**1.1 EXERCISE**

**Fill in the blanks:**

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 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) **Beta** 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.

**Exercises 1.2**

**Fill in the blanks:**

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.

**Exercises 1.3**

**Fill in the blanks:**

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) **UML (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:**

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 **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 that 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.

### ****Exercises 1.5****

**Fill in the blanks:**

a) The **Java** programming language is now used to develop large-scale enterprise applications, enhance the functionality of web servers, provide applications for consumer devices, and many other purposes.

b) **C** initially became widely known as the development language of the UNIX operating system.

c) The **Transmission Control Protocol (TCP)** ensures that messages, consisting of sequentially numbered pieces called bytes, are properly routed from sender to receiver, arrive intact, and are assembled in the correct order.

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

### ****Exercises 1.6****

**Fill in the blanks:**

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** 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.

### ****Exercises 1.7****

**The Two Compilation Phases of Java Programs:**

1. **Compilation Phase:**
   * The Java compiler (javac) translates source code (.java file) into bytecode (.class file).
2. **Execution Phase:**
   * The JVM loads and verifies the bytecode, then interprets or compiles it into machine code for execution.

### ****Exercises 1.8****

**Applying OOP Concepts to a Wristwatch:**

* **Object:** A wristwatch is an object because it has properties and behaviors.
* **Attributes:** It has properties like brand, color, type (analog/digital), and battery life.
* **Behaviors:** It performs actions like displaying time, setting alarms, and tracking fitness data.
* **Class:** A wristwatch belongs to a general class of "Watches."
* **Inheritance:** An alarm clock could be a subclass of a watch, inheriting basic functionalities but adding an alarm feature.
* **Modeling:** Designing a watch in software requires modeling its attributes and behaviors.
* **Messages:** The watch's components communicate (e.g., pressing a button sends a signal to adjust the time).
* **Encapsulation:** Internal mechanisms of the watch (like the quartz movement) are hidden from the user.
* **Interface:** The display and buttons form the interface through which users interact with the watch.
* **Information Hiding:** The internal working of the watch is not visible to the user, only necessary functionalities are exposed.

Test-Drive: Carbon Footprint Calculator 1.9 **EX**

A carbon footprint measures the total amount of greenhouse gases (GHG), mainly carbon dioxide (CO₂), that an individual, organization, or product emits. It is measured in kilograms (kg) or metric tons (t) of CO₂ equivalent (CO₂e).

Step 1: Identifying Emission Sources

Your carbon footprint comes from various activities. The main sources are:

1. Transportation

Driving a gasoline or diesel car

Air travel (short-haul vs. long-haul flights)

Public transport (buses, trains)

2. Energy Usage at Home

Electricity consumption

Natural gas or fuel for heating

3. Food Consumption

Eating meat (especially beef) increases your carbon footprint

Processed and packaged foods

4. Daily Activities

Using electronic devices

Buying new clothes, gadgets, and appliances

Step 2: Using a Carbon Footprint Calculator

You can calculate your footprint using online calculators like:

TerraPass

Carbon Footprint

Example Calculation (Car Travel)

If you drive a petrol car that consumes 10 liters of fuel per 100 km, and your yearly driving distance is 15,000 km, you can estimate:

1. Fuel used per year:

15,000 \text{ km} \times 0.1 \text{ L/km} = 1,500 \text{ L of petrol}

1,500 \text{ L} \times 2.3 \text{ kg CO₂/L} = 3,450 \text{ kg CO₂}

Step 3: Researching Carbon Footprint Reduction Methods

After calculating your footprint, consider ways to reduce it:

1. Transportation

Use public transport, cycle, or walk

Switch to electric or hybrid vehicles

Reduce flight travel or choose direct flights

2. Energy Consumption

Use energy-efficient appliances

Switch to renewable energy (solar, wind)

Turn off lights and devices when not in use

3. Food Choices

Reduce meat and dairy consumption

Buy local and seasonal foods

Minimize food waste

4. Lifestyle Changes

Buy second-hand clothes and electronics

Reduce plastic usage

Plant trees to offset carbon emissions

**Exercises 1.11**

**Attributes of Hybrid Vehicles:**

* City MPG, Highway MPG
* Battery Type (Lithium-ion, Nickel-Metal Hydride)
* Battery Weight and Capacity
* Charging Time, Regenerative Braking
* Engine Type (Hybrid/Electric)

**Exercises 1.12**

**Gender-Neutral Text Processing Algorithm:**

* Read the paragraph.
* Replace gender-specific words with neutral terms using a dictionary.
* Avoid incorrect replacements like “woperchild” by ensuring whole words are replaced, not substrings.