**1.1 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.

**1.2 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 Object-Oriented Programming Concepts:**

a) Objects enable the design practice of **encapsulation**—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) **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.

**1.4 Computer Architecture Concepts:**

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 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) **Central processing unit (CPU)** 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 Programming Languages and Network Concepts:**

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 **Transmission Control Protocol (TCP)** 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 Java Program Execution:**

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.

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

1. **Compilation Phase**:
   * The Java compiler (javac) translates the Java source code (.java file) into bytecode (.class file).
   * This intermediate representation is platform-independent and can be executed on any system with a Java Virtual Machine (JVM).
2. **Execution Phase**:
   * The Java Virtual Machine (java command) loads the bytecode into memory.
   * The **class loader** transfers .class files to memory, and the **bytecode verifier** checks them for security and correctness.
   * The **JVM interpreter or Just-In-Time (JIT) compiler** translates the bytecodes into machine code, which the CPU executes.

**1.8 Object-Oriented Concepts Applied to a Wristwatch:**

* **Object**: A wristwatch is an object because it has properties (attributes) and functionalities (behaviors).
* **Attributes**: A watch has attributes like color, brand, material, size, and battery life.
* **Behaviors**: A watch can show time, set alarms, and measure elapsed time (stopwatch function).
* **Class**: The general blueprint for watches that defines common properties and behaviors. A digital watch and an analog watch are objects (instances) of this class.
* **Inheritance**: An alarm clock is a specialized type of watch that inherits common features from a basic watch but adds new capabilities like setting alarms.
* **Modeling**: Engineers and designers create models of watches before manufacturing them. In object-oriented programming, modeling helps represent real-world objects in code.
* **Messages**: The buttons on a watch send messages (commands) to update the time, start the stopwatch, or set an alarm.
* **Encapsulation**: The internal workings of a watch (mechanisms, circuits) are hidden from the user, just like encapsulation in object-oriented programming hides implementation details.
* **Interface**: The display and buttons of a watch serve as an interface that allows users to interact with it. Similarly, object-oriented programs use interfaces to communicate between objects.
* **Information Hiding**: The user only sees the time or alarm settings, while the internal mechanisms of the watch are hidden from view, much like how object-oriented programming hides internal details of a class.