

Introduction to Programming

with Java, for Beginners

Welcome

Introduction

- Instructor:
 - Diana Palsetia (palsetia@seas.upenn.edu)
 - **Location:** 174 Moore, **Office Hours:** TBA
- ESE112 involves 2 components:
 - Computer Programming Lecture with Java Programming Language (.5 cu)
 - Lab component (.5 cu)
- You must enroll in both components
 - If you already know Beginner Level Java then you can take the **Placeout Exam** - more details later

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Lecture Information

- Meeting Times:
 - TR: 11:00-noon in Moore 212
 - We will also have some lecture days put theory into practice (more details – next week)
- Course website:
<http://www.seas.upenn.edu/~ese112>
- Blackboard for gradebook and discussion forums
<https://courseweb.library.upenn.edu/>

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Lecture Logistics

- Grades
 - 3 Exams: 55 % (15%, 15%, 25%)
 - Exam 1 (Oct 2nd – Evening Exam)
 - Exam 2 (Nov 4th – Evening Exam)
 - Exam 3 (Final Exam Period)
 - Homeworks: 30%
 - Exercise: 15%
 - Participation and attendance
 - May be asked to turn in work
 - Late Policy for assignments: 10% off per day upto 4 days and then no credit
- No makeup exams are scheduled. Conflict? Schedule in advance
- How to turn assignments – See website for more details

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Placeout Exam

- Already know Java ?
 - If yes, then take the exam to placeout of the lecture component
- If you pass
 - See Denice Gorte (email on Staff page)
 - Further ESE majors (or leaning towards ESE) need to enroll in 0.5 cu of ESE116 (C programming) which required for ESE majors
- Exam: Sept 5, 1-3pm in Moore 101 (RCA lab).
- See course site for details about the material on exam

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Computer Programming

- Computer Programming is sub-field of Computer Science
- It involves learning how to *translate* a complex problem/simulation/game in to a *computing solution*

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Computing

- Formal Definition:
 - The use of a *computer* process data or perform calculations
- Advancement in *electronics* enabled computing devices that were faster than humans
 - A computer no longer tied to the desk anymore!!
 - E.g. PDA, Cell phones



Source: <http://cannon.sfsu.edu/~gmarcy/cswa/history/pick.html>

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Computing Examples

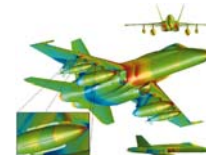


User information Assurance



Mars
Rover

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



Performance Simulation



Information Security

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

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Computer Science in General

- Computer Science is the study of
 - What we can do with computers?
 - Automate a known solution
 - How we can best do it
 - Investigate things we don't know
 - Example: The *Blue Brain Project* by IBM started in July 2005
- How does CS fit in with ESE?
 - Its theoretical foundation lies in
 - Mathematics (discrete math)
 - Electrical Engineering

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What does the computer does best?

- Perform operations
 - Add, sub, multiply, copy from data from location to another
- Depending on memory capacity
 - Store huge amount of information
- Interact with outside world
 - Input/Output
- Fast
 - E.g. 2 GHz processor can roughly carry out 2 billion instruction in 1 second or 1 instruction in 0.5 nanosecond

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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. 01000001 can be
 1. Decimal value 65
 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 (hardware) Language**
 - Each machine has its unique language
 - E.g. combination of 00101001 is not the same meaning on different machines
 - Difficult for humans to program the computer in machine language



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Programming to Machine Language

- Write in language almost like English
- Another special software (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 machines
- Java avoids the above problem
 - Code is portable - Write once, run anywhere!
 - One of the features for the popularity of Java



www.hackerstickers.com

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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 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

$y = x^2 + 2x + 10$ MEANS -

- (1) INPUT A NUMBER x
- (2) MULTIPLY x TIMES ITSELF
- (3) MULTIPLY x TIMES 2
- (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 a variety of 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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