INTRODUCTION TO VBA PROGRAMMING

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Foreword

- Who am I?
  - Dario Bonino – dario.bonino@polito.it
- What I do apart teaching?
  - Research on Semantics and Domotics in the e-Lite research group – http://elite.polito.it
- Where you can find these slides?
  - http://elite.polito.it/teaching-mainmenu-69/laurea-i-livello-mainmenu-82/79-01kwthx

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Agenda

- Foundations
  - What is programming?
  - Why do we need to program?
  - Which language to use?
  - First experiments with paper and pencil
- Tools
  - Integrated Development Environment

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Foundations

What is programming?

"The process of writing, testing, debugging/troubleshooting, and maintaining the source code of computer programs. This source code is written in a programming language." (Wikipedia – 2009)

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What is programming?

- ☐ Solving problems by
  - ☐ Identifying relevant issues
  - ☐ Identifying involved operations and/or interactions
  - ☐ Splitting them down to trivial operations (divide et impera)
  - ☐ Combining together trivial solutions
- ☐ Example problem: peeling an apple
  - ☐ Subproblems: picking the apple, picking the knife, dragging the knife over the apple surface, trashing peels, splitting the apple in quarters.

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Example 1: Multiplication

- ☐ Problem: we want to compute the product of 2 by 3
- ☐ Condition: we are only able to perform additions
- ☐ Solution (Program):
  - ☐ Take the number 2 and perform 3 sums:
    - ■ 2+
    - ■ 2+
    - ■ 2=6 (2x3)

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Example 2: Power

- Problem 2: we want to compute 2 to the power of 3
- Condition: we are only able to perform additions
- Solution?
  - 2+2 = 4 (2x2)
  - (2+2)+(2+2) = 8 (2x2x2)
- What if we want to compute 2^4
  - ((2+2)+(2+2))+((2+2)+(2+2)) = 16 (2x2x2x2)

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Example 3: Chocolate cake

- We want to prepare a chocolate cake for the birthday of our best friend
- Conditions: we have cocoa powder, eggs, flour, salt, olive oil, sugar, milk and yeast
- Solution:
  - Take a bowl
  - Put 200g of flour in the bowl
  - Put 200g of sugar in the bowl
  - Put the yeast in the bowl
  - Put 50g of cocoa powder in the bowl
  - Stir

- Solution (continued)
  - Break the egg
  - Put the red and white in the bowl
  - Put one spoon of olive oil in the bowl
  - Stir
  - Add milk
  - Stir
  - ....

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Program

- A program is a set of simple instructions that must be executed (in sequence) to solve a given problem
- Who executes the program?
  - Cake Recipe
    - A Human
  - Multiplication
    - A Human
    - A Computer
- A Computer Program is...?
  - *a set of instructions given to the computer to perform a specified task within a specified time.* (Wikipedia – 2009)

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Foundations

Why do we need to program?

Why do we need to program?

- We are intelligent enough to solve most problems but
  - We get annoyed / tired
  - We are slow
  - We can handle few data at time
- The computer is stupid!
  - It can do nothing without instructions
  - It only manages "numbers"
- But
  - It is extremely fast

Why do we need to program?

- To solve long and boring tasks
  - Count all the pills in a medicine bottle
- To solve complex tasks
  - Compute the speed of every air molecule in a tornado
- To automatize repetitive tasks
  - Categorize and search data
- For many other reasons...

Why do we need to program?

- To solve problems by
  - Splitting them in simple operations
  - Describing each operation in way that a computer can execute it
  - Delegating the problem solution to the computer (faster than ourselves)

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Foundations

Which language to use?

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How to make computers do things?

0011001001
1101001110
0011101010
1011101111

Sum 2 by 2
Multiply by 4
Drop the milk
Raise the shutter
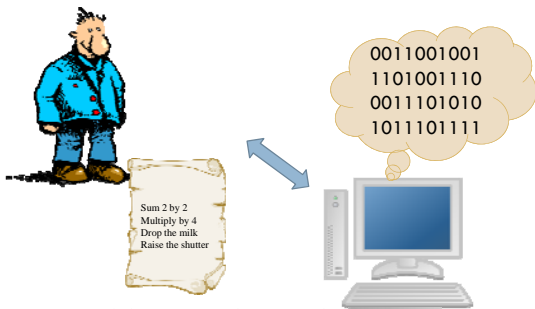
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The Language Problem

- Humans and computer languages are very different
- Humans
  - Use words and phrases
    - E.g. "Add 2 to 5 and then multiply the result by 4"
  - Tend to oversimplify / work on a more abstract level
    - E.g. "Compute the mean of these 10 numbers"
- Computers
  - Only understand sequences of 0s and 1s (Machine Language)
  - Every sequence has a given meaning (on a given machine):
    - 11010 = SUM

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Type of Computer Languages

- Low level
  - Machine code
    - used in the early times of the Computer era
    - Binary
    - Every CPU has a different set of instructions (binary code and associated operations)

    `11001100 10100010`
  - Assembly
    - Uses letters and numbers
    - Very similar to machine code, just a human readable translation
    - Few simple operations (instructions) depending on the CPU
      - RISC reduced instruction set cpu (~50÷70)
      - CISC complex instruction set cpu (~200)

      `MOV AL, #61h`

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Type of Computer Languages

- High Level
  - Strong abstraction from the details of the computer
  - May use natural language elements
  - May be easier to use
  - May be more portable

    Apple myApple = new Apple();
    Knife myKnife = new Knife();
    myKnife.peel(myApple)

- BUT needs to be converted to machine code!!
  - A translator is needed!

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The world of computer languages
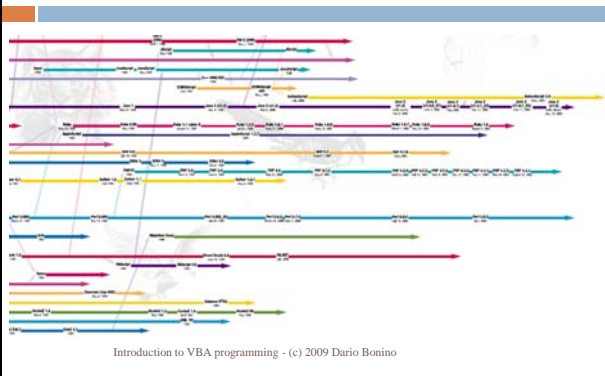
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From Humans to Machines

- High level languages need to be converted to a machine understandable representation (code)
- 2 types of translators
  - Compilers
    - Convert the whole high-level code of a program
  - Interpreters
    - Convert the high-level code line by line (or similar)

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Compilers

- Translators which generate machine code from source code
- A program translated by a compiler tends to be much faster than an interpreter executing the same program
- longer edit-run cycles

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Interpreters

- Translate source code to machine code at the time of execution
- Give programs certain extra flexibility over compiled languages
- Usually much less efficient then compiled program execution

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Compiled and/or Interpreted...

- In principle any language can be implemented with a compiler or with an interpreter
- Combinations of both solutions are increasingly common (C#, Java,…)
- Example of compiled and/or interpreted languages
  - C (compiled)
  - Java, C# (both)
  - Basic (interpreted)
    - Visual Basic for Applications

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Tools

How to write programs?

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Integrated Development Environment

- Integrated Development Environment (IDE)
  - "a software application that provides comprehensive facilities to computer programmers for software development"
- An IDE normally consists of:
  - a source code editor
  - a compiler and/or an interpreter
  - build automation tools
  - a debugger

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Integrated Development Environment

- IDEs can be designed for a single language or can be exploited to write programs in multiple languages
  - Eclipse
    - Java, PHP, C, Tcl/Tk, JSP, XML, (X)HTML, JavaScript,...
  - Visual Studio
    - C, C++, C#, Visual Basic, Visual J++, XAML, XML, (X)HTML, ASP,...
  - MS Office
    - VBA

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VBA development environment

- Directly accessible from any MS Office program
  - Excel, Word, Power Point
  - Macro support must be enabled
- Supports development of VBA applications
- Easy to switch on
  - select Macro from the Tools menu
  - select Visual Basic Editor
  - Or
    - press the Alt-F11 keys
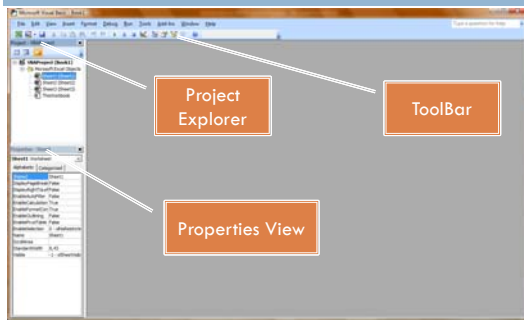
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VBA IDE - Layout

Project Explorer

ToolBar

Properties View

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Playing with the VBA IDE

- □ We want to write a simple Hello World program
  - ◻ The program shall display a simple message box saying "Hello World!"
  - ◻ Ingredients:
    - ▪ The VBA IDE
    - ▪ A Single VBA instruction:
      - ▪ MsgBox ("Hello World!")

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Playing with the VBA IDE

- □ Solution:
  - ◻ Open Microsoft Excel
  - ◻ Press ALT+F11 to activate the Visual Basic for Applications IDE
    - ▪ May also be accessed by selecting:
      - ▪ The Macro item from the Tools menu
      - ▪ Selecting "Visual Basic Editor"
  - ◻ Start writing our first hello world program (Macro in VBA jargon)

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Playing with the VBA IDE

□ Solution (continued):

```
Sub HelloWorld()
    MsgBox ("Hello World!")
End Sub
```

▪ Press the green "play" button to run the program

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Playing with the VBA IDE

□ What have we done?
  ▪ We programmed
  ▪ We learned some VBA coding practices
    ▪ Sub Name () – End Sub
      ▪ Subroutine definition, will see later what means, for now it defines where code shall be placed
    ▪ MsgBox (Message)
      ▪ VBA instruction
      ▪ Creates a "Message Box", i.e. A window reporting the Message text and carrying an OK button for aknowledging the message
    ▪ Identation
      ▪ Mandatory to keep the code clean and readable

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