

Digital world

- Generic algorithms: copying, compressing, transmitting, archiving, etc.



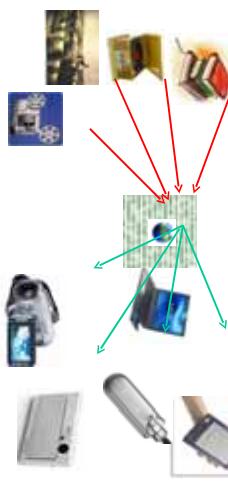
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Raise the question: What is the (digital) information?

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Digital world

- Universal player (machine) and dedicated devices



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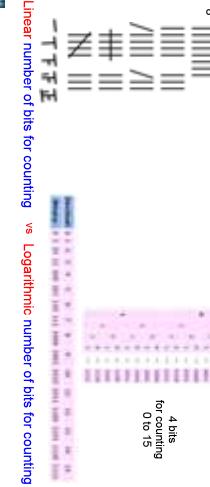


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Genetics

Digital world: Why 0/1 bits?

Information, first needs of counting...
Unary numeral systems: Binary numeral systems:



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Digital world

- Benefits of the analog-to-digital paradigm shift?
- Dissociate contents from support: digitize/"binarize"

Learn to program with/in Java
Computing as a science
(some basic principles)

• Popular (computer) science



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Jobs & Informatics

Introduction to programming
and computer science

Les bases de l'informatique et de la programmation

Frank NIELSEN
nicelsen@lix.polytechnique.fr

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Nature of computing?

Irregularities to consider...

Amph 1, Lundi 5 mai 10h30-12h00, TD 13h30-15h30 (Gr1-9) at 15h45-17h45 (Gr7-12)

Amph 2, Jeudi 15 mai 10h30-12h00, TD 2, 13h30-15h30 (Gr7-12), et 15h45-17h45 (Gr1-9)

Amph 3, Lundi 19 mai 10h30-12h00, TD 3, 13h30-15h30 (Gr1-9)

Amph 4, Mercredi 20 mai 8h30-10h00, TD 4, 13h30-15h30 (Gr1-9)

Amph 5, Lundi 26 mai 10h30-12h00, TD 5, 13h30-15h30 (Gr1-9)

Amph 6, Lundi 2 juin 10h30-12h00, TD 6, 13h30-15h30 (Gr7-12), et 15h45-17h45 (Gr1-9)

TD 6, Mercredi 4 juin 10h30-12h00, TD 7, 13h30-15h30 (Gr7-12)

Amph 7, Lundi 9 juin 10h30-12h00, TD 8, 13h30-15h30 (Gr7-12), et 15h45-17h45 (Gr1-9)

Amph 8, Lundi 16 juin 10h30-12h00, TD 9, 13h30-15h30 (Gr7-12), et 15h45-17h45 (Gr1-9)

Amph 9, Lundi 23 juin 10h30-12h00, TD 10, 13h30-15h30 (Gr7-12), et 15h45-17h45 (Gr1-9)

Amph 10, Lundi 30 juin 10h30-12h00, TD 11, 13h30-15h30 (Gr7-12), et 15h45-17h45 (Gr1-9)

Information= Data sets, input discrete binary sequences of 0/1
Automatic= General recipe that works on any input
= ALGORITHM

Al-Khwarizmi: Scholar of scientifically flourishing Bagdad:
• Algorithms (arithmetization) => Algorithm

• AI lab => Algebra

Provide readers a generic pipeline solution

to solve a quadratic equation.

Arabs-Astro

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INF311: Schedule

Welcome to INF311

<http://www.enseignement.polytechnique.fr/informatique/INF311/>

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Synopsis of INF311

Computer science is not programming PCs

Computers = computing machineries

Difference engine of Charles Babbage (conceived in 1822 on paper, built much later)

Computing is a principle of reality (and science)

Watson and Crick 1951 (DNA double helix theory)

Computing is 21st Century's Science of integration

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Digital world/computing

Ubiquitous computing= computing everywhere

Digital = Binary + Calculations

New features

Example:
Computational
photography



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Computer Science at Ecole Polytechnique
<http://www.enseignement.polytechnique.fr/informatique/>

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INF311: Schedule

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Programming algorithms in Java

• Conceived by Bill Joy (SUN co-founder) and James Gosling



• Started in 1990, for the "next wave in computing"

• On-time for the Internet and WEB (scripts are Java applications, Javascript, etc.)

Crossplatform runs on various operating systems Windows, UNIX, Leopard, etc.)

Type oriented (OO, ease the conception and modularity of applications)

• Rich set of Applications Programming Interface (**API**)

• Free Software Development kit on many platforms (**SDK**)

• Verbose for catching bugs and debugging applications.

Algorithms and their performances (resource/complexities)

There is usually *not* a single recipe for solving the task:

E.g., compute 54422/2319 (human decimal, machine binary, Indian base 60, many tricks, etc.) Donald Knuth

How to **evaluate** and **compare** different algorithms?

Clean framework for assessing the use of resources:

• time,

• memory,

• # communications,

etc., etc.

Judge the generic algorithms not for a given instance.

Therefore, analyze:

• worst-case complexity

• average-case complexity

• hidden challenges (inplace, bottlenecks & streaming, etc.)

etc., etc.

Philippe Flajolet, INRIA

CS curriculum at Ecole Polytechnique

- * INF511+421 allow you to reach INF431
- * Open doors to MCDEX
- * Allow you to go to Master courses (international level)

But first, we need to harmonize our background with the **very basics**

(like solfege in music or ... studying the theory of driving cars before driving and conceiving them...)

About your instructor...

Philippe Flajolet, INRIA
1897 - senior researcher at Sony Computer Science Laboratories

- Many more devices than PCs)
- Computing impacted all Sciences: **Computational sciences** (complex systems, science of computation)
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21st century computer science

- Computers (and computing) are **omnipresent**
- **Ubiquitous computing** (Mark Weiser)
- Computers are abundant and versatile: (**pucierons**) of Gerard Berry, Collège de France)

1952-1999
Kern par son Esprit

1887 - senior researcher at Sony Computer Science Laboratories

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My first (java) program

Programmers and CS scientists cherish...
... their "Hello World" programs



... their "Hello World" programs

c:\> javac QuadraticEquationSolver.java

public static void main(String[] args) {

 double a,b,c;

 b=-Math.sqrt(13.0);

 c=-3.0;

 double delta=b*b-4*a*c;

 double root1=(-b-Math.sqrt(delta))/2*a;

 root2=(-b-Math.sqrt(delta))/2*a;

 System.out.println("Let's check the roots:");

 System.out.println("Root1=" + root1);

 System.out.println("Root2=" + root2);

 System.out.println("a=" + a + " b=" + b + " c=" + c);

}

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Arithmetic expressions

If no compile error happens, it produces a file **filename.class**. Then execute the compiled code.

prompt>**java** filename > result.txt

To store output to a file:

prompt>**java** filename > result.txt

Refined console to filename result

Why programming languages?

Machines are "stupid"; they obey you 100% (no room for ambiguity, the bug is yours!!)

... Machines only "understand" 0/1 binary sequences

(e.g., **instruction codes** of microprocessors)

Machine = Processing + Peripherals (I/O)

... controlled by an **Operating System (OS)**

But Human masters "natural language"

... and we need to unleash ease of programming

ASSEMBLER, FORTRAN, ALGOL, BASIC,JAVA

Key principle of CS: **Bootstrapping**!

use existing languages to create more powerful languages:

Python, Ruby, etc.

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Programming simple formula

Use any text editor to program (edit in UNIX, notepad under windows)

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Display

To store output to a file:

prompt>**java** filename > result.txt

Refined console to filename result

Programming: Solver for quadratic equations

Use any text editor to program (edit in UNIX, notepad under windows)

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Variable

Assignments

Declaration

Delta

Root1

Root2

System.out.println

System.out.print

System.out.println

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Programming: Solver for quadratic equations

Use any text editor to program

(edit in UNIX, notepad under windows)

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Indention is up to you

⇒ helps read programs

with standard

white space

with standard

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Programming: Solver for quadratic equations

Use any text editor to program

(edit in UNIX, notepad under windows)

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Solution: the at most two real roots

$$a \cdot x^2 + b \cdot x + c = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Input: a, b, c of the quadratic equations

Solution: the at most two real roots

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

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Compiling and executing a Java program

prompt>**javac** filename.java

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