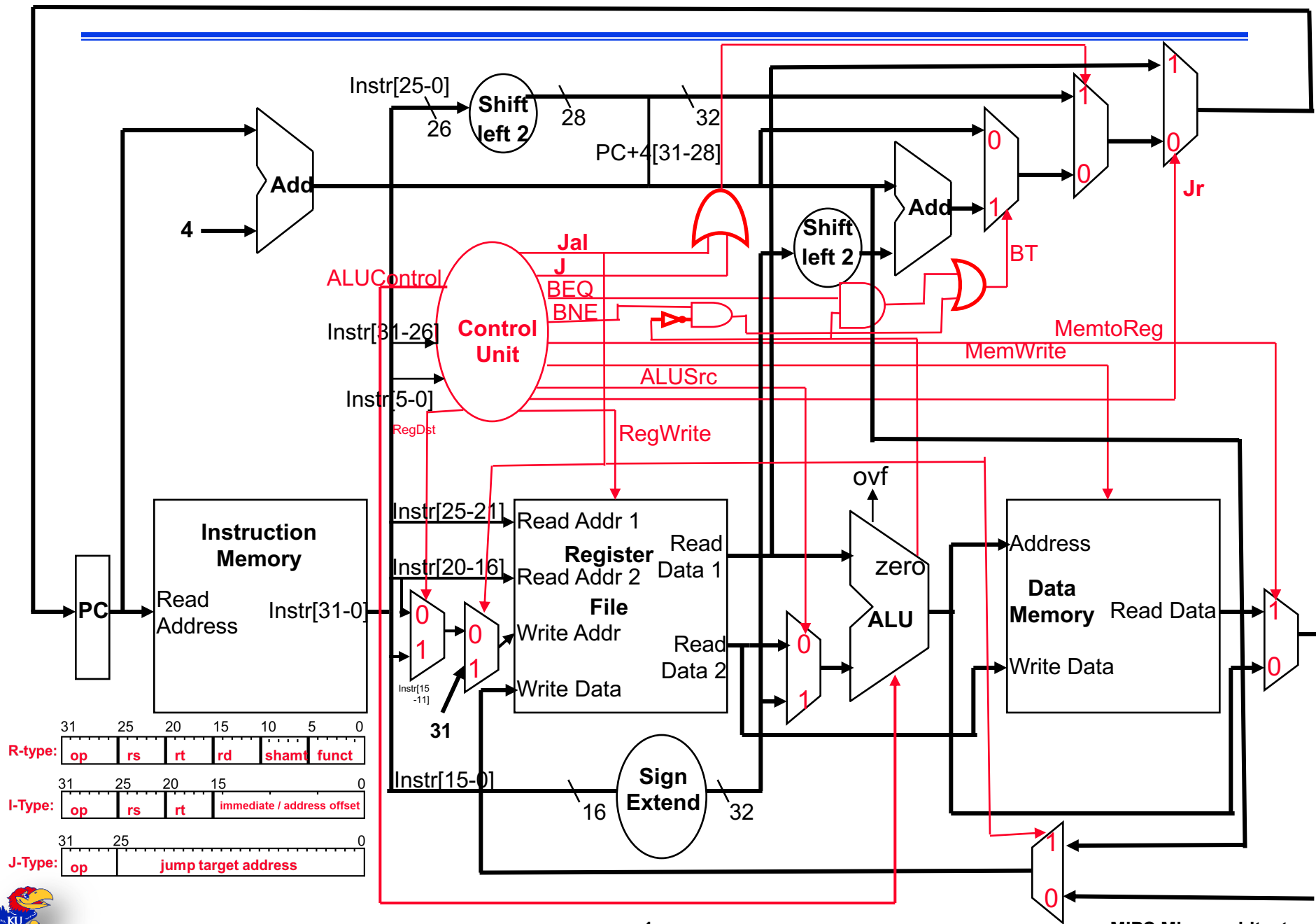


Single-Cycle/Non-Pipelined Datapath (Modify to Support 16 Instructions)



Extended ALU Control (Use This Table to Complete the CU Table)

- **ALUControl** derived from **opcode** and **funct**
 - Combinational logic derives ALU control

opcode	rs	rt	rd	shamt	funct
31:26	25:21	20:16	15:11	10:6	5:0

Operation	opcode	funct	ALU function	ALUControl
AND	R-type \equiv 000000	100100	AND	0000
OR		100101	OR	0001
add		100000	add	0010
subtract		100010	subtract	0110
set-on-less-than		101010	set-on-less-than	0111
NOR		100111	NOR	1100
add immediate	addi \equiv 001000	xxxxxx	add	0010
load word	lw \equiv 100011			
store word	sw \equiv 101011			
branch on equal	beq \equiv 000100	xxxxxx	subtract	0110
branch not equal	bne \equiv 000101			
or immediate	ori \equiv 001101	xxxxxx	OR immediate	1101
load upper immediate	lui \equiv 001111	xxxxxx	shift left 16	1111



Extended Control Unit (Modify to Support 16 Instructions)

opcode	funct	ALUControl	RegDst	ALUSrc	MemToReg	RegWr	MemWr	BEQ	J	BNE	Jal	Jr
R-type \equiv 000000	AND 100100	0000	1	0	0	1	0	0	0	0	0	0
	OR 100101	0001										
	add 100000	0010										
	sub 100010	0110										
	slt 101010	0111										
	NOR 100111	1100										
	jr 001000	0000	0	0	0	0	0	0	0	0	0	1
lw \equiv 100011	xxxxxx	0010	0	1	1	1	0	0	0	0	0	0
sw \equiv 101011	xxxxxx	0010	0	1	0	0	1	0	0	0	0	0
beq \equiv 000100	xxxxxx	0110	0	0	0	0	0	1	0	0	0	0
j \equiv 000010	xxxxxx	0000	0	0	0	0	0	0	1	0	0	0
addi \equiv 001000	xxxxxx	0010	0	1	0	1	0	0	0	0	0	0
bne \equiv 000101	xxxxxx	0110	0	0	0	0	0	0	0	1	0	0
jal \equiv 000011	xxxxxx	0000	0	0	0	1	0	0	0	0	1	0
ori \equiv 001101	xxxxxx	1101	0	1	0	1	0	0	0	0	0	0
lui \equiv 001111	xxxxxx	1111	0	1	0	1	0	0	0	0	0	0

