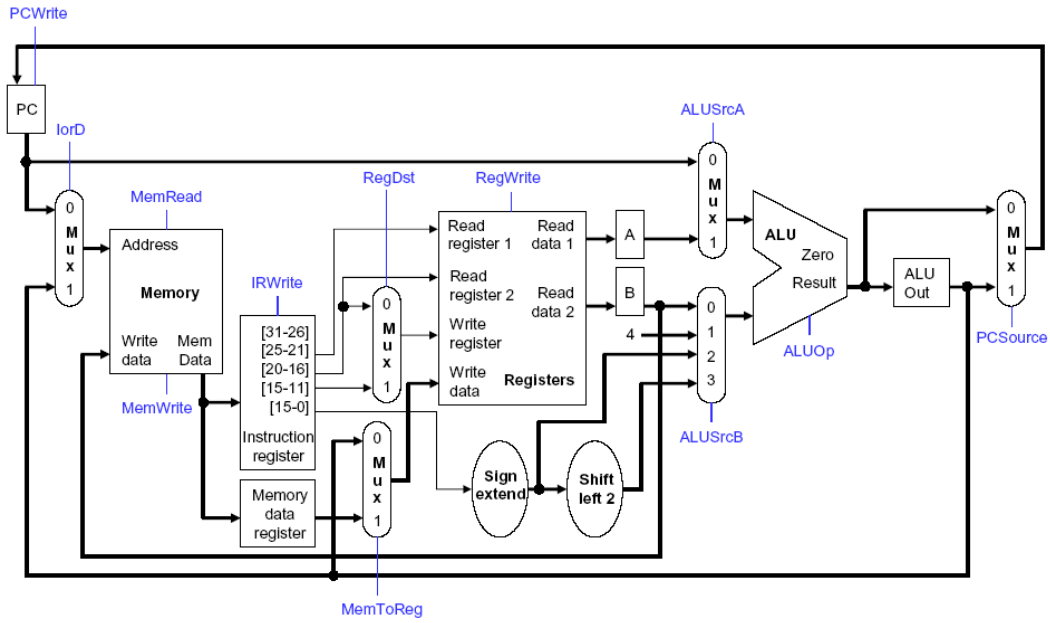
CEN 305 Computer Architecture Study Questions

Question 1 (MIPS Multi-cycle Processor). Please answer the questions regarding to multi-cycle MIPS processor.

a) A MIPS multicycle processor implementation is given below. Please add the "xor rd,rs,rt" to the processor given above. Please show the necessary additions and modifications(if any addition or modification is needed) to the both datapath and control unit. Then explain briefly how your modified processor can process the new instruction.



b) Show the new xor instruction's binary representation format and explain briefly the reason.

c) How many cycles needed for xor instruction to be executed on multi-cycle MIPS processor given in the previous question? And how much time is needed? Please use the below diagram.

Time consumptions: Reading the instruction memory: 3ns, Reading register file: 2ns, ALU computation: 4ns, Accessing data Memory: 3ns, Writing to the register file: 3ns

d) Write the values of the control signals for each cycle for multi cycle processor. (You may add new control signals if necessary)

Cycle number	PC Write	IorD	Mem Read	Mem Write	IR Write	Reg Dst	MemToReg	Reg Write	ALU SrcA	Alu SrcB	ALU Op	PC Source
1												

Question 2 (Pipeline Forwarding). Show all the data hazards in this code.

Please define the hazards in this format:

Example: EX/MEM hazard between instructions 3 and 4, because register rs=3 and register rd=3.

1. add $8, $2, $3
2. sub $6, $8, $7
3. or $3, $1, $8
4. add $5, $3 ,$6
5. sub $1, $5, $6
6. and $4, $5, $5

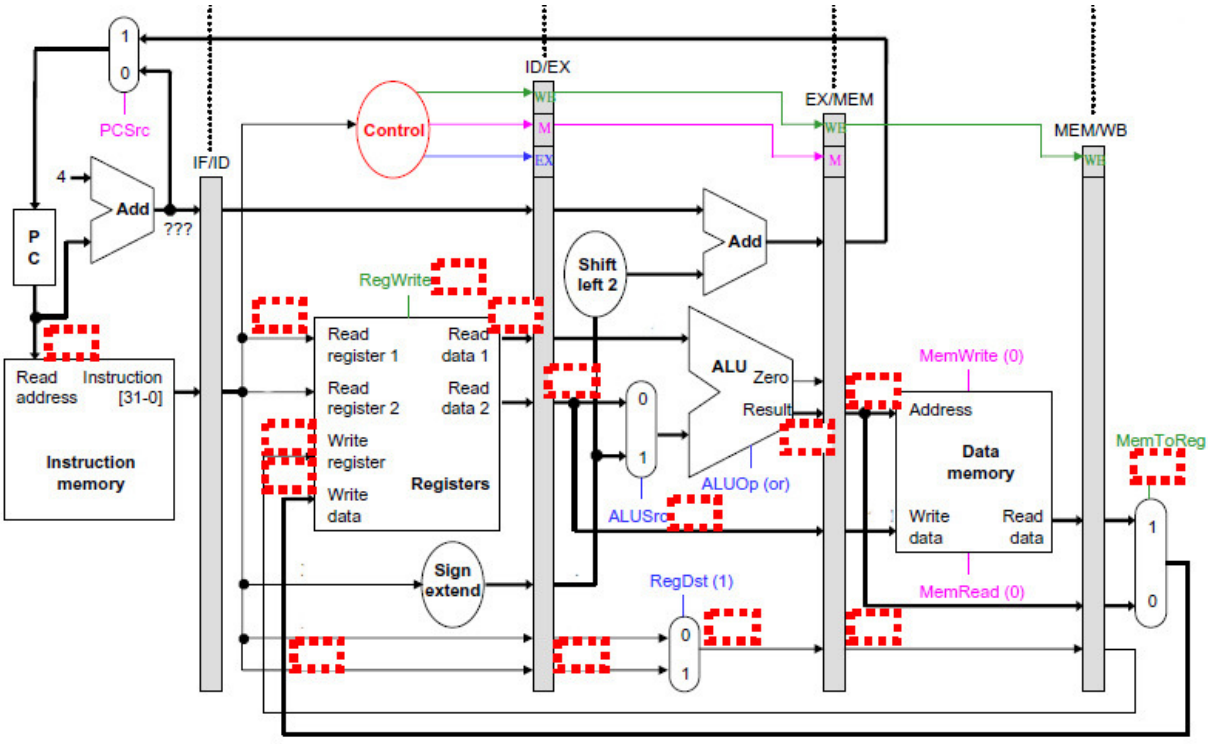
Question 3 (MIPS Pipelined CPU). Here's a sample sequence of instructions to execute.

1000: lw $30, 29($28)
1004: and $27, $26, $25
1008: or $24, $23, $22
1012: sub $21, $20, $19
1016: add $18, $17, $16

— Each register contains its number plus 100. For instance, register $8 contains 108, register $29 contains 129, and so forth.

— Every data memory location contains 99.

Please fill the values into the boxes at the fifth cycle.



Notes:

1. Please do not submit it as a homework.
2. Please restudy Homework 1 and Homework 2.

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