**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 **input unit**, **output unit**, **memory unit**, **arithmetic and logic unit (ALU)**, **central processing unit (CPU)**, and **secondary storage unit**.  
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 **compilers**.  
e) **Android** is an operating system for mobile devices based on the Linux kernel and Java.  
f) **Release candidate** 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 **information hiding**—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 **object-oriented analysis and design (OOAD)**.  
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) **The Unified Modeling Language (UML)** 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 unit**.  
b) The process of instructing the computer to solve a problem is called **computer programming**.  
c) **Assembly language** is a type of computer language that uses English-like abbreviations for machine-language instructions.  
d) **Output unit** 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 unit** and **secondary storage unit** are logical units of the computer that retain information.  
f) **Arithmetic and logic unit (ALU)** is a logical unit of the computer that performs calculations.  
g) **Arithmetic and logic unit (ALU)** is a logical unit of the computer that makes logical decisions.  
h) **High-level** 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) **Central processing unit (CPU)** 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 **Internet Protocol (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. (Note: This describes the function of TCP. However, the blank is likely looking for "TCP" or "Transmission Control Protocol" which works with IP to provide this service. The given description fits the TCP part of TCP/IP).  
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--- **edit**, **compile**, **load**, **verify**, and **execute**.  
b) A(n) **Integrated Development Environment (IDE)** 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 (JVM)**, which executes Java programs.  
d) A(n) **virtual machine (VM)** 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 **class loader** takes the .class files containing the program's bytecodes and transfers them to primary memory.  
f) The **bytecode verifier** examines bytecodes to ensure that they're valid.

**1.7 Explain the two compilation phases of Java programs.**

1. **First Compilation Phase:** In this phase, a Java compiler (javac) translates the Java source code (the .java file) into bytecodes. Bytecode is a platform-independent intermediate representation of the program, stored in a .class file.
2. **Second Compilation Phase:** In this phase, the Java Virtual Machine (JVM) takes the bytecodes and, just before or during execution, translates them into the specific machine language instructions for the host computer's platform (e.g., Intel, ARM). This second translation is often performed by a Just-In-Time (JIT) compiler within the JVM for efficiency.

**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:** A specific, physical watch (e.g., *my* black Casio watch) is an object.
* **Attributes:** These are the object's properties, such as its color, brand, size, weight, current time, and whether it is digital or analog.
* **Behaviors:** These are the actions the object can perform, such as setTime(), displayTime(), startStopwatch(), and activateBacklight().
* **Class:** The blueprint for a watch. The Watch class describes all the attributes and behaviors that any watch object will have. *My* specific watch is an *instance* of this class.
* **Inheritance:** An AlarmClock class can be a subclass of the Watch class. It *inherits* all the attributes and behaviors of a watch (like displaying time) but adds its own unique characteristics, such as an alarmTime attribute and a setAlarm() behavior.
* **Modeling:** Defining the Watch class and its subclasses is a form of modeling the real-world concept of a timepiece in software.
* **Messages:** When you press a button on the watch to see the date, you are sending a displayDate() message to the watch object. The object responds by performing that behavior.
* **Encapsulation:** The watch encapsulates its internal mechanics (gears, circuit board) and data (the internal time counter) within its case. You interact with it through its public interface (buttons, screen), not by opening it up.
* **Interface:** The buttons, crown, and screen of the watch form its public interface—the way you, the user, command it and receive information.
* **Information Hiding:** The complex internal workings of the watch are hidden from you. You don't need to know how the quartz crystal oscillates to tell the time; you only need to know how to use the interface.