

# Introduction to Programming

*with Java, for Beginners*

How does the computer work?  
Machine vs. Programming Language  
Intro to Java

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## Recap

- A *programming language*
  - a language that you can learn to write, and the *computer* can be made to understand
- We will learn Java in this course
  - But before we jump into Java, lets take a look at the computer !!



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## What Computers are good at?

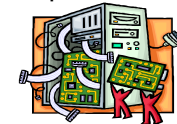
- Doing calculations and comparisons
- Producing the same answer every time
  - E.g. calculating the sum of hundreds of numbers
- Storing information
  - Applications (e.g. Word, Excel), Pictures, songs, movies
- Looking up information quickly
  - Look up telephone number quickly

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## Computer's Anatomy

- Central Processing Unit (CPU) a.k.a processor
  - Basically does all the calculation
- Memory
  - Stores Information (instructions or data)
- Input/Output Devices
  - Communicate with the outside world. E.g. keyboard



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## What does the Computer Understand?

- At the lowest level, a computer has electronic “plumbing”
  - Operates by controlling the flow of electrons through very fast tiny electronic devices called transistors
- The devices react to presence or absence of voltage
  - Could react actual voltages but designing electronics then becomes complex
- Symbolically we represent
  1. Presence of voltage as “1”
  2. Absence of voltage as “0”

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## What does the Computer process & store?

- An electronic device can represent uniquely only one of two things
  - Each “0” and Each “1” is referred to as a **Binary Digit** or **Bit**
  - Fundamental unit of information storage
- To represent more things we need more bits
  - E.g. 2 bits can represent four unique things: 00, 01, 10, 11
  - k bits can distinguish  $2^k$  distinct items
- Combination binary bits together can represent some information or data. E.g. 00101001 can be
  1. Decimal value 41
  2. Alphabet (or character) ‘A’ in ASCII notation
  3. Command to be performed e.g. Performing Add operation

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## Machine Language

- Computers understand only 0’s and 1’s
  - A.k.a **Machine Language**
  - If there are millions of voltage lines the it becomes very tedious to deal with programming a computing machine



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## Programming to Machine Language

- The compiler translates the programming language into a **specific machine** language
  - Specific Machine:
    - Electronic Hardware + Operating System
- Once translated (Programming -> Machine)
  - The same program **cannot run** on different machine
- Java avoids the above problem
  - Code is portable - Write one run anywhere!
  - One of the features for popularity of Java



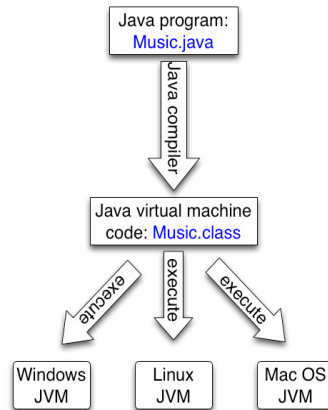
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## Java Compiler and Virtual Machine

- The Java Compiler
  - Reads file with extension **.java**
  - Checks syntax / grammar
  - Creates a **.class** file which contains **byte** (or machine) code independent of any machine
- Java Byte Code
  - **Is portable**
- JVM(Java Virtual Machine)
  - Translates **byte code** in to instructions (actual machine code) for a particular processor
  - The actual machine code then is executed on the computer



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## Other Features of Java

- Has Graphical User Interface Capability
  - Create interactive programs
    - Stand alone **Java Applications** that can be executed on any computer that has JVM
  - Create Dynamic Web Pages
    - **Java Applets** are programs that can run in Browser (e.g. Internet Explorer or Firefox) that has Java Plugin
    - **Java Servlets** are programs that can run machines hooked up to internet (server)
- Gained popularity in gadgets such as
  - PDAs, cell phones etc.

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## Editions of Java

- **Java SE**
  - “Standard Edition” (we will use version 5.0)
  - For desktop applications
- **Java ME**
  - “Micro Edition”
  - For gadgets such as smart phones or personal digital assistants
- **Java EE**
  - “Enterprise Edition”
  - For Java programs that run on web servers

Website: <http://java.sun.com/>

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## Things needed for Java Program

- **JRE, Java Runtime Environment**
  - This is the software that allows you to *run* Java programs on your computer
  - Called either “the JRE” or “the runtime”
- **JDK, Java Development Kit**
  - The software that allows you to *create and run* Java programs on your computer
  - When you install the SDK, you get a JRE along with it

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## Java Books

- [Java Backpack Reference Guide](#) (Java 5 edition) by DePasquale, Addison-Wesley
  - This is a good, light, concise, and cheap reference book. It is recommend that you bring it with you to the labs.
- [Murach's Beginning Java 2 JDK 5](#) by Doug Lowe, Joel Murach, Andrea Steelman
  - This book has detailed explanations of each topic, and good examples to go with them.
- **Others**
  - **Online:** See the [Java Resources](#) page on course website

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## Next Week

- Start Learning Java Syntax
- Write a program(s) and execute it

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