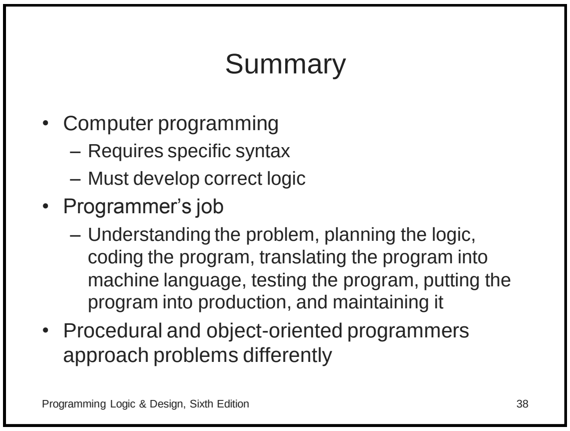
Understanding the Evolution of Programming Models

- People have been writing modern computer programs since the 1940s
- Newer programming languages
  - Look much more like natural language
  - Easier to use
  - Create self-contained modules or program segments that can be pieced together in a variety of ways



Understanding the Evolution of Programming Models (continued)

- Major models or paradigms used by programmers
  - **Procedural programming**
    - Focuses on the procedures that programmers create
  - **Object-oriented programming**
    - Focuses on objects, or “things,” and describes their features (or attributes) and their behaviors
  - Major difference
    - Focus the programmer takes during the earliest planning stages of a project



Summary

- Computer programming
  - Requires specific syntax
  - Must develop correct logic
- Programmer’s job
  - Understanding the problem, planning the logic, coding the program, translating the program into machine language, testing the program, putting the program into production, and maintaining it
- Procedural and object-oriented programmers approach problems differently