

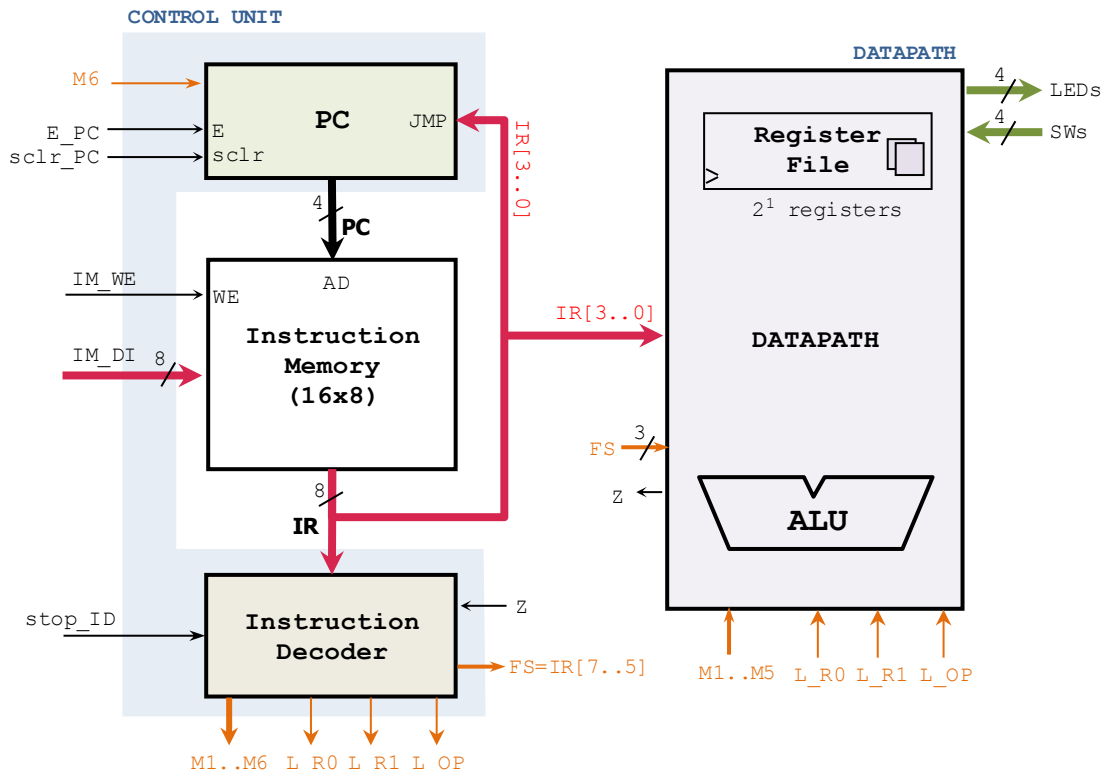
# Homework 4

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

Presentation and clarity are very important! Show your procedure!

## PROBLEM 1 (30 PTS)

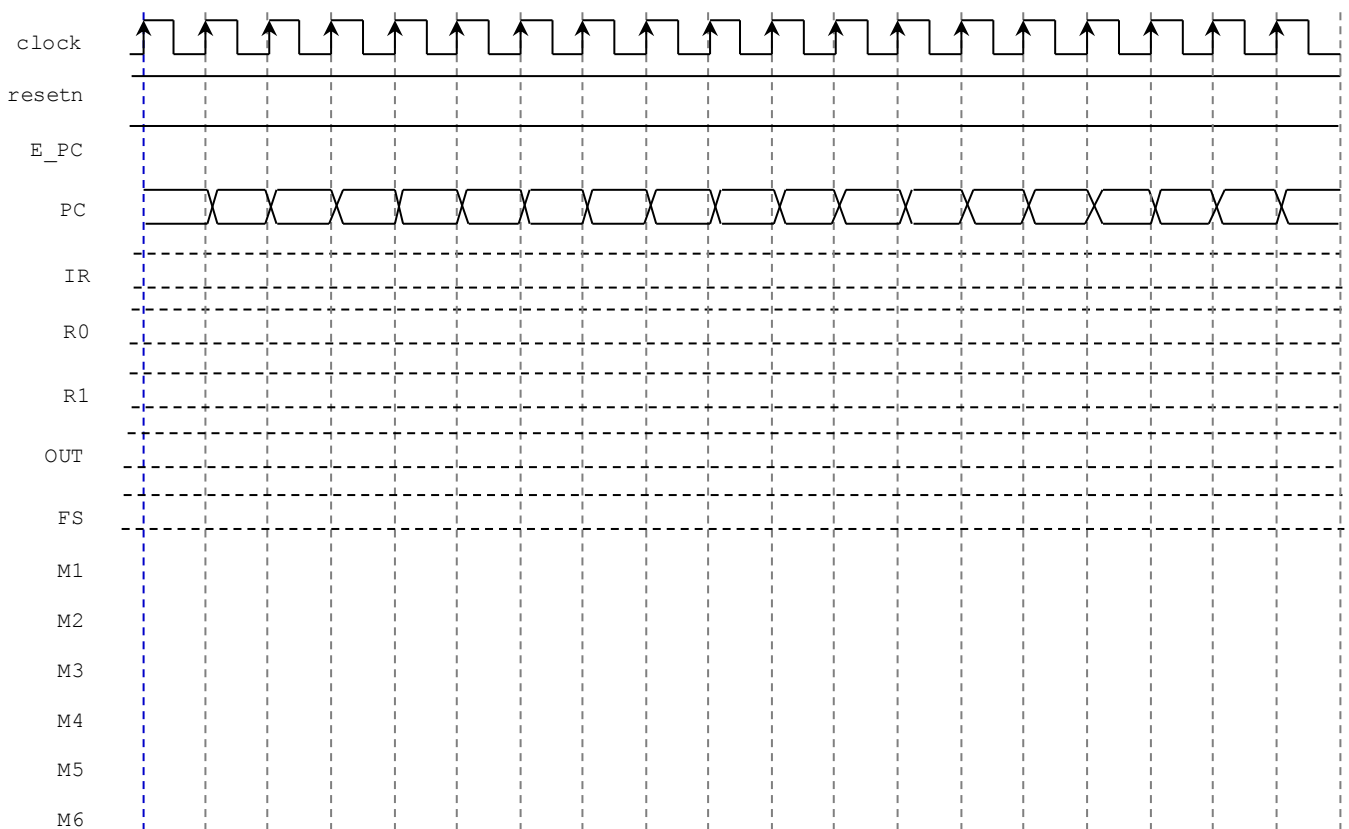
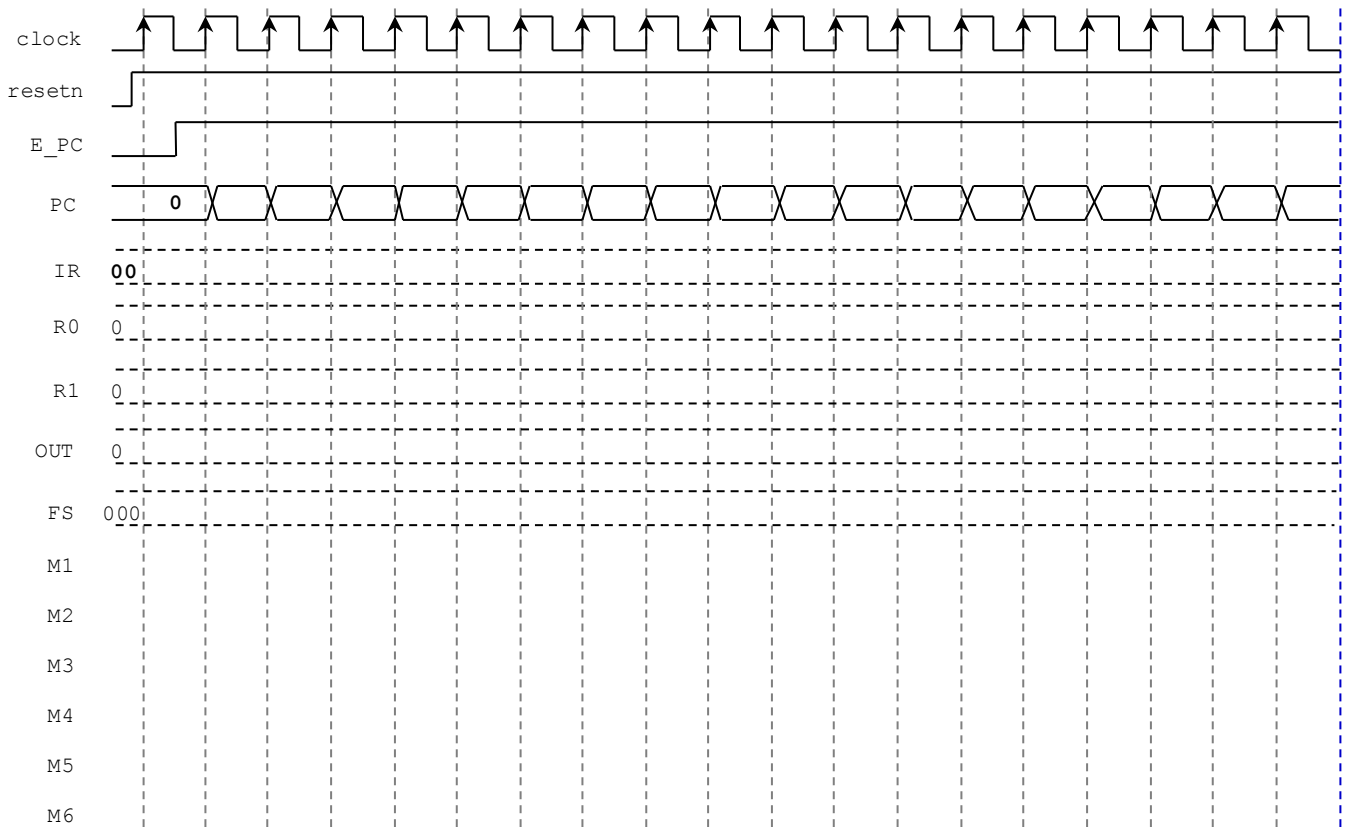
- **"VBC (Very Basic Computer)":** 2 registers, 16-word Instruction Memory (IM), 8 bits per instruction (see Notes – Unit 6).



- ✓ 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  $\equiv$  R0  $\leftarrow$  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.





- **"PicoBlaze MicroProcessor":** 16 registers, 1024-word Instruction Memory, 18 bits per instruction (see Notes – Unit 6).
  - ✓ Emulate the execution of this program by completing the state of the registers (hexadecimal values) and the status flags (C, Z) after the instruction pointed to by PC is executed. Then, complete the PC (hexadecimal values) of the next instruction and update SP (binary values). Complete it until the `jump` instruction (003) is reached (execute this instruction as well).

Address	Assembly Program
000	main: load s3,05
001	load s4,03
002	call umult
003	jump main
...	...
067	umult: load s5,00
068	load s7,08
069	loop: sr0 s4
06A	jump nc, sh_p
06B	add s5, s3
06C	sh_p: sra s5
06D	sra s6
06E	sub s7,01
06F	jump nz, loop
070	return
...	...

[illegible]

[illegible]

- Attach a printout of your Project Status Report (no more than three pages, single-spaced, 2 columns). This report should contain the current status of the project. You **MUST** use the provided template (Final Project - Report Template.docx).