

CompSci 100e

Prog Design and Analysis II



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Web

Did you mean: [computer science](#)

January 13, 2011

Prof. Rodger

Announcements

- Labs start this week on Wed (is Mon) and Fri!
 - Bring laptops to lab
- See prelab work and Resources page
 - Install Java, Eclipse, and Ambient
- Read Chapter 1.1-1.4 for next class
 - Java data types, conditions, loops, arrays
- Today is about introductions, the class and getting started

What is Computer Science?

- Computer science is no more about computers than astronomy is about telescopes. - Edsger Dijkstra



- Computer science is not as old as physics; it lags by a couple hundred years. However this does not mean that there is significantly less on the computer scientist's plate than on the physicist's: younger it may be, but it has had a far more intense upbringing! - Richard Feynman



Scientists and Engineers

- Scientists build to learn, engineers learn to build. - Fred Brooks

- Duke alum
- Chair of UNC's
Computer Science
Department
- Turing Award Winner



Computer Science is a young discipline

- First computer science department formed in 1962

PURDUE
UNIVERSITY

1962



Samuel D. Conte
Professor emeritus of computer science and mathematics was the founding department head of the nation's first computer science program. October 1962.

What Is Computer Science?

- What is it that distinguishes it from the separate subjects with which it is related? What is the linking thread which gathers these disparate branches into a single discipline? My answer to these questions is simple --- *it is the art of programming a computer*. It is the art of designing efficient and elegant methods of getting a computer to solve problems, theoretical or practical, small or large, simple or complex.

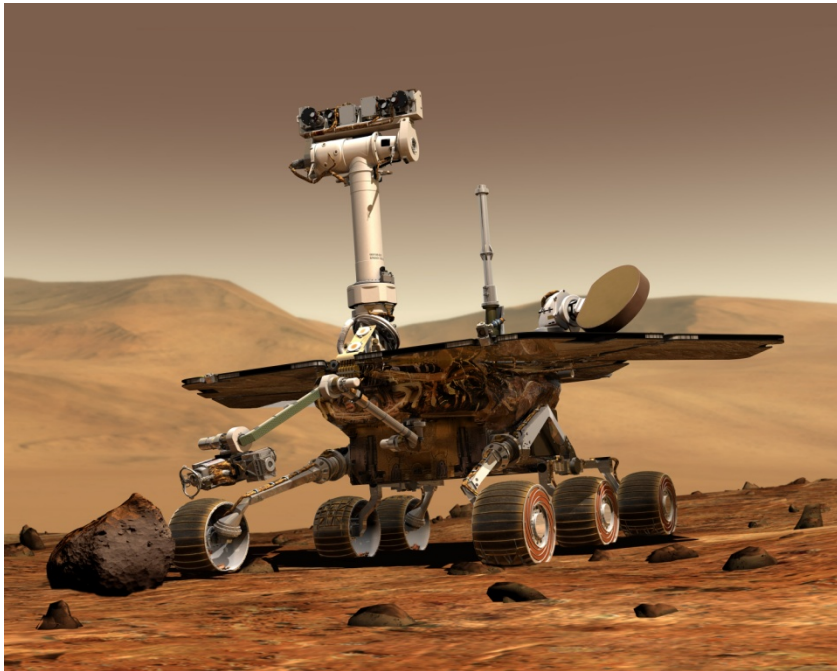
C.A.R. (Tony) Hoare

- Turing Award Winner
- Knighted by Queen Elizabeth



What is Computer Science?

- Artificial Intelligence



Spirit, Mars Rover



Roomba



CMU's Sandstorm

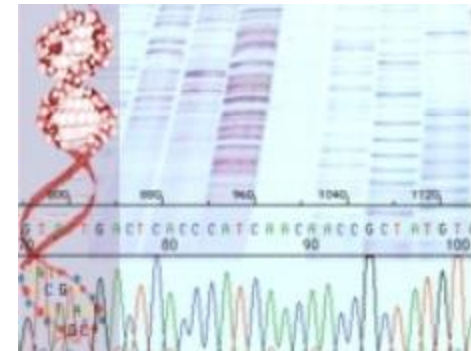
What is Computer Science?

- Animation



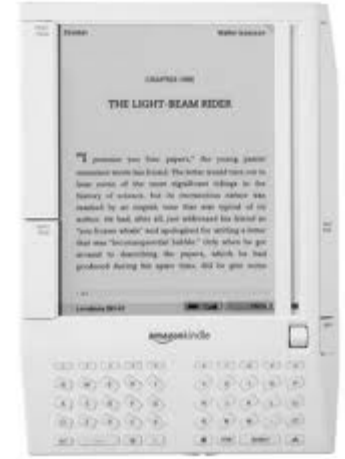
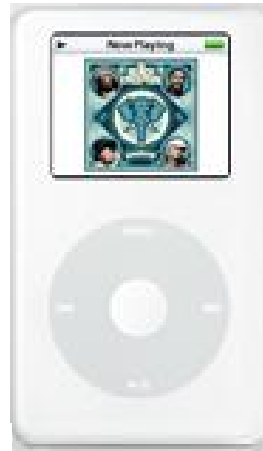
What is Computer Science?

- Medicine, Genomics



What is Computer Science?

- Devices



Computer Science in a Nutshell



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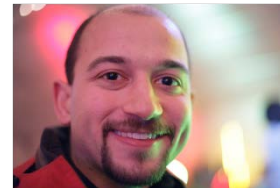


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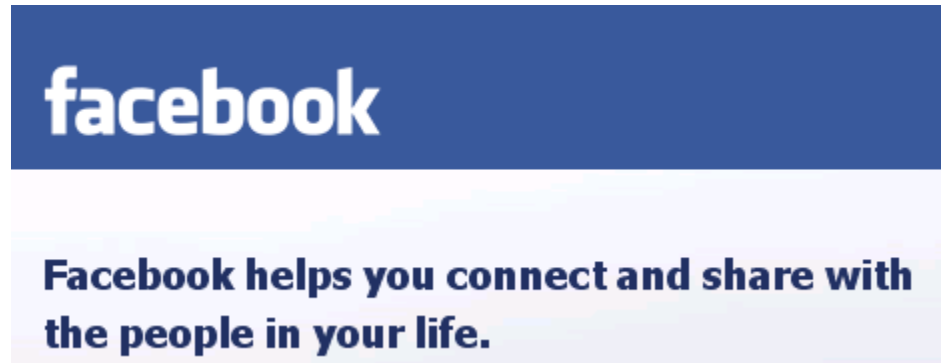
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What is this class about?

- The Organization of Data, and Searching



Did you mean: [computer science](#)



Efficient *design, programs, code*

Using the language: Java (or C++, or Python, or ...), its idioms, its idiosyncracies

Object-oriented design and patterns. Software design principles transcend language, but ...

Know data structures and algorithms. Trees, hashing, binary search, sorting, priority queues, greedy methods, graphs ...

Engineer, scientist: what toolkits do you bring to programming? Mathematics, design patterns, libraries --- standard and others...

Tradeoffs

Programming, design,
algorithmic, data-
structural

Fast programs, small
programs, run anywhere-
at-all programs. Runtime,
space-time, your time,
CPU time...

Simple, elegant, quick,
efficient: what are our
goals in programming?
What does XP say about
simplicity? Einstein?

How do we decide
what tradeoffs are
important? Tension
between generality,
simplicity, elegance, ...

What's in Compsci 100/100E?

- Understanding tradeoffs: reasoning, analyzing, describing...
 - Algorithms
 - Data Structures
 - Programming
 - Design
- Programming using Java -
 - Tools: Eclipse, JDK, Libraries, ...
 - Ideas: Design Patterns, OOP
 - Engineering and analyzing designs and programs
 - Using mathematical and scientific techniques
 - Scaling solutions

Course Web Page

www.cs.duke.edu/courses/cps100e/spring11/rodger/

CompSci 100e, Spring 2011, Prof. Rodger Home - Mozilla Firefox

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http://www.cs.duke.edu/courses/spring11/cps100e/rodger/index.php

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CompSci 100e Program Design and Analysis II Course Description

A continuation of Computer Science 6 and ENG 53. Object-oriented design and programming using Java emphasizing abstract data types and their lower-level implementations. Advanced data structures including balanced trees, hash tables, graphs. Intuitive and rigorous analysis of algorithms. We use the Eclipse environment.

Course Announcements

- The first day of class is January 13, 2011.
- HELP - How do I get help?

We will setup consulting hours and office hours. they will be posted on the CompSci 100e web

Done

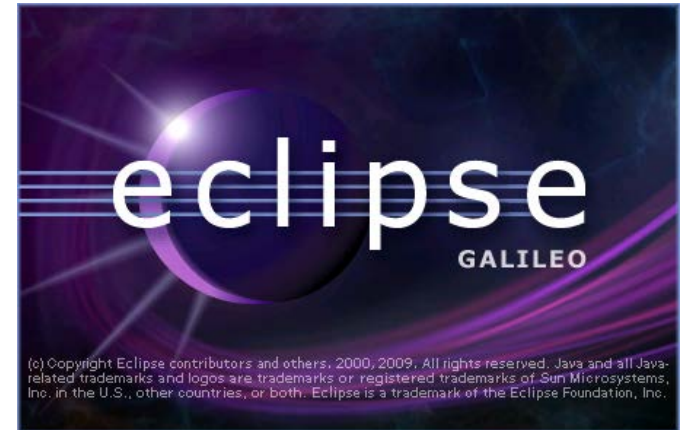
Course Overview

- Course Web Page has details
 - APTs: Algorithmic Problem-solving and Testing
 - Weekly small programming assignments, tested online
 - Programming assignments
- Who is Prof. Rodger?
 - What does she know and not know?
- Should you come to class/lab?
 - Meet people, learn things, participate in a community
 - Active classwork
 - We code together



Environment we will use

- Eclipse – an Integrated Development Environment
 - Editor
 - Compiler
 - An output console
 - Visualization of files and folders
 - Submission of programs (Ambient)
- See CompSci 100e Resources page for installing Java, Eclipse and Ambient on your computer



Am I in the right course (100/100E)?

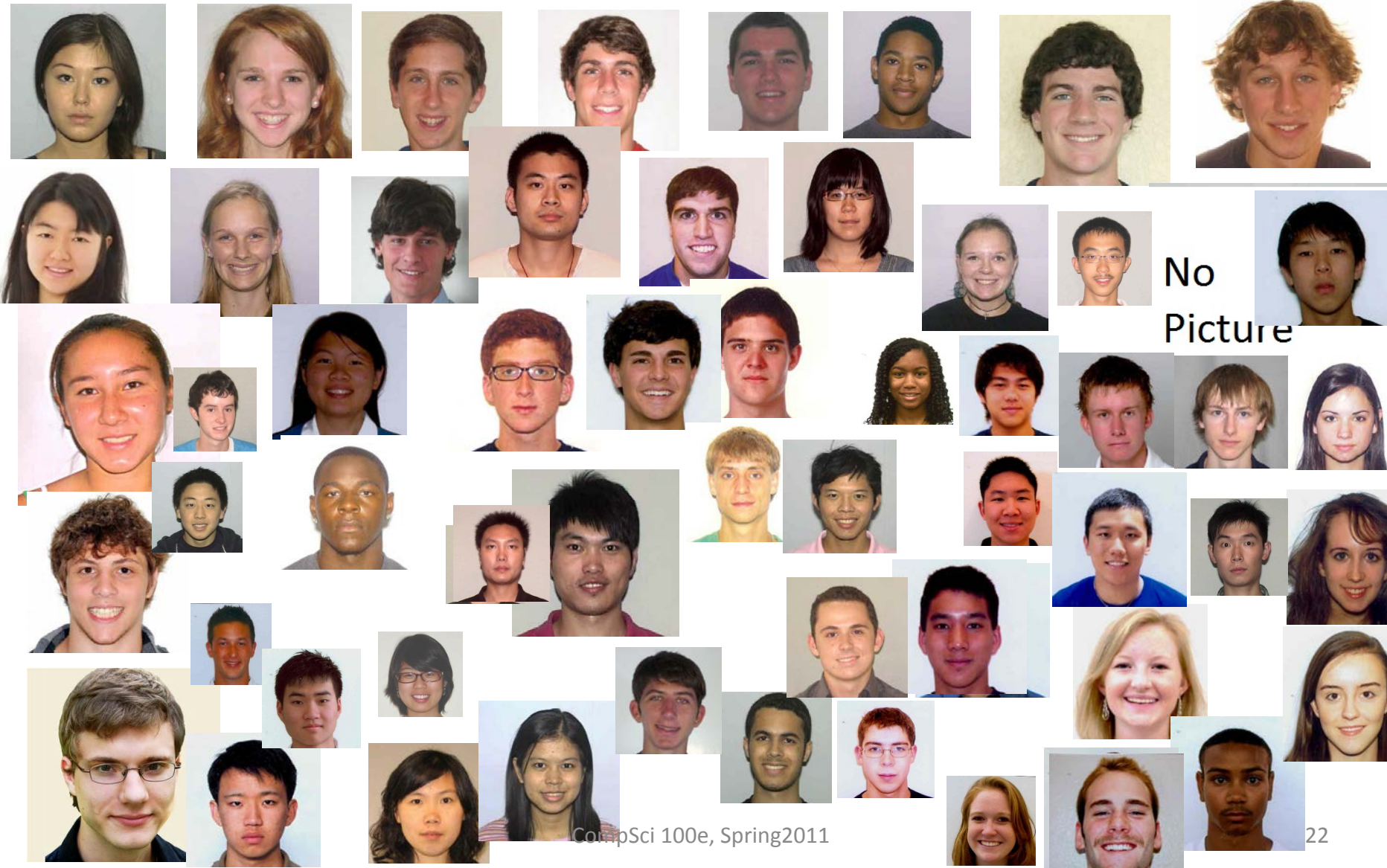
- You should already know....
 - How to program – variables, conditional (if), loops (for/while), arrays/lists
 - Prereq: CompSci 6, ENG 53, AP CS A, self-taught....
- You don't need to know Java
 - Be aware, some people will know Java, most won't
- This class will teach you Java for the topics above and then teach you algorithms and data structures such as:
 - Trees, linked lists, sets, maps, queues, stacks, priorityqueues,

Who has taken Compsci 100/100e?

- Jessica Abrams, Trinity '98
 - Pixar, iPhone, Guitar Hero
- Luis von Ahn, Trinity '00
 - Macarthur, reCaptcha, GWAP
- Rachel Zurer, Trinity '04
 - Americorps, Creative Writing
- Ge Wang, Trinity '00
 - T-Pain, Ocarina, Music
- Jim Bungener, Pratt '99
 - CFD, Team Alinghi
- Ted Hung, Trinity '02
 - Electronic Arts, Lucasarts



Who is taking CompSci 100/100E?



No
Picture

Java

- Developed 1995 by Sun
 - James Gosling and Patrick Naughton and team
- Simpler than C++
- Rich and LARGE library
 - We will not learn all of Java!
- Portable – runs on different platforms (this is a big deal!)





Why Java?

- **Java features.**

- Widely used.
- Widely available.
- Embraces full set of modern abstractions.
- Variety of automatic checks for mistakes in programs.
- Buzzword-enabled

“Java is a simple, object-oriented, distributed, interpreted, robust, secure, architecture-neutral, portable, high performance, multi-threaded, and dynamic language”

- **Caveat.** No perfect language.

- **Our approach.**

- Minimal subset of Java.
- Develop general programming skills that are applicable to: C, C++, C#, Perl, Python, Ruby, Matlab, Fortran, Fortress, ...



A Rich Subset of the Java Language

Built-In Types	
int	double
long	String
char	boolean

System
System.out.println()
System.out.print()
System.out.printf()

Math Library	
Math.sin()	Math.cos()
Math.log()	Math.exp()
Math.sqrt()	Math.pow()
Math.min()	Math.max()
Math.abs()	Math.PI

Flow Control	
if	else
for	while

Parsing
Integer.parseInt()
Double.parseDouble()

Boolean	
true	false
	&&
!	

Punctuation	
{	}
()
,	;

Primitive Numeric Types		
+	-	*
/	%	++
--	>	<
<=	>=	==
!=		

String	
+	""
length()	compareTo()
charAt()	matches()

Arrays
a[i]
new
a.length

Objects	
class	static
public	private
toString()	equals()
new	main()



Programming in Java

- Programming in Java.

- Create the program by typing it into a text editor, and save it as HelloWorld.java

```
/*  
 * Prints "Hello, World"  
 * Everyone's first Java program.  
 */  
  
public class HelloWorld {  
    public static void main(String[] args) {  
        System.out.println("Hello, World");  
    }  
}
```

HelloWorld.java

Programming in Java

- **Programming in Java.**

- Create the program by typing it into a text editor, and save it as `HelloWorld.java`
- **Compile** it using Eclipse or by typing at the command-line:
`javac HelloWorld.java`

command-line



```
% javac HelloWorld.java
```

(or click the Save button in Eclipse)

- This creates a Java bytecode file named: `HelloWorld.class`

Java Bytecode

HelloWorld.class

```
0000000 312 376 272 276 \0 \0 \0 . \0 035 \n \0 006 \0 017 \t
0000020 \0 020 \0 021 \b \0 022 \n \0 023 \0 024 007 \0 025 007
0000040 \0 026 001 \0 006 < i n i t > 001 \0 003 ( )
0000060 v 001 \0 004 C o d e 001 \0 017 L i n e N
0000100 u m b e r T a b l e 001 \0 004 m a i
0000120 n 001 \0 026 ( [ L j a v a / l a n g
0000140 / s t r i n g ; ) v 001 \0 \n s o u
0000160 r c e F i l e 001 \0 017 H e l l o W
0000200 o r l d . j a v a \f \0 007 \0 \b 007 \0
0000220 027 \f \0 030 \0 031 001 \0 \f H e l l o ,
0000240 W o r l d 007 \0 032 \f \0 033 \0 034 001 \0 \n
0000260 H e l l o W o r l d 001 \0 020 j a v
0000300 a / l a n g / O b j e c t 001 \0 020
0000320 j a v a / l a n g / s y s t e m
0000340 001 \0 003 o u t 001 \0 025 L j a v a / i
0000360 o / P r i n t S t r e a m ; 001 \0
0000400 023 j a v a / i o / P r i n t S t
0000420 r e a m 001 \0 007 p r i n t l n 001 \0
0000440 025 ( L j a v a / l a n g / s t r
0000460 i n g ; ) v \0 ! \0 005 \0 006 \0 \0 \0 \0
0000500 \0 002 \0 001 \0 007 \0 \b \0 001 \0 \t \0 \0 \0 035
0000520 \0 001 \0 001 \0 \0 \0 005 * 267 \0 001 261 \0 \0 \0
0000540 001 \0 \n \0 \0 \0 006 \0 001 \0 \0 \0 \f \0 \t \0
0000560 013 \0 \f \0 001 \0 \t \0 \0 \0 % \0 002 \0 001 \0
0000600 \0 \0 \t 262 \0 002 022 003 266 \0 004 261 \0 \0 \0 001
0000620 \0 \n \0 \0 \0 \n \0 002 \0 \0 \0 017 \0 \b \0 020
0000640 \0 001 \0 \r \0 \0 \0 002 \0 016
0000652
```

Java Types and Variables

- Every value has a type:

```
int number = 6;
```

```
double pi = 3.14;
```

```
String month = "January";
```

```
FileStream infile;
```

```
Color originalColor;
```

- Declare variable (state its type) only the first time it is used

Assignment Statement

```
int numberOfDays;  
numberOfDays = 6;
```

- `numberOfDays` is “assigned” the value 6
- OR 6 is stored in memory location for `numberOfDays`
- This also illustrates the declaration first time used, and use of a variable.

Identifiers

- Choose meaningful names for variables, methods and classes

```
int x = 60;    // what does x represent?  
// instead of x, use ..  
int numberOfDays = 6;
```

- Follow rules for identifiers
- Follow conventions for identifiers
- What is the difference?

A Java Program

```
public class HelloWorld
{
    public static void main(String [] args)
    {
        // display a greeting
        System.out.println("Hello, World!");
    }
}
```


About the Java Program

- What is the name of the class?
- What is the name of the method?
- What is printed?
- What does the “;” mean?
- What does “public static void” mean?
- What is “String [] args”?

Program to Convert Temperature

```
public class TempConversion
{
    public static void main(String [] args)
    {
        // temp in Fahrenheit
        double temp = 65.0;    // declare, initialize
        double ctemp = (5/9) * (temp - 32);
        System.out.println(temp + "F" + " = " + ctemp + "C");
    }
}
```

Error in Previous Program

- Output for this program is:
 $65.0F = 0.0C$

That is not correct! How do we fix it?

Who is Alan Perlis?

- It is easier to write an incorrect program than to understand a correct one
- Simplicity does not precede complexity, but follows it
- If you have a procedure with ten parameters you probably missed some
- If a listener nods his head when you're explaining your program, wake him up
- Programming is an unnatural act
- Won first Turing award, - when?, what for?
 - 1966, Algol programming language

