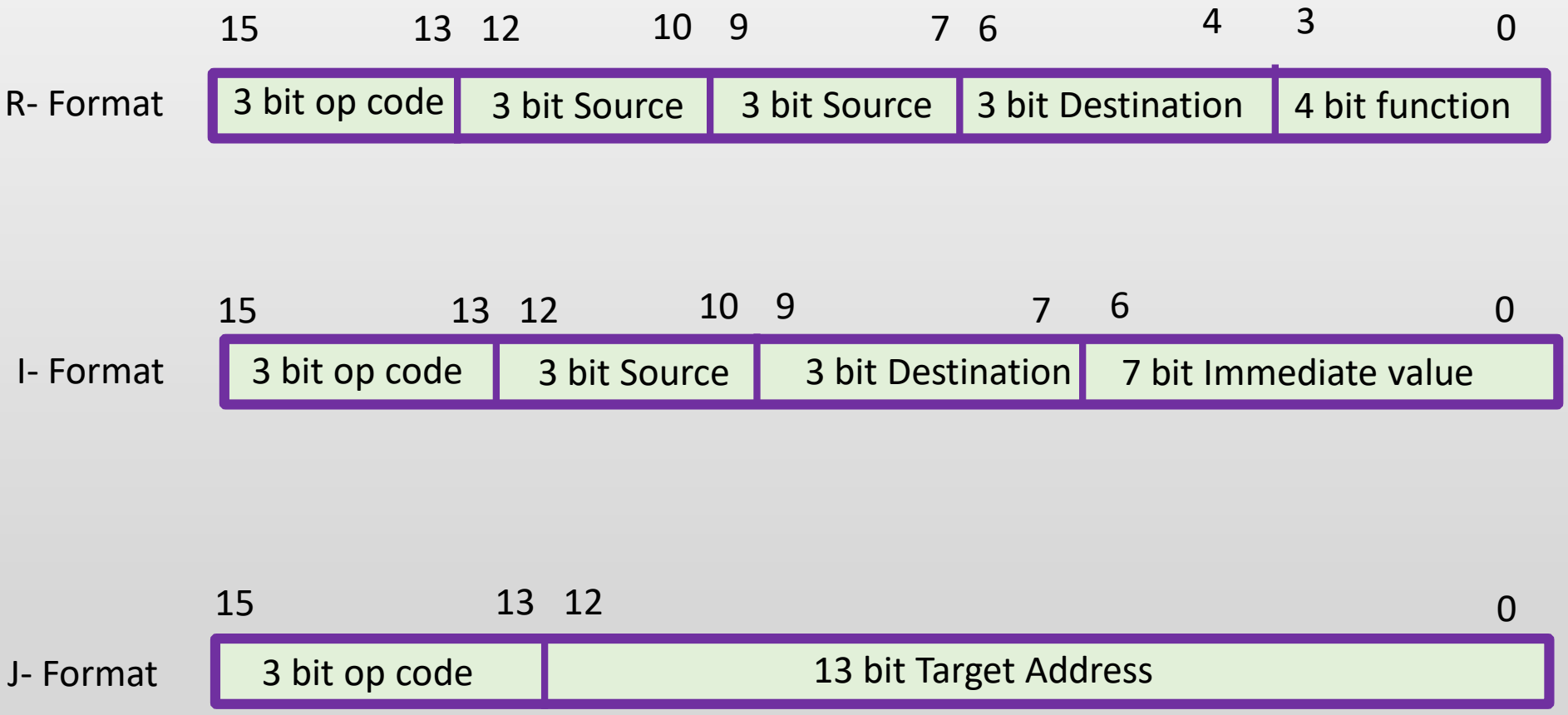
Instruction Formats



ALU Design

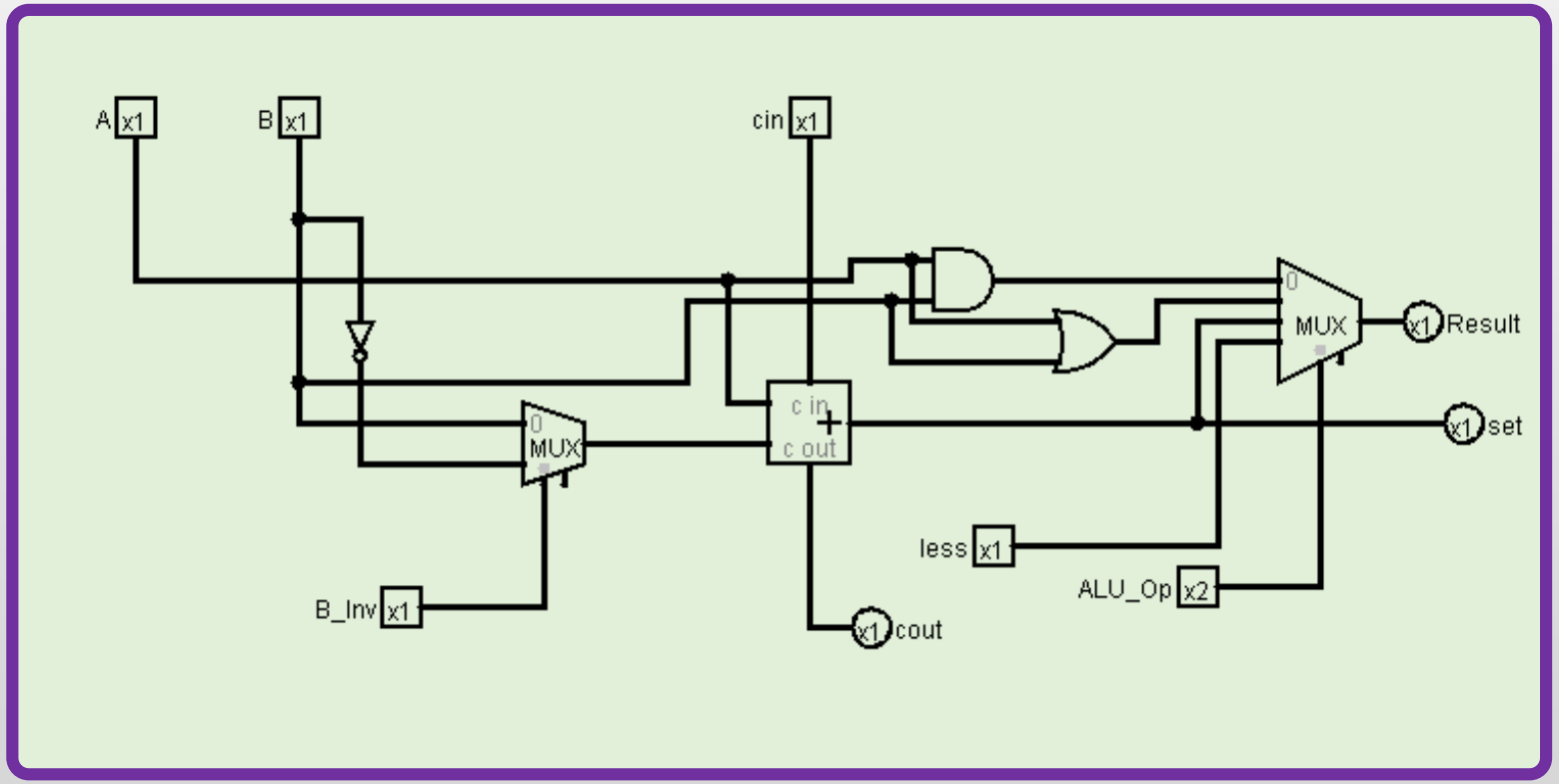


Fig: 1 bit ALU

Operations	ALU Mux
And	00
Or	01
Add	10 | bin=0|cin0
Sub	10 | bin=1|cin1

Register File

8 Registers
Each-> 16 Bits

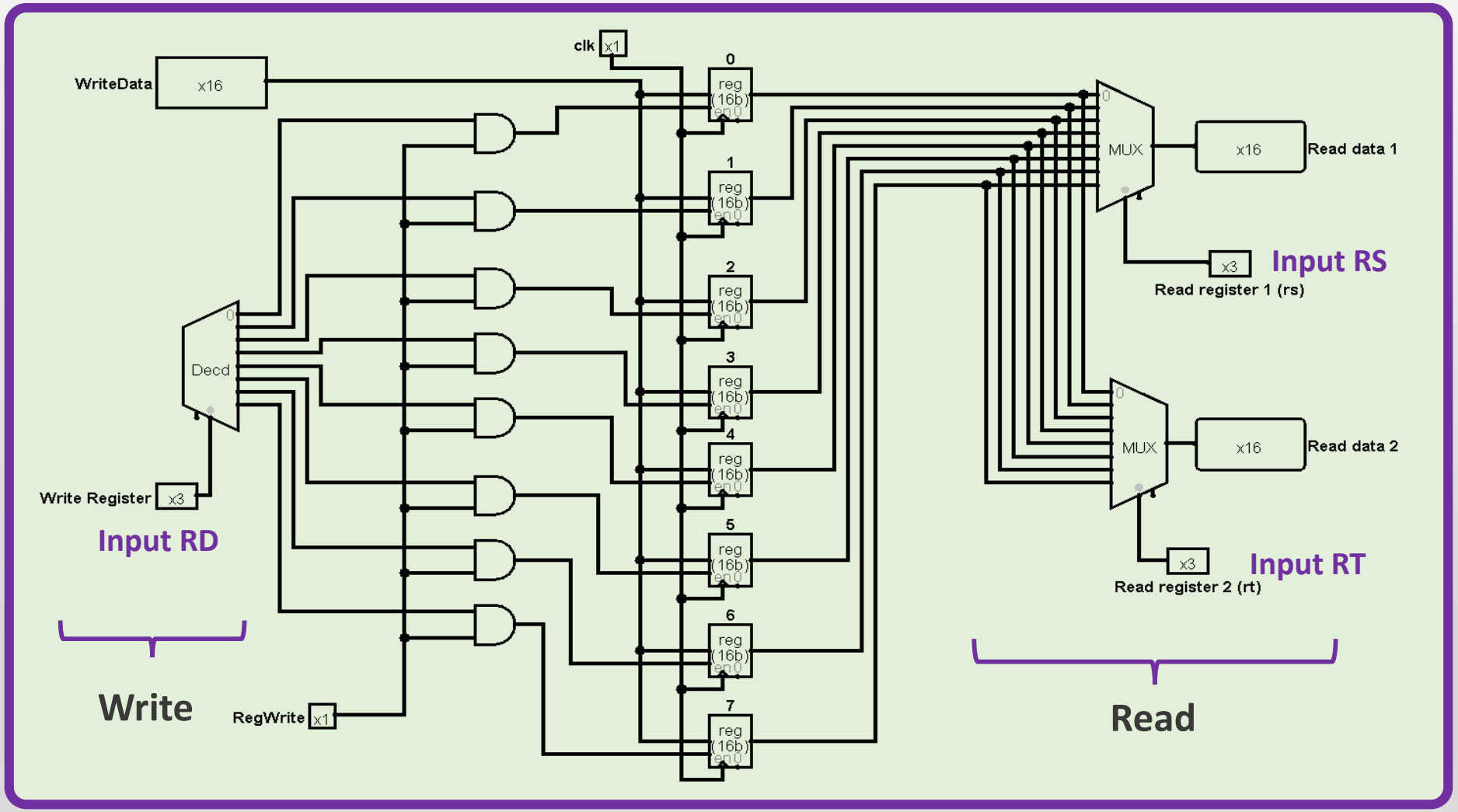
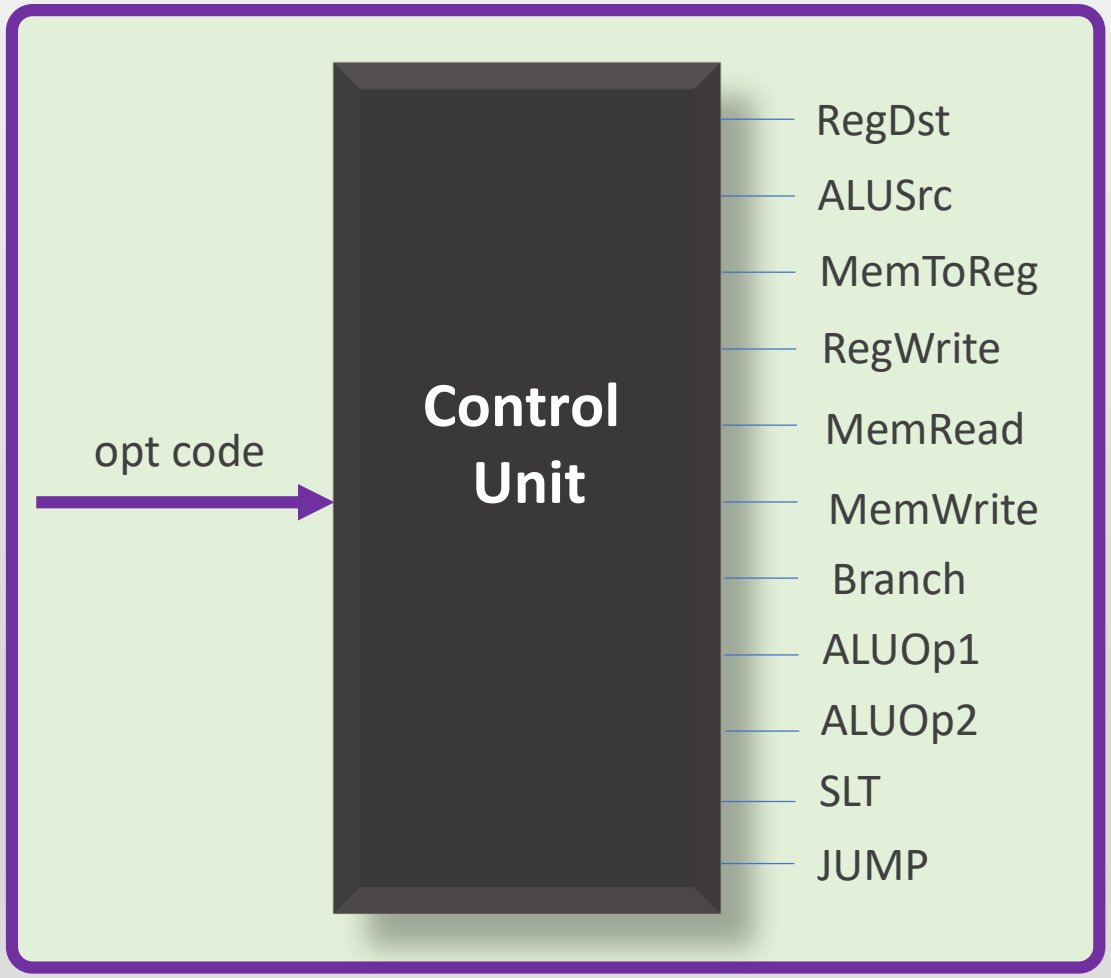


Fig: 8 bit Register File

Control Unit

From opt code to control unit



Signal Name	R-f	Lw	Sw	beq	jump	slt
Op2	0	0	0	0	1	1
Op1	0	0	1	1	0	0
Op0	0	1	0	1	0	1
RegDst	1	0	x	x	0	0
ALUSrc	0	1	1	0	0	1
MemtoReg	0	1	x	x	0	0
RegWrite	1	1	0	0	0	1
MemRead	0	1	0	0	0	0
MemWrite	1	1	0	0	0	0
Branch	0	0	0	1	0	0
ALUOp1	1	0	0	0	0	0
ALUOp2	0	0	0	1	0	1
SLT	0	0	0	0	0	1
JUMP	0	0	0	0	1	0

Input

Output

Control Unit

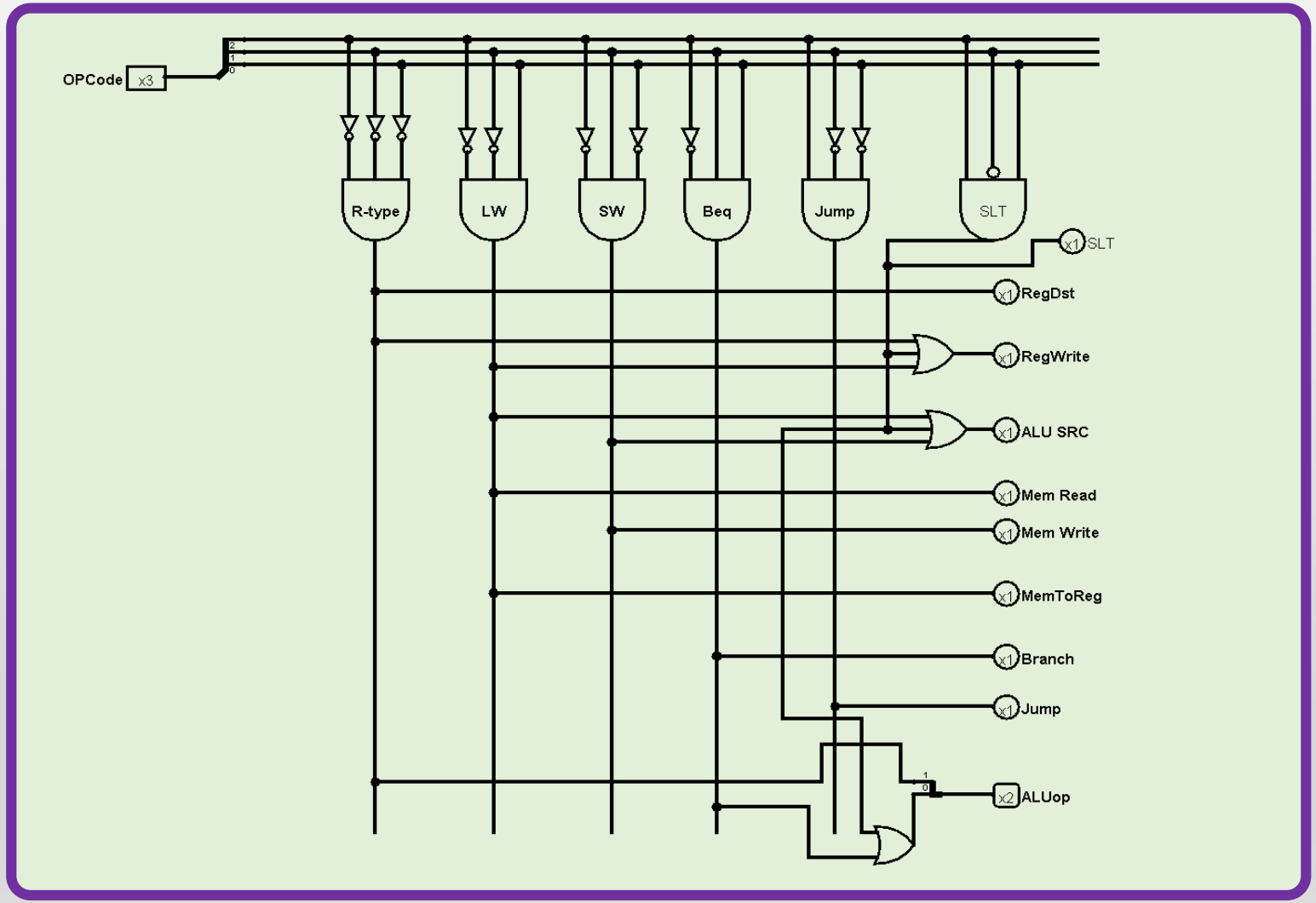
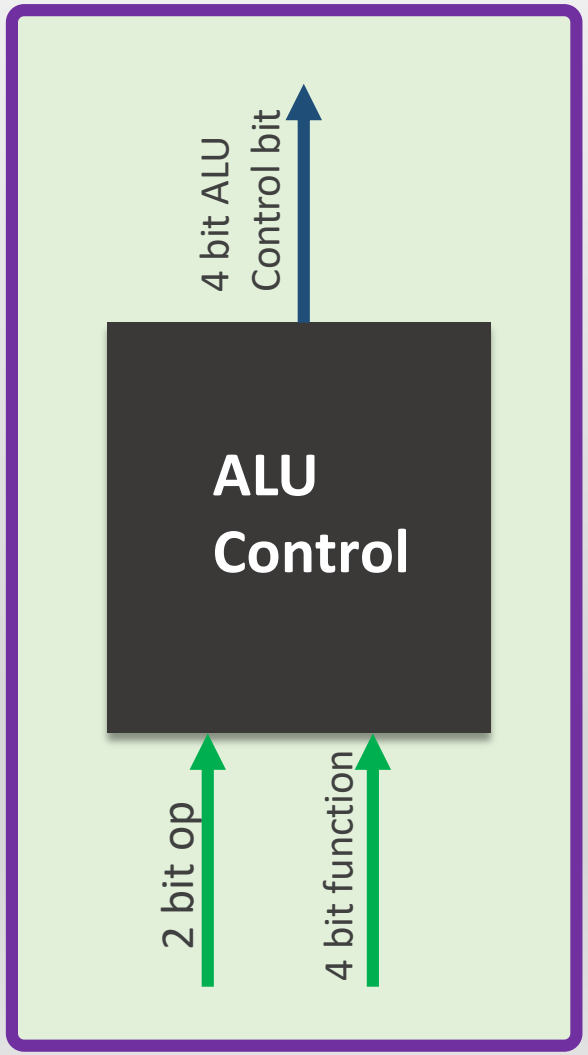


Fig: Control Unit

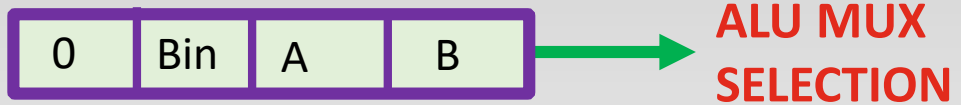
ALU Control

From ALU OP of control signal and Function to 4 Bit ALU control bit



OPCode	Format	ALU-OP	Function	Operation	ALU-op	Alu control bits
000	R	10	0000	Add	Add	0010
000	R	10	0010	Sub	Sub	0110
000	R	10	0100	And	And	0000
000	R	10	0101	Or	Or	0001
001	I	00	XXXX	LW	Add	0010
010	I	00	XXXX	SW	Add	0010
011	I	01	XXXX	BEQ	SUB	0110
101	I	01	XXXX	SLT	SUB	0110
100	J	XX	XXXX	JUMP	-	-

Alu control bits:



ALU MUX SELECTION

ALU CONTROL

ALU OP1 – A
ALU OP0 – B
FUN 3,2,1,0 = C,D,E,F

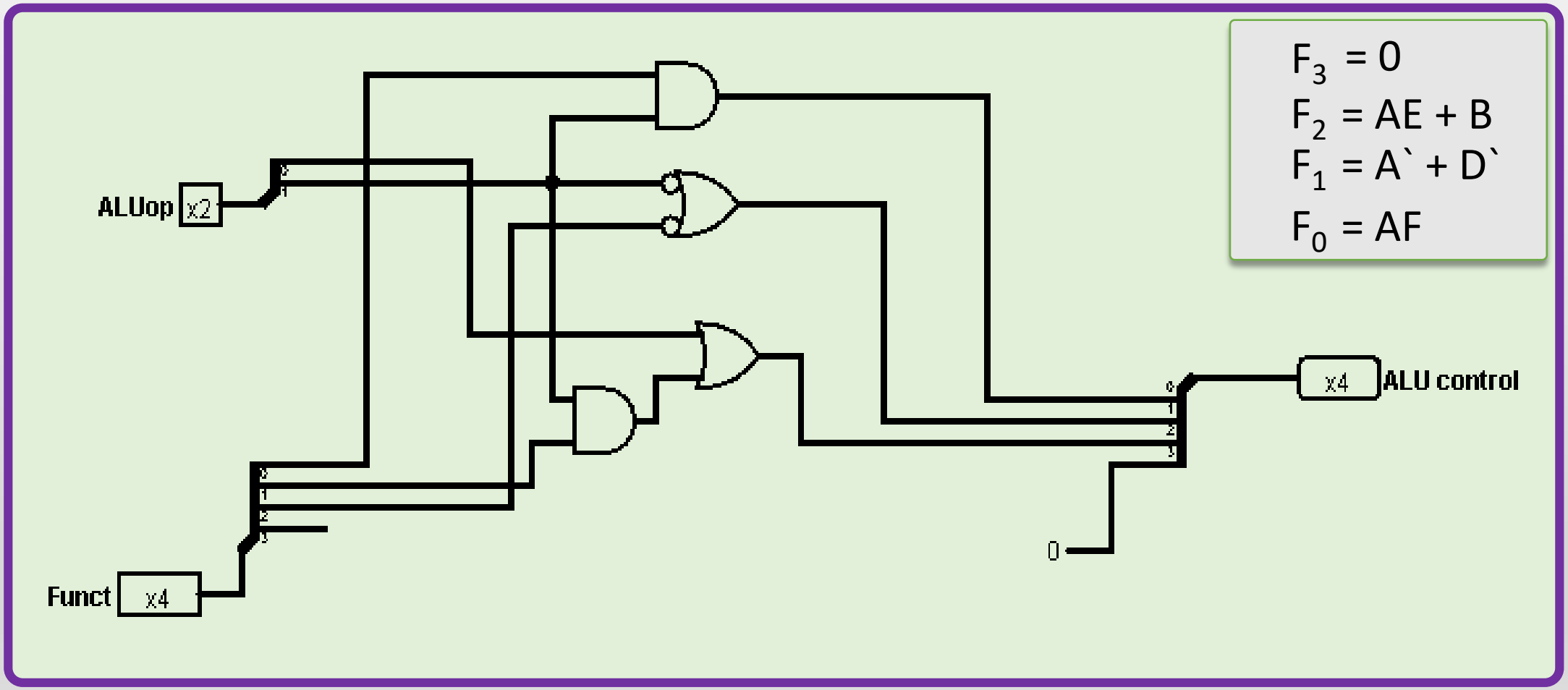
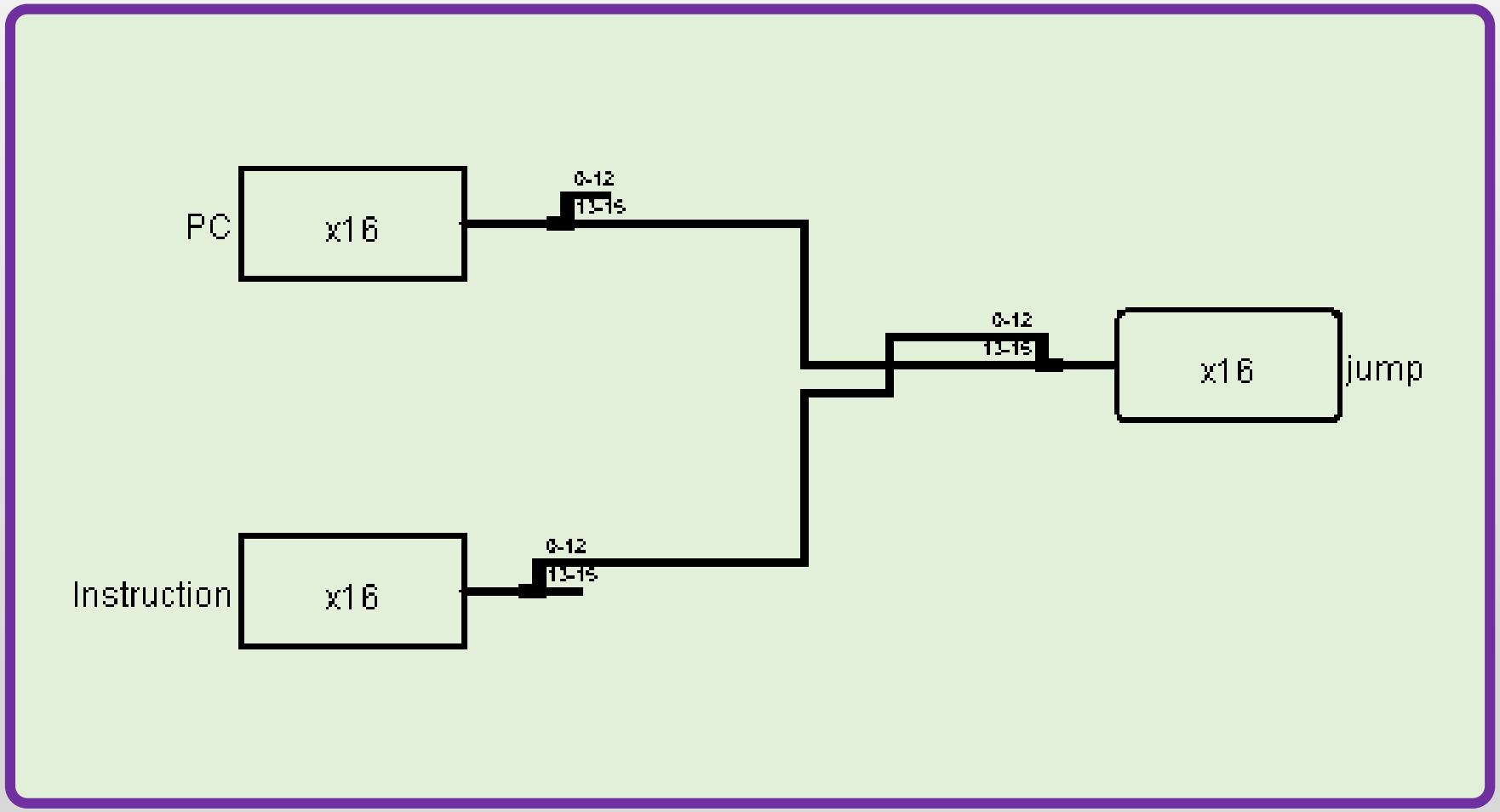


Fig: Alu Control

JUMP

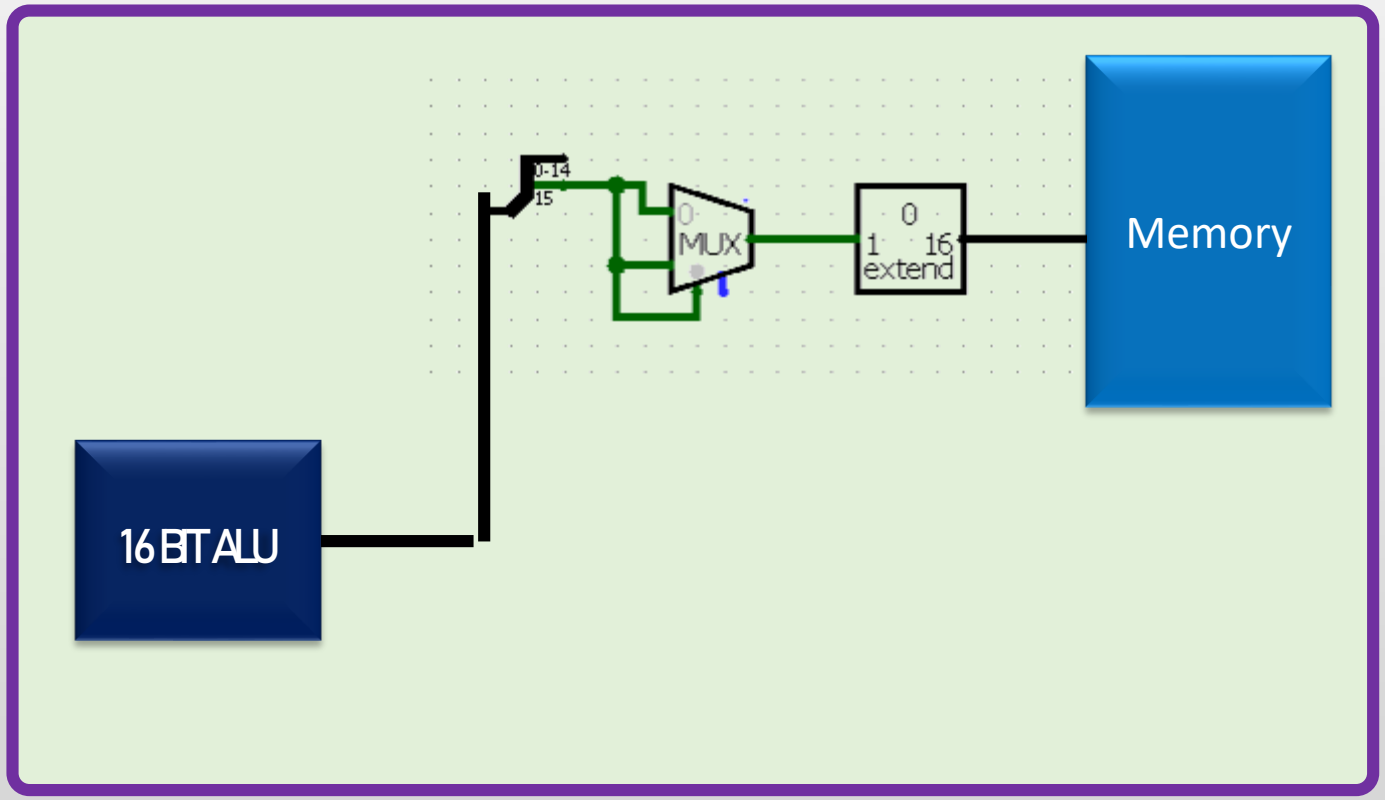


SET LESS THEN

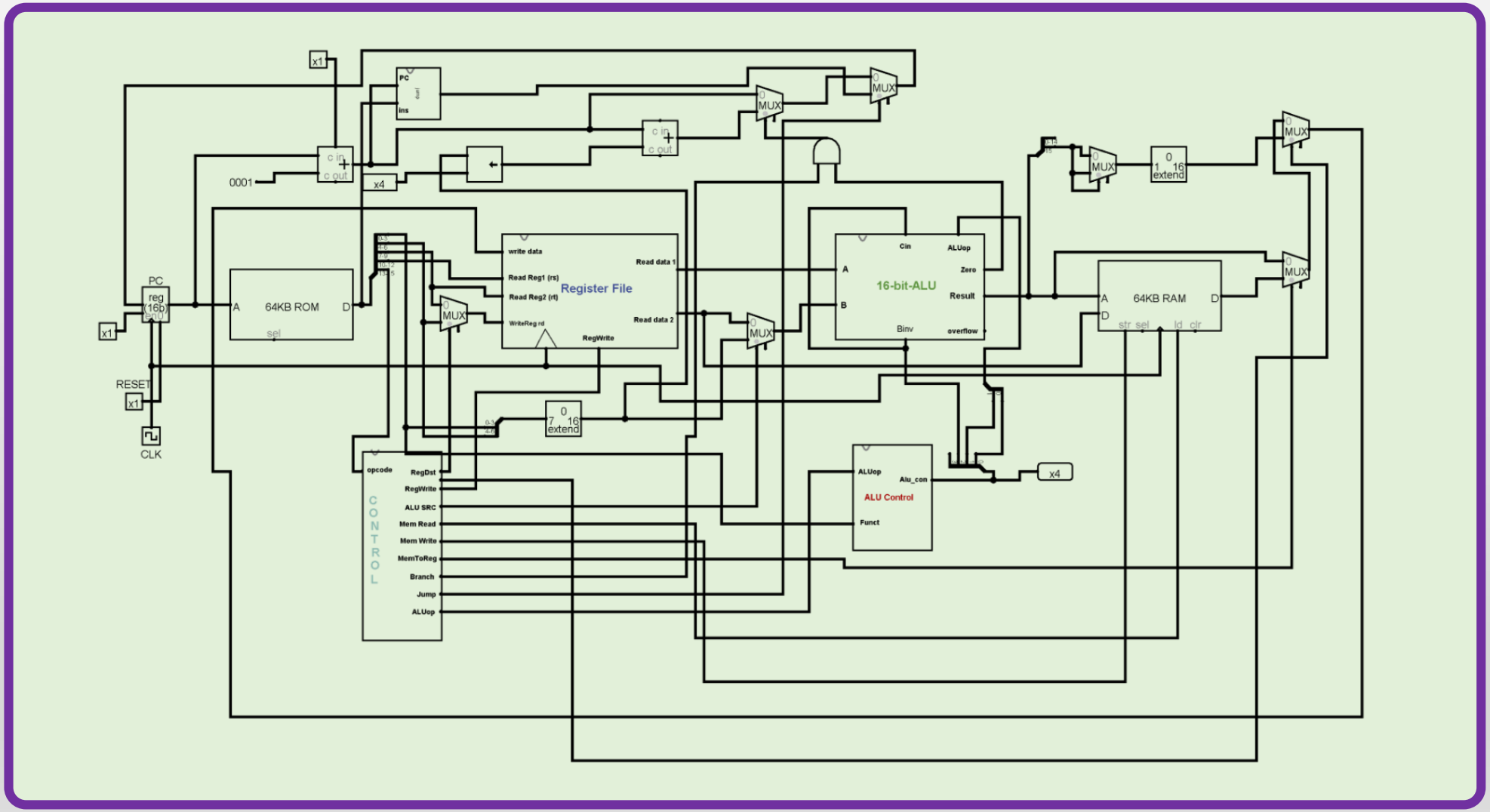
SLT $s3, $s2, 10

SLT(op)	Rs	Rd	7 bit Immediate value

```
If Rs – immediate< 0:
   Store 1 and extend to
16bit in RD
Else:
   Store 0 and extend to
16bit in RD
```



DATA PATH


x1
PC
ins
c in
c out
0001
x4
MUX
write data
Read Reg1 (rs)
Read Reg2 (rt)
WriteReg rd
Register File
Read data 1
Read data 2
RegWrite
PC
reg
16b
A
64KB ROM
D
sel
RESET
CLK
opcode
RegDst
RegWrite
ALU SRC
Mem Read
Mem Write
MemToReg
Branch
Jump
ALUop
CONTROL
0
7
16
extend
Cin
ALUop
A
B
16-bit-ALU
Zero
Result
Binv
overflow
ALUop
Alu_con
ALU Control
Funct
1
16
extend
64KB RAM
str sel
ld clr

Problem

Find the sum of 10 decimal number using loop