

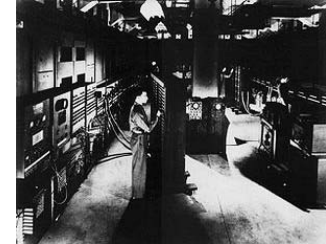
Introduction to Programming

with Java, for Beginners

Intro

Computing

- Formal Definition:
 - The use of a *computer* process data or perform calculations
- Penn Legacy - ENIAC (Electronic Numerical Integrator And Computer)
 - Built to calculate artillery firing tables
 - Reprogrammable
- Advancement in *electronics* enabled computing devices that were faster than man
 - A computer no longer tied to the desk anymore!!
 - E.g. PDA, Smart phones, EduBot



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Computing Examples

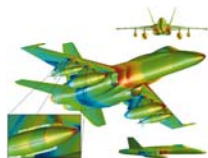


User information Assurance



Mars Rover

Source: <http://www.physics.arizona.edu/~thews/reu/granados.htm>



Performance Simulation



Digital Special Effects



Information Security

Other Sources: <http://coweb.cc.gatech.edu/ice-gu/274>

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Digital Computer

- Modern day computers are made out of electronic device called transistors
 - Transistor is made from a semi-conductor
- The devices react to presence or absence of voltage
- Symbolically we represent
 - Presence of voltage as "1"
 - Absence of voltage as "0"



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Computer Information & Storage

- 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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Programming Languages

- Computer Programming
 - Is telling the computer how to do something
 - Wikipedia Definition: Applies specific **programming languages** to solve specific computational problems with solutions
- Programming Languages
 - Unlike human languages
 - Designed for **instructing** computers to solve problems
 - The listener (the compiler) is exacting & unforgiving (grr!)
 - Like human languages
 - They have a **grammar**
 - We will be learning grammar for **Java** Programming Language

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Programming to Machine Language

- Computers understand only 0s and 1s
 - a.k.a machine language
 - Tedious for humans to work in
- The compiler (special system software) translates the programming language into a **specific machine** language
 - Specific Machine: Electronic Hardware + Operating System
 - e.g. Intel Process + Windows XP vs. Intel processor + Mac OS
- 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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Programming Language Syntax

- Syntax is the **grammar** of the language
 - The Listener a.k.a Compiler will point out every syntax error
 - Analogous to rules in English Language:
 - Missing a period after sentence
 - Rules using verbs, nouns etc..
 - Error messages may be helpful
 - Often, they are not
 - You gain experience with error messages after a while

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Program

- A written set of instructions in particular language
- The first step in writing any program is to analyze the work/job to be done
 - Think **Algorithmically**
- Algorithm
 - Step-by-step procedure that is guaranteed to terminate, such that each step is precisely stated and can be carried out.



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Algorithm Example

(1) INPUT A NUMBER x
(2) MULTIPLY x TIMES ITSELF
(3) MULTIPLY x TIMES 2
 $y = x^2 + 2x + 10$ MEANS - (4) ADD THE RESULTS OF (2) AND (3)
(5) ADD 10 TO THE RESULT OF (4)

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Algorithm or Not?



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Programming Language Semantics

- When the computer carries out your instructions
 - **Running** or **Executing** a program
- Semantics is the **meaning** of the program
 - We learn the semantics after we run or execute the program
 - Basically we observe the output
- After the **executing** program, the semantics of the program may or may be correct
- Semantic errors cause your answers to be wrong
 - You may or may not get error messages
 - E.g. Error Message – Dividing a number by zero
 - If your program is not doing what you want it to do, though it runs, the error is **semantic**

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Programming - The Craft

- People have different tastes in programming, but many values are held in common
 - Programming is an *art* as well as a *craft*
- Craft
 - Learn *concepts* fundamental to all programming languages
 - Learn about Object Oriented Programming (OOP) model using Java
 - Learn some basic data structures and algorithms

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Programming Recurring Themes

- Modularity
 - Break big problem into sub problems and compose
- Algorithm Thinking
 - A well defined procedure
- Abstraction
 - Look for and encode common features

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Java Books (Optional)

- Non Required!
 - Learn from Course Notes
 - Online Resources (see course website)
- Optional
 - Java Backpack Reference Guide (Java 5 edition) by DePasquale, Addison-Wesley
 - Murach's Beginning SE 6 by Doug Lowe, Joel Murach, Andrea Steelman
 - Java 6 Illuminated: An Active Learning Approach (Jones and Barlett Illuminated) (Paperback)

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Software

- Java Development Kit (JDK)
 - Compiler Software (for analyzing syntax)
 - Java Runtime Environment (JRE) software that allows you to run Java programs on your computer
- Dr Java
 - Free Development Environment
 - Create, edit, compile and run programs written in Java with help of JDK
- Both are Multiplatform (Windows, Mac, Linux)
- Installation guide can be found on Resources page

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