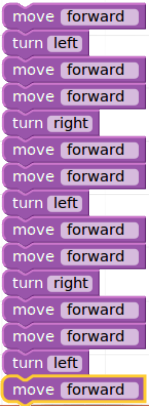

Software

ver. 11

Wojciech Myszka

2020-11-19 07:33:11 +0100

HR EXCELLENCE IN RESEARCH

Wrocław University of Science and Technology

What determines the speed of computers?

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   - way of performing arithmetic operations

Pipelining

Pipeline

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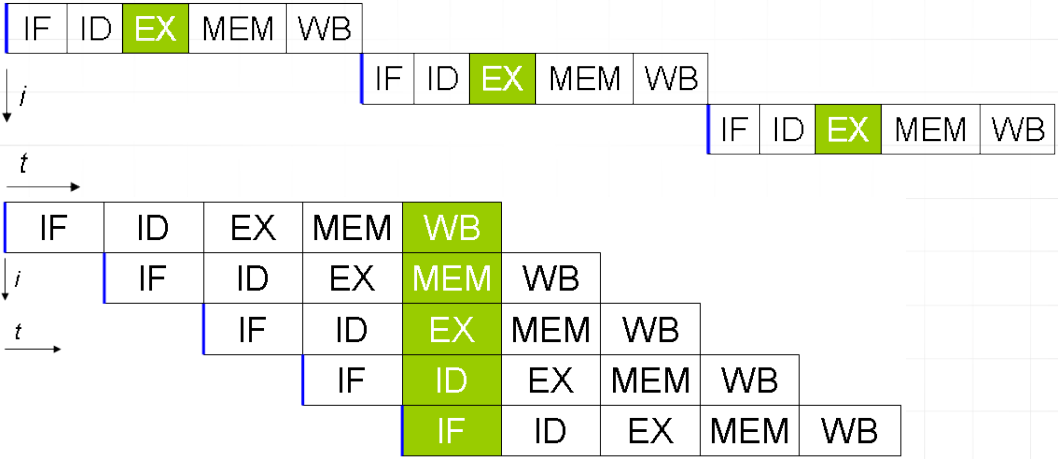
Pipeline



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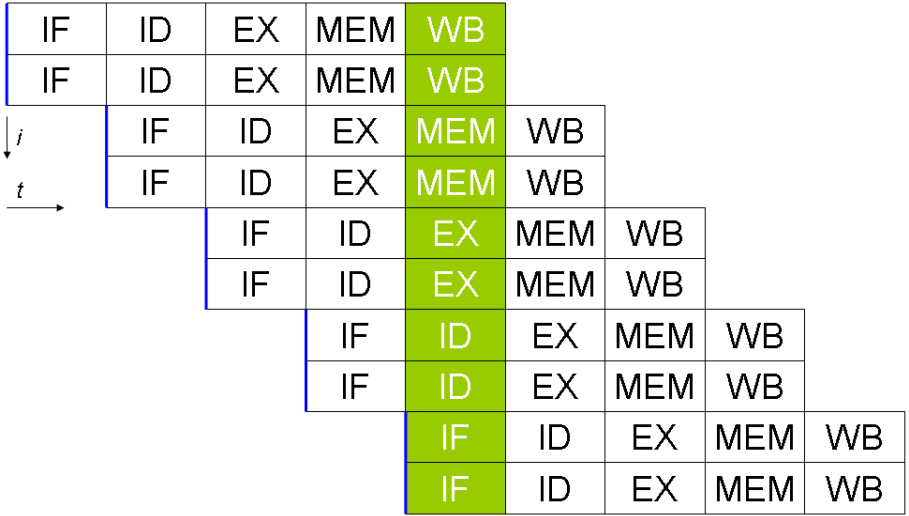
Pipelining

Pipeline + two processors



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What else determines the speed of computing?

Vector processors

1. Vector (array) processor has instructions allowing to perform operations on one dimensional arrays of data. This means that at the same time it performs several operations at once.
2. This is called SIMD — Single Instruction, Multiple Data
3. Basis of a “supercomputers” from 80 and 90.
4. In 2000, IBM, Toshiba and Sony worked together on the development of the Cell processor containing one scalar processor (the inverse of a vector processor) and eight vector processors, which it was used (among other things) in the PlayStation 3.

Various abbreviations

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Homework: Read about this abbreviations!

Various abbreviations

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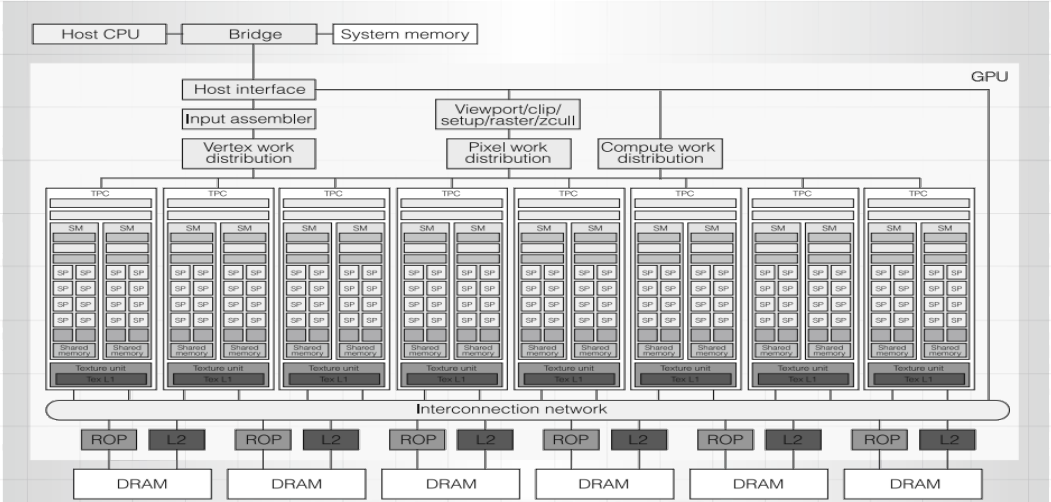
4. **CUDA** (Compute Unified Device Architecture) is a parallel computing platform and application programming interface (API) model created by Nvidia.

NVIDIA CUDA


Host CPU
Bridge
System memory
GPU
Host interface
Input assembler
Viewport/clip/
setup/raster/zcull
Vertex work
distribution
Pixel work
distribution
Compute work
distribution
TPC
SM
SP
Shared
memory
Texture unit
Tex L1
Interconnection network
ROP
L2
DRAM

Homework

Read something about all this mentioned acronyms.

Why does computer work?

1. What is a computer?

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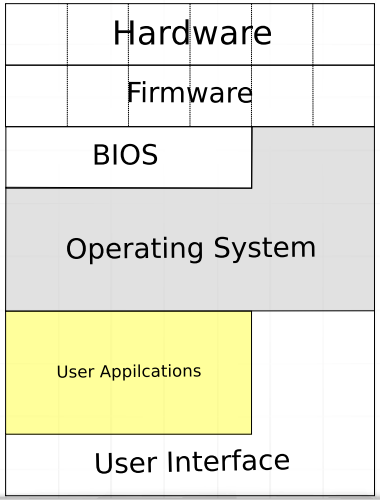
7. Operating System runs applications.

BIOS

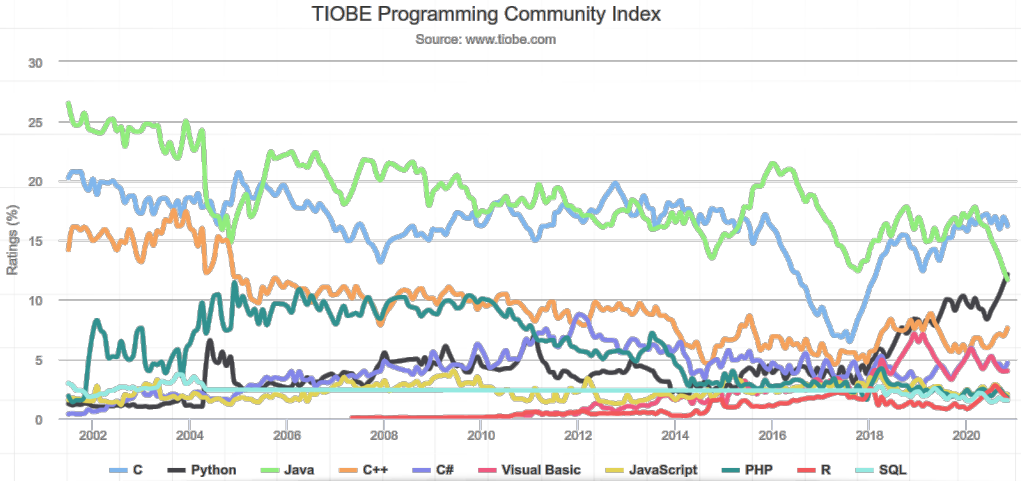

Hardware
Firmware
BIOS
Operating System
User Appilcations
User Interface

Programs

- Software (and its quality) influences the effective speed of computers.
- What is computer programming?

Are the programming skills important?

Programming languages



Simple tasks

The sum of numbers

The task is that we have to add, say, 1000 numbers (provided on paper). How to do it:

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- using a self-made computer program?

More advanced technical problem

Period of oscillation of a pendulum

is given by the equation

$$T = 2\pi\sqrt{\frac{l}{g}}$$

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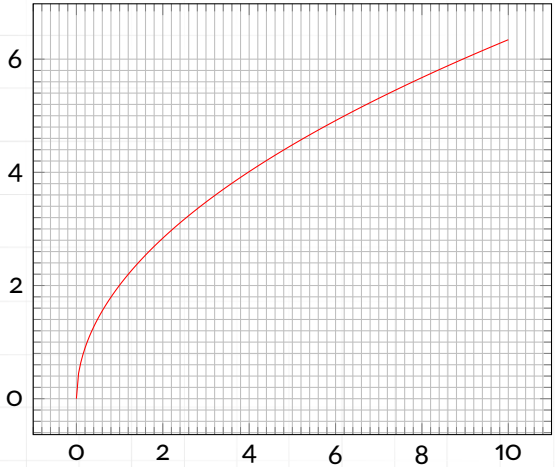
  - use a spreadsheet?
  - plot the function, using, for example, Gnuplot?

Plot



Maze

Problem statement

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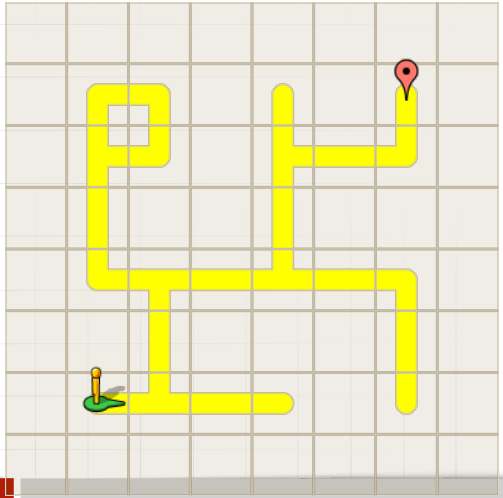
Maze

Problem statement

- we have the simplest maze
- there is an “entry”
- there is an “exit”
- you have to find a way from the entry to the exit…

More complicated problem

Maze



Programming language: Google Blockly

There are two versions:

1. Blockly Games (in β version) 

2. Google 

Blockly is a visual programming editor.

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Blockly is a visual programming editor.

- Can be used on-line: `https://blockly.games/`
- Can be downloaded to ones computer
  `https://github.com/google/blockly-games/wiki/Offline`
  - unpack in some directory
  - and find file `/blockly-read-only/demos/index.html` in that directory and open it in web browser.

Maze

How to solve the maze?

- You can direct Pegman (tell the way) to find the exit (example in the browser).

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- Left-/right- hand walk: follow the wall touching it using your left/right hand.

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- What the reminder is?

Greatest Common Divisor

The simple algorithm “from the definition”

- find all divisors of the first number.

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- find the greatest one.

Find all divisors

- check if 1 divides n
- check if 2 divides n
- ...
- check if $n - 1$ divides n

Finding all divider

Can we simplify this

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Finding all divider

Can we simplify this

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- When stopping this procedure?
- It is enough to finish at $\sqrt{n}$ (any whole number close to $\sqrt{n}$).

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4. If you have not passed through all the objects in the set *N*, take the next element and go to step 2.

Searching for the maximum element

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6. else, it will be the **current maximum value**.

Euclidean algorithm

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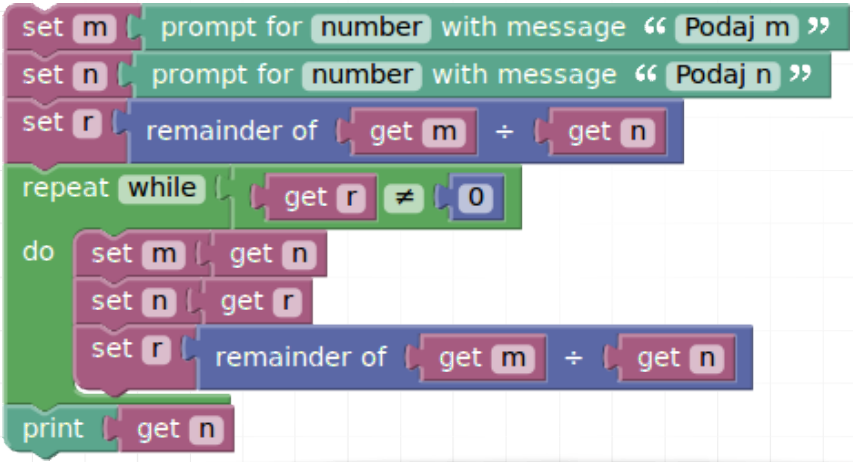
E3. Else
$m \leftarrow n$
$n \leftarrow r$
Go to E1

GCD

Blockly implementation



GCD

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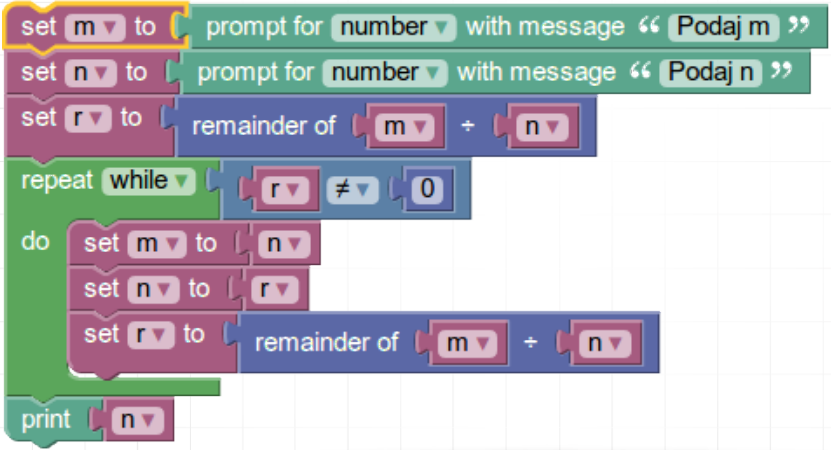

Homework

- Find other variants of Euclidean algorithm…
- …and program it in Blockly

Algorithm B

(Binary greatest common divisor algorithm)

1. $k \leftarrow 0$
2. while u is even and v is even
   $u \leftarrow u/2$
   $v \leftarrow v/2$
   $k \leftarrow k + 1$
   now u or v (or both) are odd
3. if u is odd, let $t \leftarrow -v$ and go to step 5 else let $t \leftarrow u$
4. (At this point t is even and not equal 0.) Let $t \leftarrow t/2$
5. If t is even then go to step 4
6. If $t > 0$ then let $u \leftarrow t$ else let $v \leftarrow -t$.
7. Let $t \leftarrow u - v$. If $t \neq 0$ then goto 4. Else, the result is $u \cdot 2^k$

Homework?

Program Algorithm B in Blockly. . . ?

Homework?

Program Algorithm B in Blockly…?

Ups… probably to difficult…!

Homework?

Program Algorithm B in Blockly…?

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Solve it for chosen *u* and *v* (both less then 1000) “by hand”: using paper and pencil.

Bibliography

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