Getting Started with Java

Introduction

In this unit you will learn some background about programming and Java. You will also build your first program.

Programming Overview:

A **program** is a set of commands written in a programming language to perform a task. A **programming language** is a structured language that allows a **programmer**, the person that builds a program, to communicate with the computer through a list of commands.

Programming is the act of writing a program. It may seem a little crazy, but computers do everything in **Binary**, a number system where only the numbers zero and one are used. Commands are given to computers in a language called **machine code**. Machine Code is a language that the computer understands and consists of commands written only in binary.

Commands in binary are very long and difficult to read and write. To help programmers write programs, programming languages were built. These languages use commands writing in text and are easier for programmers to read and write. Before these programs are run they will be translated to machine code.

Programming languages are usually broken into two categories high level programming languages and low level programming languages. **Low level programming languages** need few translations to reach machine code and are little faster than programs written in a higher level languages. The drawback to low level languages is that they are generally more difficult to program in. Assembler and C are examples of low level languages.

High level programming languages are easier for the programmer to work with, but require more translations to get to machine code. Being translated multiple times leads to less efficient programs. Java and C# are examples of high level languages.

Why Java?

- Java is platform independent – **Platform independent programs** work on virtually any machine no matter what hardware or operating system it has. **Platform dependent programs** are programs that are limited on what computers they will run on based on the hardware or operating system of the machine.
- Java is a high level language – A high level language is a lot easier for the programmer to write in and read.
- Java is Object Oriented – **Object oriented languages** are languages that allow the programmer to create "Objects" that store custom sets of data and can perform actions involving that data.
- Java has a garbage collector – When data is created during the life of a program it needs to be removed once it is no longer needed; to make room for new data. In most languages when an Object is created it will exist, taking up space, until a command is run to delete it.

  When items are not deleted by mistake it can cause **memory leak**, a problem where memory is slowly lost because data gets created, but never deleted. Memory leaks can cause a program to crash when the program needs to create a piece of data, but is out of room.

  Java has a built in **garbage collector**, a program that monitors created data and automatically deletes it when it is no longer being used. This helps prevent memory leaks, giving the programmer one less thing to worry about.
- The AP Board tests in Java – The AP Board decided that they wanted to tests students' programming skills with the Java language. Learning programming in Java equips the students with the tools needed to take the AP exam. When students pass the AP test they get college credit!

Quick Programming Tools Overview

There are several tools involved with programming and in running Java applications. The following is a list of these tools.

- **Compiler** – A program that checks your code and gives you errors if there are problems with it. When the code is correct it will build your program.
- **Debugger** – A program that allows the programmer to monitor and manipulate data while a program is running.
- **Editor** – A program used for writing code.
- **Integrated Development Environment** (IDE) – A single program that contains an editor, compiler and debugger.

- **Java Development Kit** (JDK) – This program contains the tools needed to build and run Java programs. Contains a JVM and a JRE.
- **Java Runtime Environment** (JRE) – This is a program that allows the computer to run programs that are written in Java.
- **Java Virtual Machine** (JVM) – This is a program in the JRE that converts Byte Code commands into instructions for the operating system. The JVM contains the garbage collector.

How Programming in Java Works

1. Open an IDE and write a program consisting of one or more Java Files. **Java files** contain code written in the Java.
2. Compile the .java files. If there are errors they will need to be corrected and recompiled.
3. Once the files have been successfully complied the compiler will generate a **class files** for each of your java files. The class files contain **byte code**, code that is understood by a special program called a Java Virtual Machine.
4. Once the class files have been generated the program can be executed. The program is run by the computer taking the following actions.
    a. First the byte files are given to the JVM
    b. The JVM will translate all the byte code into commands that the local machine will understand. An **Operating System** is a program that works a middle man for communication between the user/other programs and hardware
    c. These instructions are then run on the computer to execute your program.

Types of programs

The two main categories of programs are **Graphical Applications** and **Console Applications.** Graphical applications are programs that have a **Graphical User Interface (GUI)**. A GUI generally consists of both text and non-text graphical output. These programs may include pictures, input boxes, menus, buttons and more, like the application you are using to view this file.

Applets are a special type of graphical application that have their window built into a webpage, like Yahoo Games.

Console applications are programs that interact with the user through a **console**, a text only area where the user can write and view text.

Errors

There are three types of errors that happen when programming. When a program is compiled the compiler will give the programmer a list of errors with the program code that prevent it from compiling, these errors are called **compile time errors**.

Errors that occur when the program is running are called **run time errors**. The third type of error is when the program runs fine, but produces the incorrect output. This type of error is called a **logic error**.

Terms

Applet	A special type of graphical application that has its window built into a webpage.
Binary	A number system where only the numbers zero and one are used.
Byte Code	Code that is understood by a JVM
Class Files	Files that contain byte code and have a .class extension.
Compiler	A program that converts code in one language to another.
Compiling\Building	The process of converting code written in one language to another.
Compile Time Errors	Errors with the program code that prevents the compiler from being able to build the program.
Console	A text only area where the user and the program interact.
Console Application	A program that interacts with the user through a console.
Debugger	A program that allows the programmer to monitor and manipulate data while a program is running.
Editor	A program used for writing code.
Executing	Running a program.
Garbage Collector	A program that monitors created data and automatically deletes it when it is no longer being used a program.
Graphical Application	A program that has a GUI.
Graphical User Interface (GUI)	An interface that consists of both text and not-text graphical output.
High Level Programming Languages	Languages that take more work for the computer to decode, but are easier to program in.
Integrated Development Environment (IDE)	A single program that contains an editor, compiler and debugger.
Java Development Kit (JDK)	This program contains the tools needed to build and run Java programs. Contains a JVM and JRE.
Java File	Contains code written in the Java and has a .java extension.
Java Runtime Environment (JRE)	A program that allows the computer to run java applications.

Java Virtual Machine (JVM)	A program in the JRE that translates byte code into code that can run on the local machine. The JRE contains the garbage collector.
Logic Error	When a program produces the incorrect output due to a flaw in programming.
Low Level Programming Languages	Languages that need few translations to reach machine code, but they tend to be more difficult to program in.
Memory Leak	A problem where data gets created, but never deleted.
Machine Code	A language that the computer understands and consists of commands written only in binary.
Object Oriented Languages	Languages that allow the programmer to create "objects" that store custom sets of data and can perform actions involving that data.
Operating System	A program that works as middle man for communication between the user/other programs and the hardware.
Platform Dependent Programs	Programs that are limited on what computers they will work on based on hardware/software requirements.
Platform Independent Programs	Programs that work on virtually any machine no matter what hardware or software it has.
Program	A set of commands written in a computer language to perform a task.
Programmer	The person that writes a program.
Programming	The act of writing a program in a computer language.
Programming Language	A structured language that allows a programmer to communicate with the computer through the commands that exist in the programming language.
Run time Errors	Errors that occur when the program is being executed.

Labs

(1) Level A	Level B	Level C
Hello World		