**Chapter 1**

**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 \_\_\_programs\_\_\_\_\_\_\_\_ .

b) The key logical units of the computer are the \_\_\_\_cpu\_\_,\_\_memory\_\_\_\_\_,\_\_input devices\_\_\_\_\_\_ ,\_\_output devices\_\_\_ ,\_storage\_\_\_\_\_ and \_\_\_network\_\_\_.

c) The three types of languages they are\_\_\_machine language\_\_\_\_ , \_assembly language\_\_\_\_\_\_\_\_and \_\_high level language\_\_\_\_\_\_.

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

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

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

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

**1.2 Fill in the blanks in each of the following sentences about the Java environment:**

a) The \_\_Java\_\_\_\_\_ command from the JDK executes a Java application.

b) The \_Javac\_\_\_\_\_\_ command from the JDK compiles a Java program.

c) A Java source code file must end with the \_.java\_\_\_\_\_\_ file extension.

d) When a Java program is compiled, the file produced by the compiler ends with the \_\_.class\_\_\_\_\_\_ file extension.

e) The file produced by the Java compiler contains \_\_\_bytecodes\_\_\_\_\_\_ that are executed by the Java Virtual Machine.

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

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

b) Java programmers concentrate on creating \_classes\_\_\_\_ , which contain fields and the set of methods that manipulate those fields and provide services to clients.

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

d) A new class of objects can be created conveniently by \_\_inheritance\_\_\_\_\_\_\_ —the new class (called the subclass) starts with the characteristics of an existing class (called the superclass), possibly customizing them and adding unique characteristics of its own.

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

f) The size, shape, color and weight of an object are considered\_\_attributes\_\_\_\_\_ of the object’s class.

**Exercises 1.4 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 \_input device\_\_\_\_\_\_ .

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

c) \_Assembly Langugae\_\_\_\_\_ is a type of computer language that uses English-like abbreviations for machine-language instructions.

d) \_Output device\_\_\_\_\_\_\_ 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.

e) \_Memory\_\_\_\_\_\_\_and \_\_storage\_\_\_\_ are logical units of the computer that retain information.

f) \_\_\_Arithmetic Logic Unit\_\_\_\_\_\_\_ is a logical unit of the computer that performs calculations.

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

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

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

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

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

a) The \_\_Java\_\_\_\_\_\_\_ programming language 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.

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

c) The \_\_\_TCP/IP\_\_\_\_\_ ensures that messages, consisting of sequentially numbered pieces called bytes, were properly routed from sender to receiver, arrived intact and were assembled in the correct order.

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

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

a) Java programs normally go through five phases— \_\_editing\_\_\_\_, \_compiling\_\_\_\_\_\_ ,\_\_\_\_loading\_\_\_\_\_ , \_\_interpertation\_\_\_\_\_\_\_ and \_\_execution\_\_\_\_\_\_\_ .

b) A(n)\_\_\_Integrated Development Environment \_\_\_\_\_\_\_ provides many tools that support the software development process, such as editors for writing and editing programs, debuggers for locating logic errors in programs, and many other features.

c) The command java invokes the \_\_\_\_\_Java Virtual Machine\_\_\_\_\_, which executes Java programs.

d) A(n) \_virtual machine\_\_\_\_\_\_\_ is a software application that simulates a computer, but hides the underlying operating system and hardware from the programs that interact with it.

e) The \_\_JVM\_\_\_\_\_\_\_ takes the .class files containing the program’s bytecodes and transfers them to primary memory. f) The examines bytecodes to ensure that they’re valid.

f) The \_\_\_\_JVM\_\_\_\_\_\_ examines bytecodes to ensure that they’re valid.

1.7 Explain the two compilation phases of Java programs.

Answer:

1.Compilation: During this phase, the Java source code (with a .java extension) is converted into bytecode by the javac compiler. The resulting bytecode file has a .class extension.

2.Interpretation/Execution: The bytecode file is then executed by the Java Virtual Machine (JVM). The JVM reads the bytecode and translates it into machine code that can be executed on the underlying hardware.

1.8 One of the world’s most common objects is a wrist 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), modeling, messages, encapsulation, interface and information hiding.

Answer:

For a watch:

Object: A wristwatch can be considered an object in an object-oriented program.

Attributes: Examples include the color, size, material, brand, and time displayed.

Behaviors: A watch might have behaviors like "tell time," "alarm," "set time," etc.

Class: A class might be created for watches, with attributes like color and behaviors like setting the time.

Inheritance: A subclass like "Alarm Clock" could inherit from the watch class, adding an alarm feature.

Modeling: A programmer can create a model of the watch in a program, abstracting it as an object with relevant attributes and behaviors.

Messages: A message could be sent to the watch to "set time" or "display time."

Encapsulation: The internal mechanisms of how the watch works (e.g., the gears inside) would be hidden from the user, who only interacts with the watch interface.

Interface: The user interacts with the watch through its interface, which could be buttons, touch screens, or voice commands.

Information hiding: The internal workings (like the movement mechanism) are hidden from the user.

**Making a Difference**

***1.9 (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/> 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.

Answer:

For the Carbon Footprint Calculator, the task involves understanding the formulae used to calculate carbon footprints, such as based on transportation, energy usage, and waste. You’ll need to research how different activities (e.g., driving, flying, electricity usage) contribute to carbon emissions and build formulas into your program.

***1.10 (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. A forthcoming exercise will ask you to program your own BMI calculator. To prepare for this, use the web to research the formulas for calculating BMI.

Answer:

1.10

For the BMI Calculator, you will research the formula for calculating

BMI=weight (kg)/height (m)^2

You would gather information about a person’s weight and height, then use this formula to compute and categorize their BMI.

***1.11 (Attributes of Hybrid Vehicles)***

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.).

Answer:

For the Hybrid Vehicles, you would research the features of hybrid vehicles, including attributes like fuel efficiency (city and highway mpg), battery type (e.g., lithium-ion), and environmental impact. You would collect data on how these attributes vary across different models.

***1.12 (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 both “wife” and “husband” with “spouse,” “man” and “woman” with “person,” “daughter” and “son” with “child”), 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?” You’ll soon 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. We’ll show how to develop algorithms then convert them to Java programs which can be run on computers.

Answer:

To create a gender-neutrality program, you would:

Read through a given paragraph.

Look for any gender-specific words (e.g., “wife,” “husband”) and replace them with gender-neutral terms (e.g., “spouse”).

Ensure replacements are done systematically and check for any unexpected combinations (like “woperchild”) that might arise from incorrect replacements. An algorithm would specify this step-by-step.