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Laboratory work №3

Week 3

Use LMC

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Software: machine code

- Software - code that runs on the hardware
- CPU implements "machine code" instructions
- Each machine code instruction is extremely simple
  - e.g. add 2 numbers
  - e.g. compare 2 numbers

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Software: machine code

The language of the machine code is hardwired into the design of the CPU

- it is not something that can be changed
- Each family of compatible CPUs (e.g. the very popular Intel x86 family) has its own machine code which is not compatible with the machine code of other CPU families.

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Lyrics

CPU is capable of performing simple instructions if you load them into RAM. For example addition/subtraction of two numbers, jumping to another instruction. While CPU is performing an instruction the temporary results are stored inside CPU itself in the fastest, smallest memory locations – registers. CPU starts by fetching an instruction from RAM and then executes/performs it. Then again fetches and executes... This is all CPU does. Initially all programs are on hard disk. When user double-clicks a program icon the machine instructions of that program get loaded to RAM where CPU can access them and execute.

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What are the instructions?

CPU has list of defined instructions, such as:

- add values
- store values
- copy values
- increment value
- go to command

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Example

- Signals sent to CPU
- (10110000 01100001) (read in hex B0 61)
- B0 means “Move a copy of the following value into AL (place in memory)”
- Value in AL memory is equal to 61 in hexadecimal

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What is assembly language

- CPU understands only electrical signals, such as: (10110000 01100001)
- But to be understandable to programmers, assembly languages were created.
- Assembly languages use words instead of binary commands, as: MOV AL, 61h

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Little Man Computer

- The Little Man Computer (LMC) is an instructional model of a computer.
- The LMC is generally used to teach students, because it models a simple architecture computer - which has all of the basic features of a modern computer.
- It can be programmed in machine code or assembly code.

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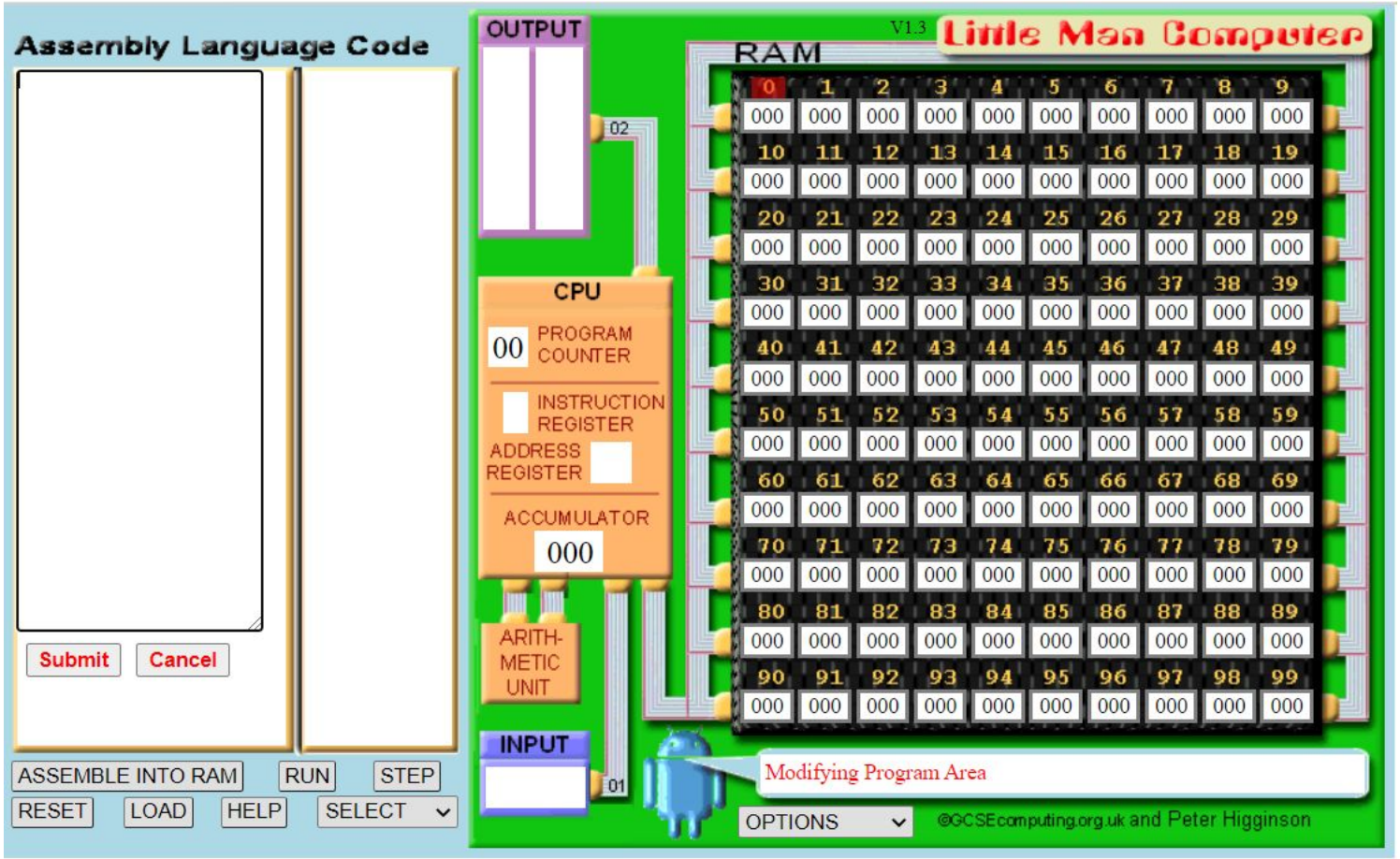
LMC



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Set of instructions:

Mnemonic Code	Numeric Code	Instruction
INP	901	Input data
ADD	1XX	Add data
SUB	2XX	Subtract data
STA	3XX	Store data
LDA	5XX	Load data
BRA	6XX	Branch to specified cell
BRZ	7XX	If 0, branch to a specified cell
BRP	8XX	If 0 or positive, branch to a specified cell
OUT	902	Output data

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Try it: Little Man Computer

- http://robowriter.info/little-man-computer/
- http://peterhigginson.co.uk/LMC/

Battle Tank:

- http://pddring.github.io/cpu-battle-tank/

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Practice

- T1: Read two numbers and output their sum and difference
- T2: Enter two numbers, and output them in ascending order
- T3: Read three numbers and output them in ascending order

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Deadline

- Laboratory work 3 deadline 07.02.21 at 23.59 pm.

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Questions?