ACADEMY FOR SCIENCE & TECHNOLOGY
COLLEGE OF ENGINEERING & TECHNOLOGY
Department : Computer Engineering Department
Course : Computer Architecture
Course Code: CC 311
Lecturer : Dr. Ahmed Abuo El-Farag
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Sheet #4

1. Describe the effect that a single stuck-at-0 fault would have for the signals shown below in the multi-cycle datapath. Which instructions, if any, will not work correctly? Explain why.

   Consider each of the following faults separately:

   a. RegWrite = 0 b. IRWrite = 0
   c. ALUSecA = 0 d. MemRead = 0
   e. ALUSrcB = 0 f. MemWrite = 0

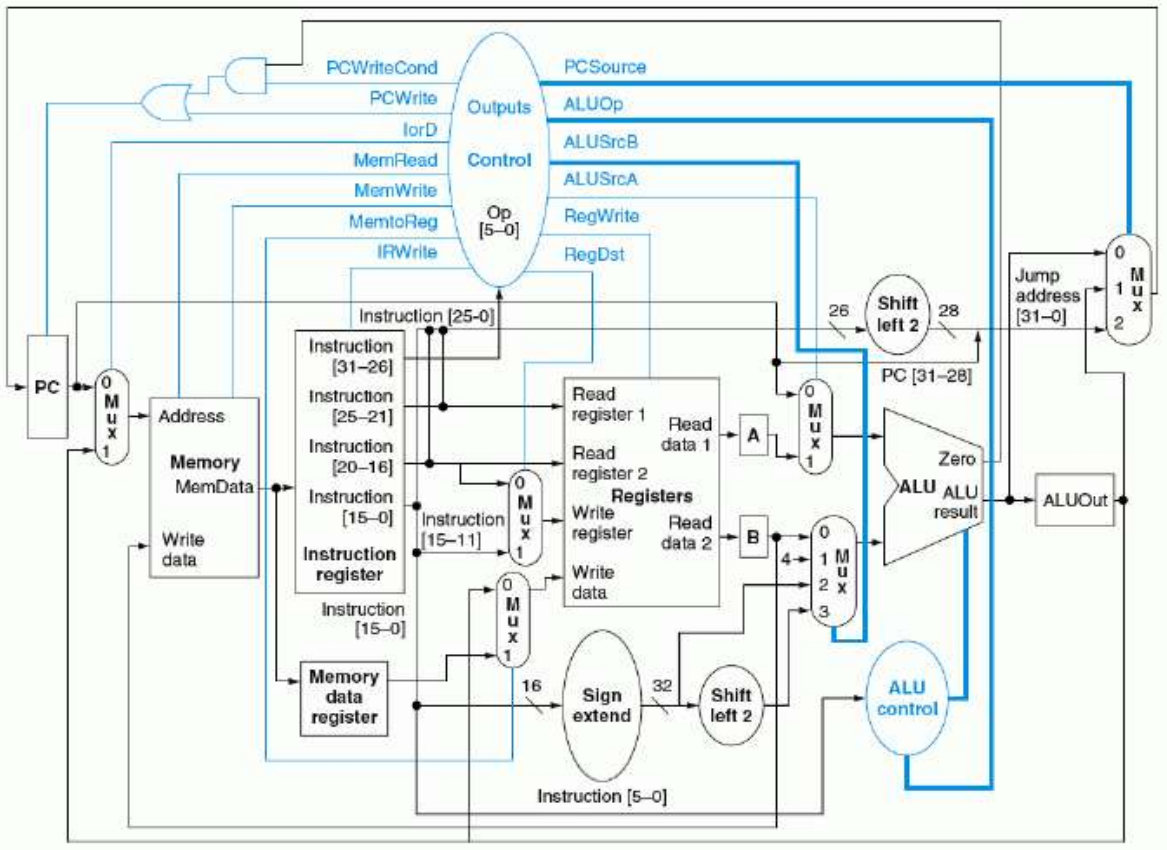
2. We wish to add the following instructions to the multi-cycle datapath described. Add and show any necessary datapaths and control signals to the single-cycle datapath .
   a. Addi (add immediate)
   b. Bne (branch if not equal)

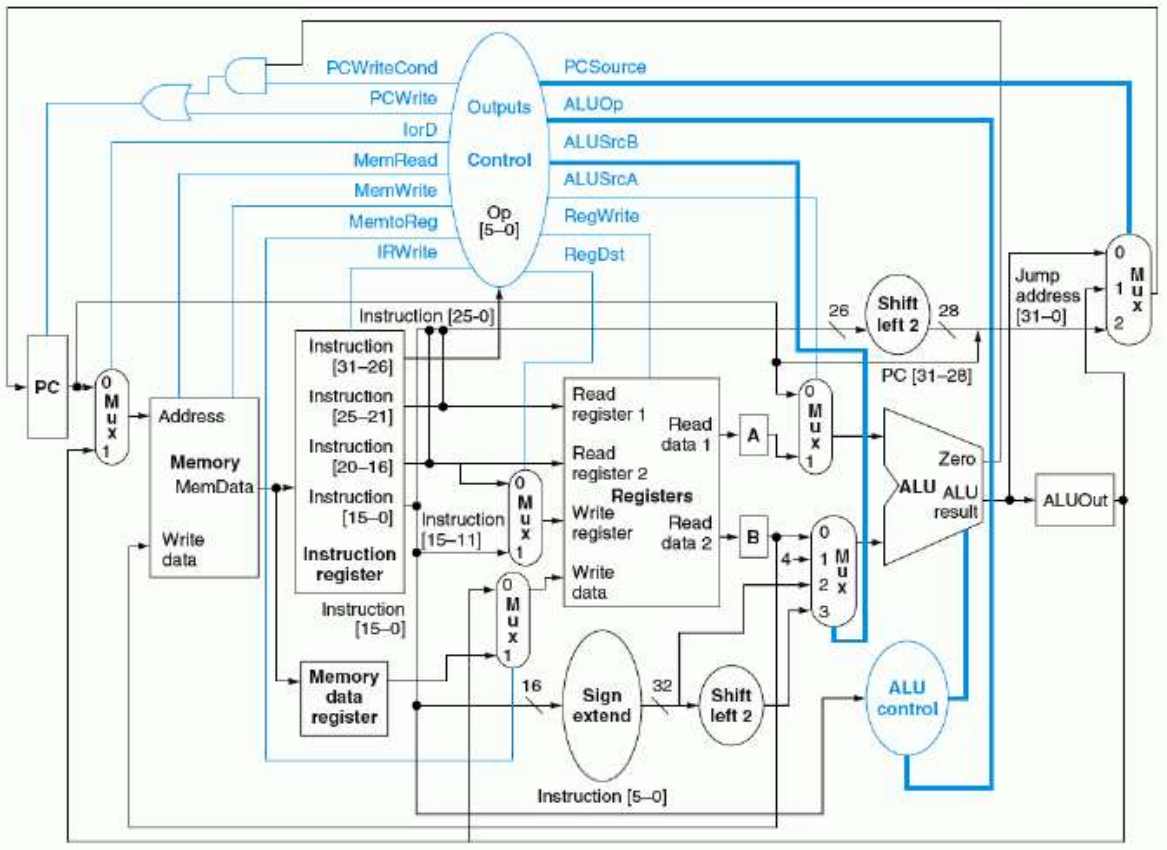
3. We wish to add a variant of the Sw (Store word) instruction, which sums two registers to obtain the address of the data to be stored and uses the R-format. Add and show any necessary datapaths and control signals to the multi-cycle datapath .

4. Assume the new MIPS instruction **SLTI** (set less than immediate). Add and show any necessary datapaths and control signals to the multi-cycle datapath.
   (Aluop for add operation=00)

5. Assume the new MIPS instruction **ADDM** (add register to memory). Add and show any necessary datapaths and control signals to the multi-cycle datapath . (Aluop for add operation=00)

addm register(rs), register(rt), immediate
rt ← rs + M [immediate]


PCWriteCond
PCWrite
IorD
MemRead
MemWrite
MemtoReg
IRWrite
Outputs
Control
Op
[5–0]
PCSource
ALUOp
ALUSrcB
ALUSrcA
RegWrite
RegDst
Instruction [25-0]
26
Shift
left 2
28
PC [31–28]
Jump
address
[31–0]
M
u
x
0
1
2
PC
Address
Memory
MemData
Write
data
Instruction
[31–26]
Instruction
[25–21]
Instruction
[20–16]
Instruction
[15–0]
Instruction
register
Instruction
[15–11]
Instruction
[15–0]
Memory
data
register
Read
register 1
Read
register 2
Registers
Write
register
Write
data
Read
data 1
Read
data 2
A
B
4
Zero
ALU
ALU
result
ALUOut
16
Sign
extend
32
Shift
left 2
ALU
control
Instruction [5–0]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PC
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MemData
Write
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Instruction
[31–26]
Instruction
[25–21]
Instruction
[20–16]
Instruction
[15–0]
Instruction
register
Instruction
[15–11]
Instruction
[15–0]
Memory
data
register
Read
register 1
Read
register 2
Registers
Write
register
Write
data
Read
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Read
data 2
A
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