

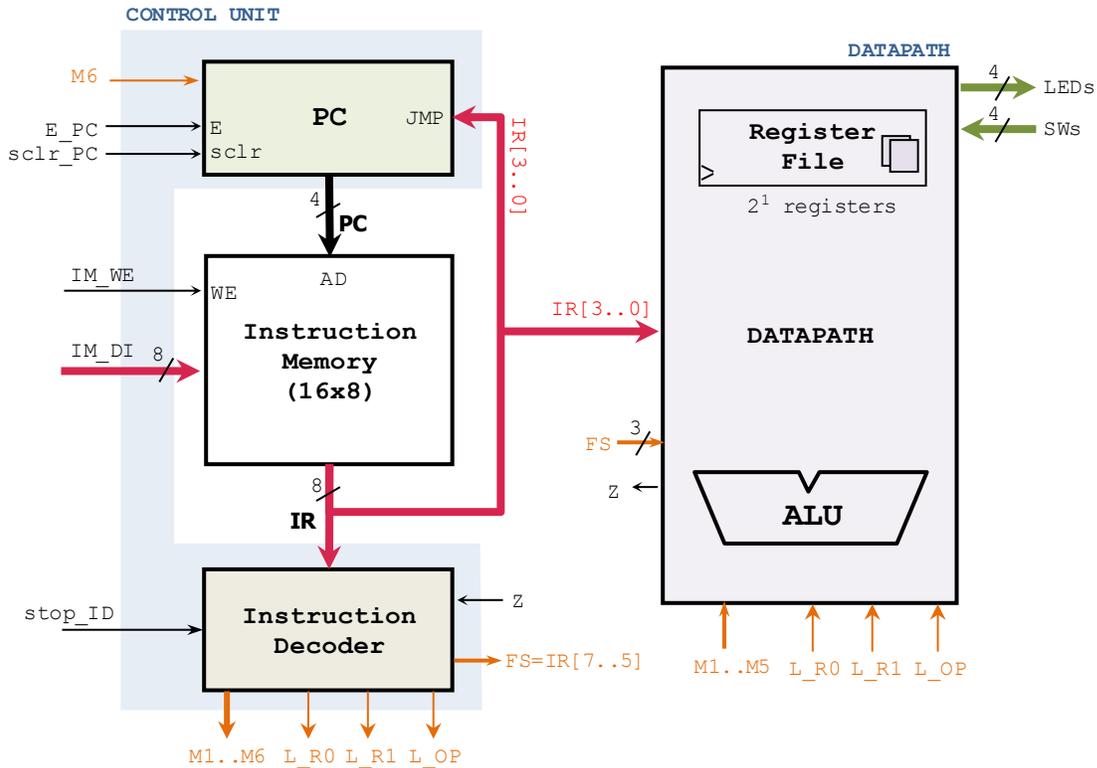
# Homework 4

(Due date: April 14<sup>th</sup> @ 7:30 pm)

Presentation and clarity are very important! Show your procedure!

## PROBLEM 1 (30 PTS)

- **"VBC (Very Basic Computer)":** 2 registers, 16-word Instruction Memory (IM), 8 bits per instruction (see Notes – Unit 6).



- ✓ Write an assembly program for a counter from 10 down to 3: 10, 9, ... 3, 10, 9, ... The count must be shown on the output register (**OUT**). Use labels to specify any address that an instruction may jump to. You can only have up to 16 instructions.  
\* To decrement the value of a register by 1 (e.g. R0), you can use: `addi R0,15 ≡ R0 ← R0-1`.
- ✓ Provide the contents of the Instruction Memory. If some instruction bits are unused, you can assign 0's.

Address	Instruction Memory	Assembly Instruction
0000		
0001		
0010		
0011		
0100		
0101		
0110		
0111		
1000		
1001		
1010		
1011		
1100		
1101		
1110		
1111		

- ✓ Complete the timing diagram for the execution of the previous program. Use unsigned decimal values for R0, R1, OUT, and PC. Specify IR in hexadecimal. (18 pts)  
 IM: Array of registers. In this case, when reading, output data appears as soon as address is ready.  
 Assumptions: the program is already in IM. Also: sclr\_PC=0, IM\_WE=0, stop\_ID=0.

