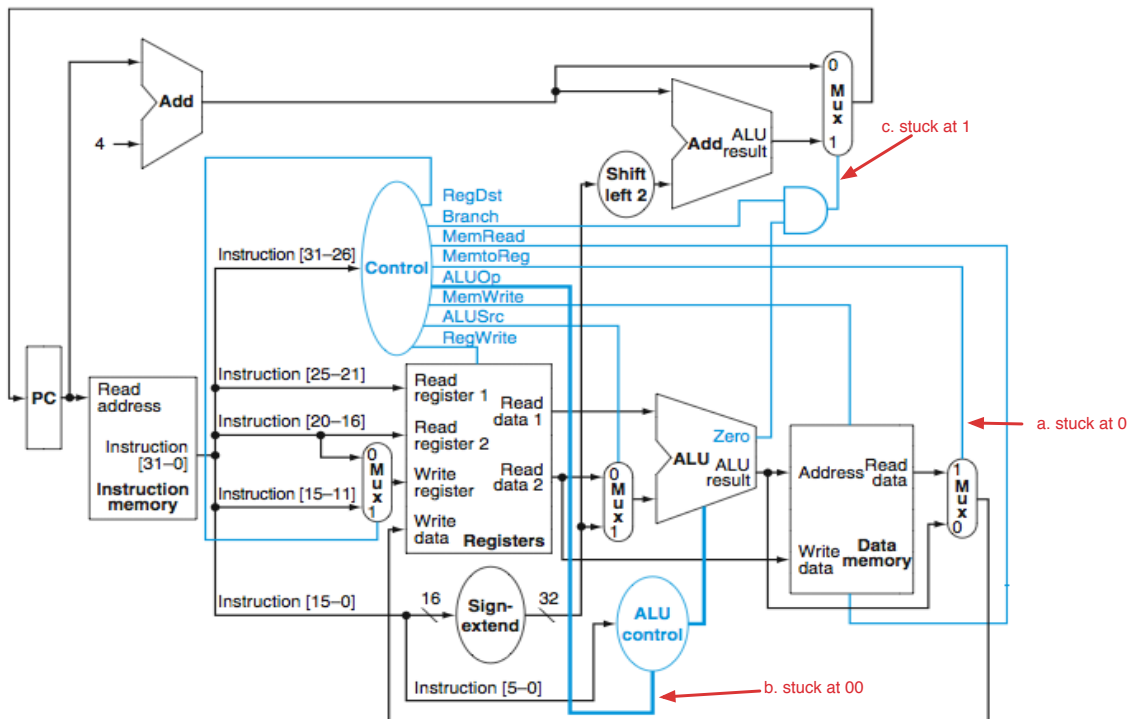
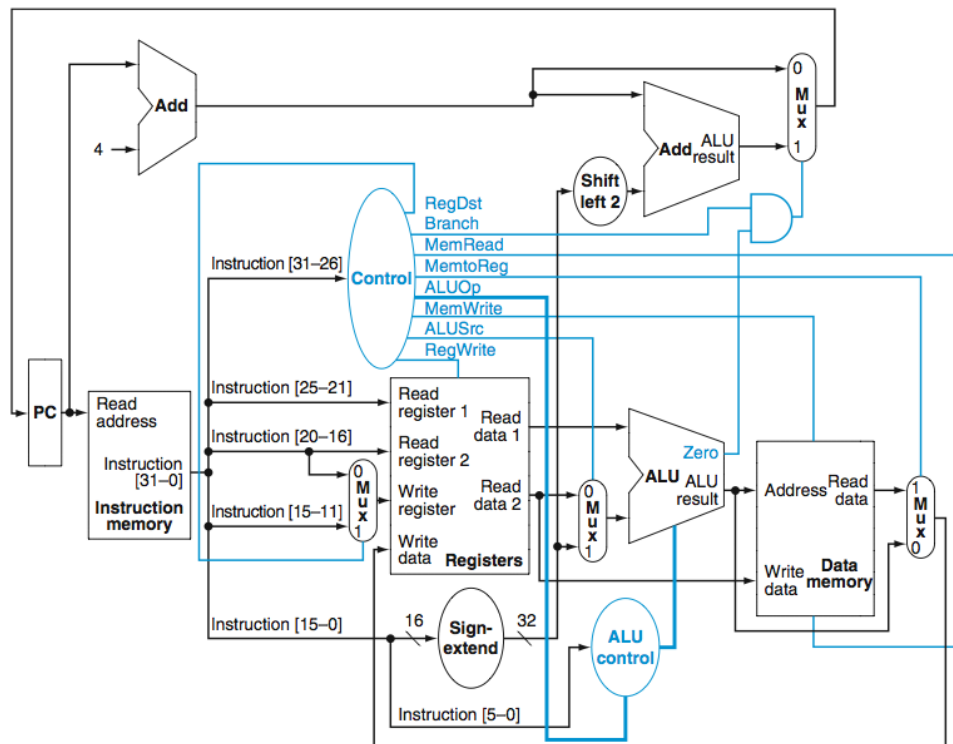


- Computer A has an overall CPI of 1.3 and can be run at a clock rate of 600MHz. Computer B has a CPI of 2.5 and can be run at a clock rate of 750MHz. When a particular program is compiled for Computer A, the program has exactly 100,000 instructions. How many instructions would the program need to have when compiled for Computer B in order for the two computers to have exactly the same execution time for this program?
- In the datapath shown below, three wires are marked with “stuck at” faults, meaning those signals always have whatever value they are stuck at regardless of the intended value. For each fault:
  - Briefly describe in words the negative consequence of the stuck at fault relative to the working, unmodified processor.
  - Provide a snippet of code that will fail.
  - Provide a snippet of code that will still work.



3. In this problem you will enhance the single-cycle MIPS processor that we have developed to support the `addi` instruction. To do this you should extend the baseline datapath and control shown below by adding to the diagram or tables as necessary. Here is some information about the instruction. `addi` is an I-type instruction (`opcode=001000`) which adds the immediate operand to the contents of register `rs` and writes the results to register `rt` ( $Reg[rt] \leftarrow Reg[rs] + SignExtend(Imm)$ ).

(We have provided extra space for this problem, so you can print these pages and turn in a solution based on these diagrams and tables.)



(Control signals on next page.)

Instruction	RegDet	ALUSrc	Memto-Reg	Reg-Write	Mem-Read	Mem-Write	Branch	ALUOp1	ALUOp0
R-format	1	0	0	1	0	0	0	1	0
lw	0	1	1	1	1	0	0	0	0
sw	X	1	X	0	0	1	0	0	0
beq	X	0	X	0	0	0	1	0	1

Instruction opcode	ALUOp	Instruction operation	Funct field	Desired ALU action	ALU control Input
LW	00	load word	XXXXXX	add	0010
SW	00	store word	XXXXXX	add	0010
Branch equal	01	branch equal	XXXXXX	subtract	0110
R-type	10	add	100000	add	0010
R-type	10	subtract	100010	subtract	0110
R-type	10	AND	100100	AND	0000
R-type	10	OR	100101	OR	0001
R-type	10	set on less than	101010	set on less than	0111