Introduction to Information Systems

– Understanding the digital world

3 Inside the CPU

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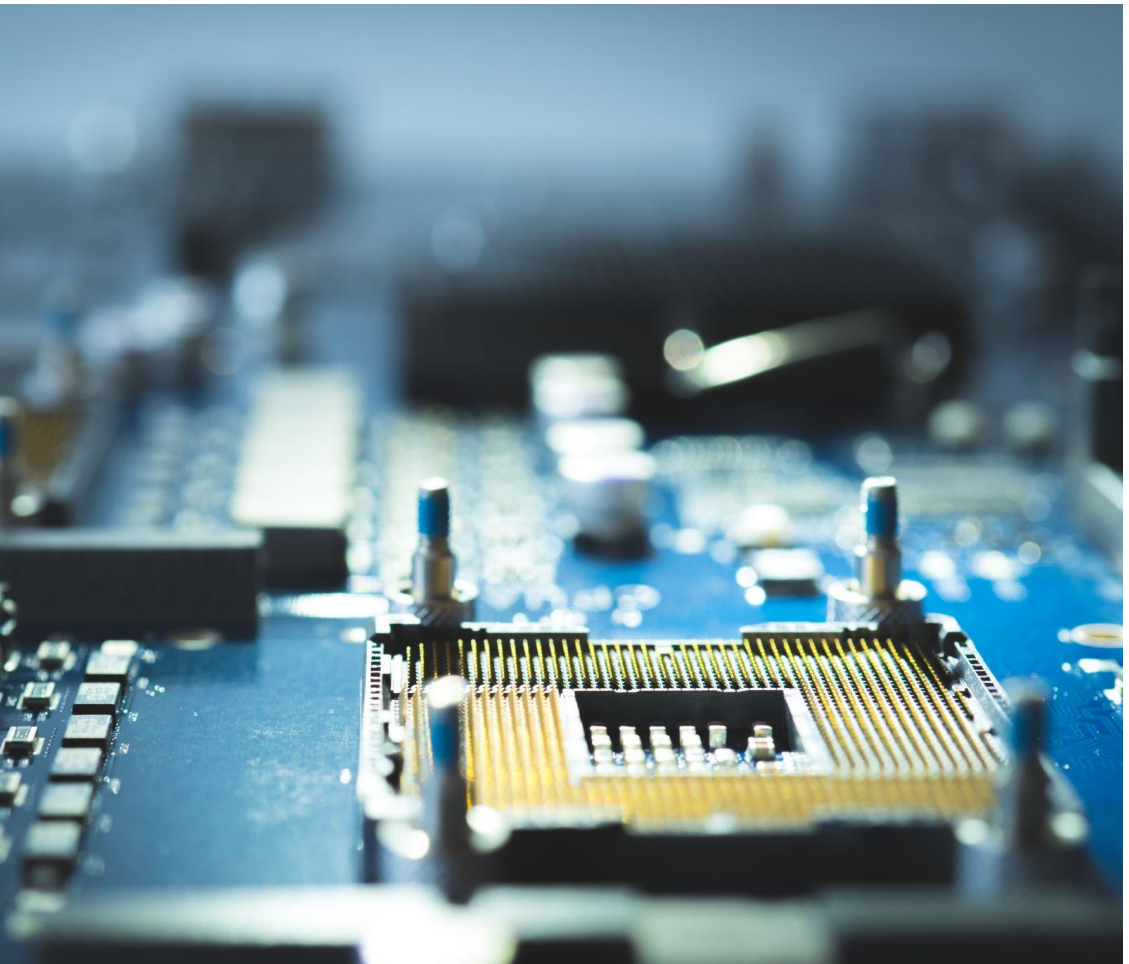
Today's schedule

- Review of Mini test #2 (5')
- Mini test #3 (25')
- CPU: Review of Chapter 3 (10')
- Coding with the Toy Machine (50')

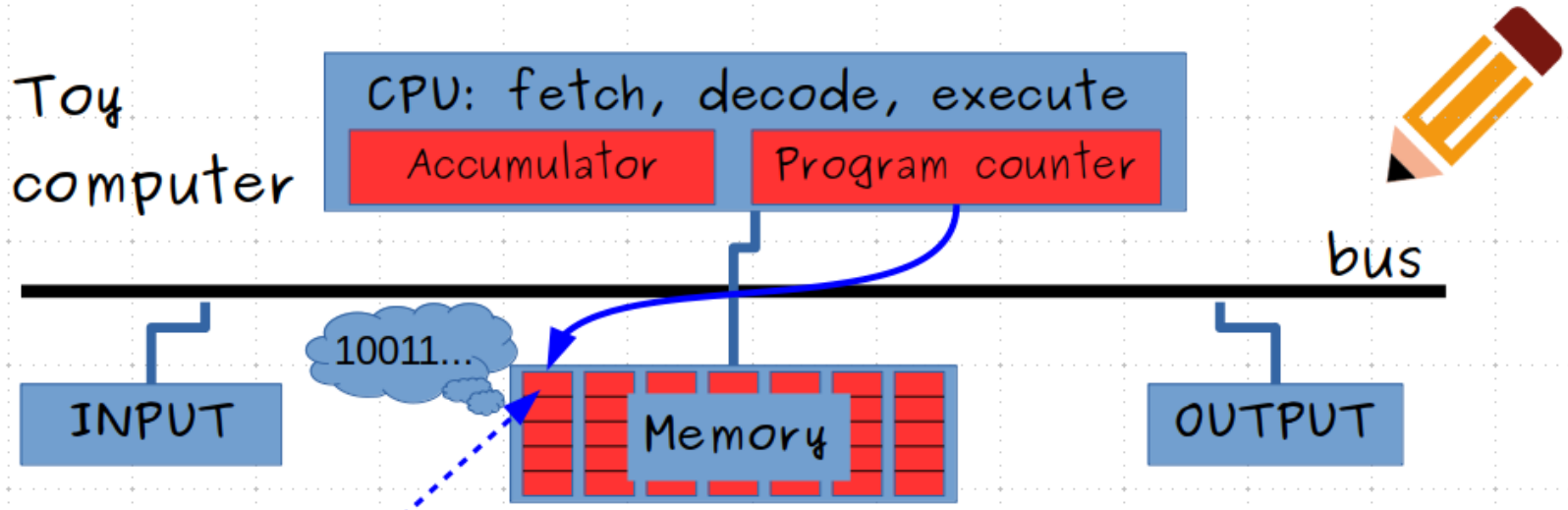
CPU (Central Processing Unit)



CPU performs:

- Arithmetic: +, -, x, /, etc.. (like a calculator with more but limited functions)
- Fetch/store/operate data from/to/in the memory (RAM)
- Coordinate input, output and others
- Compare numbers and decide the next to do
- Note: Instructions and data are in the RAM.

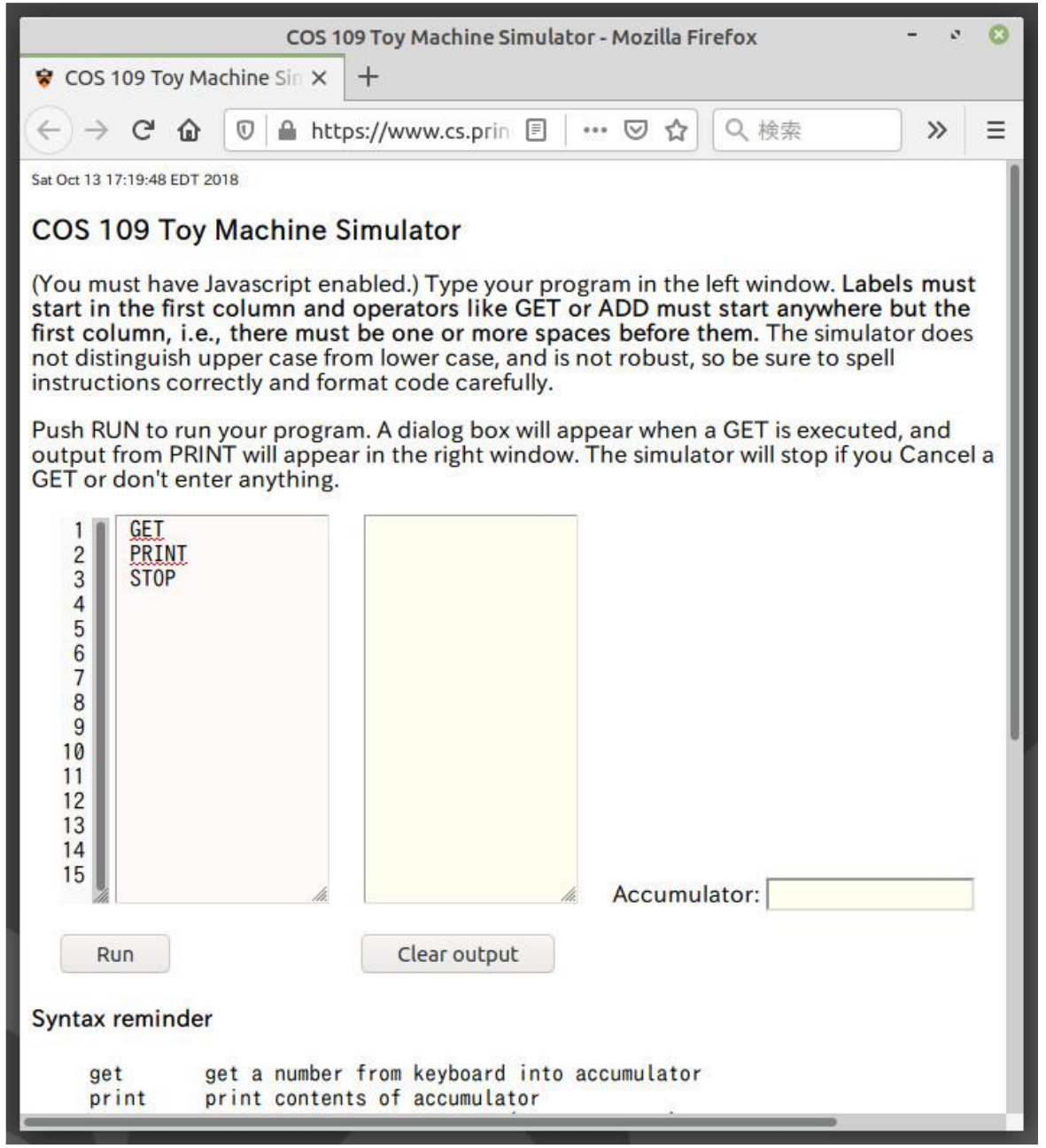
Toy Machine & instructions



label	instruction	description
	get	get a number from keyboard into accumulator
L	print	print contents of accumulator
	load Val	load accumulator with Val (Val unchanged)
	store M	store contents of accumulator into memory location called M
	add Val	add Val to contents of accumulator (Val unchanged)
	sub Val	subtract Val from contents of accumulator (Val unchanged)
	goto L	go to instruction labeled L
	ifpos L	go to instruction labeled L if accumulator is >= zero
	ifzero L	go to instruction labeled L if accumulator is zero
	stop	stop running
M	Num	before program runs, set this memory location (called M) to Num

Ex. 1: First program

- Go to http://www.cs.princeton.edu/courses/archive/fall18/cos109/toysim.html
- Input the program into the left box. Notice a space is required before the first letter (read the instructions).
- Click "Run" and input some number (e.g., 367) when asked, then check the output in the right box.
- In case of error, revise your program, spell, space, input, etc. (called debug).



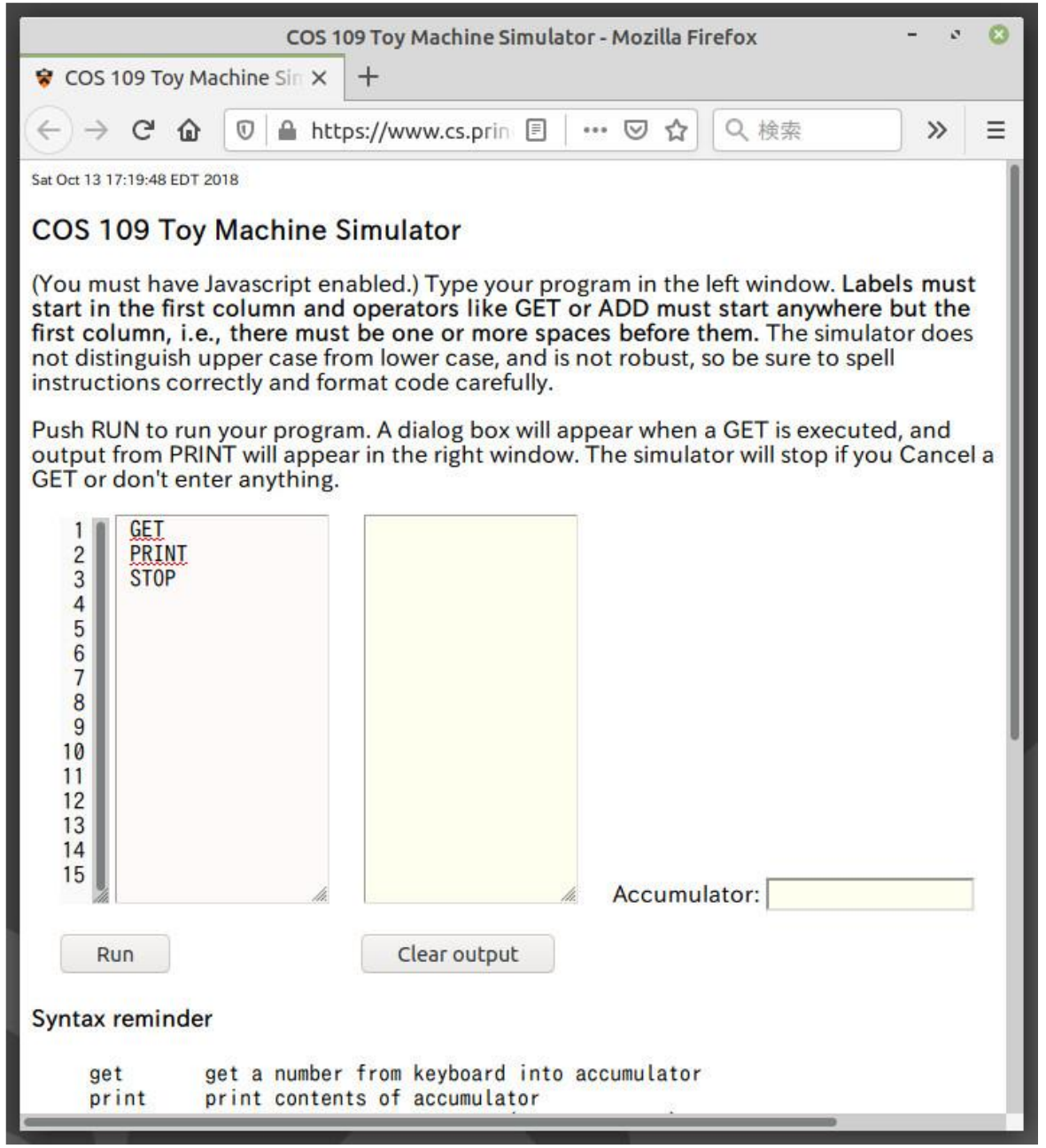
Ex. 1: Explained

1. ␣GET -> read some number [1]
2. ␣PRINT -> print it to the output [2]
3. ␣STOP -> end the program

[1] The number is store in the accumulator.

[2] It prints contents of the accumulator.

Notice: "␣" shows an invisible space.



Ex. 2: Run the next program and find what it does.

1. ␣GET
2. ␣STORE M
3. ␣ADD M
4. ␣PRINT
5. ␣ STOP
6. M

Note: STORE M copies the value in the accumulator into a space named M, whereas ADD M adds the two values in M and in the accumulator and puts the result into the accumulator.

Ex. 3: Run the next program and find what it does.

1. ␣GET
2. ␣STORE A
3. ␣GET
4. ␣ADD A
5. ␣PRINT
6. ␣STOP
7. A

Note: GET reads a number into the accumulator (and overwrite the old content).

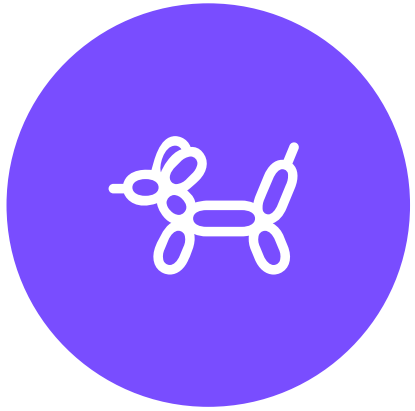
Coding task

Write a program for the Toy Machine that reads an arbitrary number A from the user, calculates 3 x A (that is, A + A + A), and prints it out.

Optional task (1 bonus point)

Write a program that reads an arbitrary number A from the user, calculates and prints 100 x A (100 times of A). A smart program is expected :-). You can try it after the lecture and submit it to me by email before Oct 16th.

Homework



WATCH TWO VIDEOS

RE-READ CHAPTER 3

YouTube -> Crash course -> Computer Science (You are not expected to understand everything)
#8 https://www.youtube.com/watch?v=zItgXvg6r3k & #9 https://www.youtube.com/watch?v=rtAIC5JIU40