EE 224 Project

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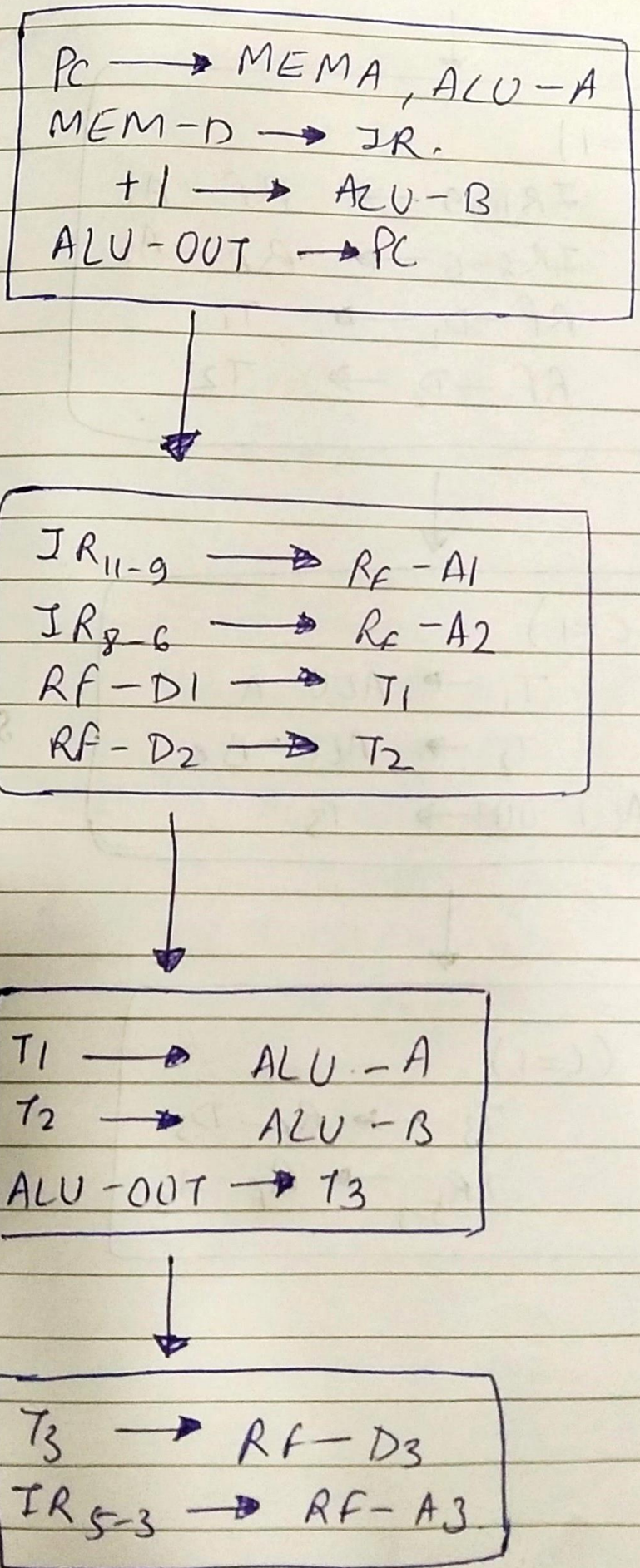
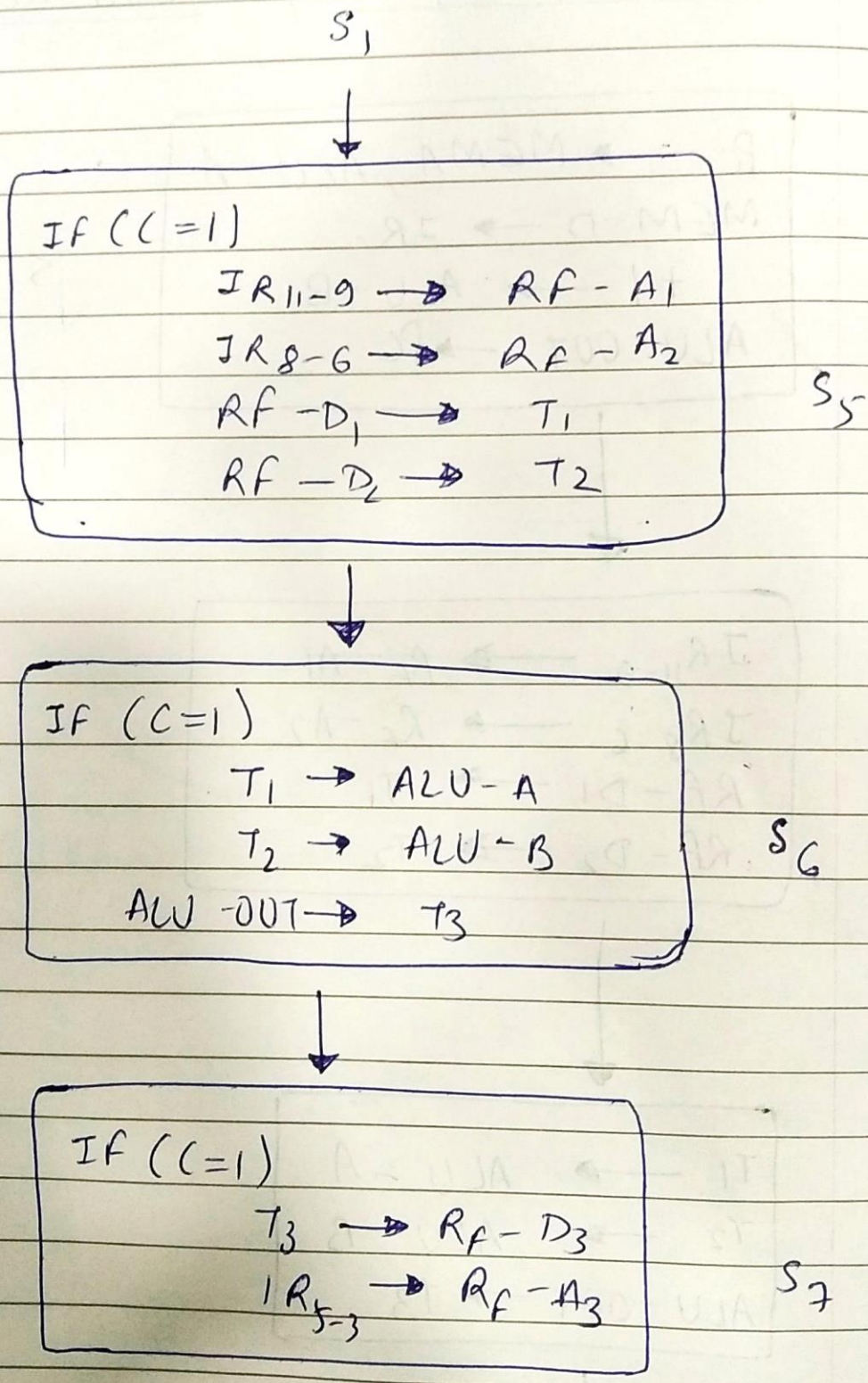
1. ADD R_C, R_A, R_B / 5. NDU R_C, R_A, R_B



2. ADC RC, RA, RB / 6. NDC RC, RA, RB



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8. ADZ R_C, R_A, R_B | 7. NDZ $R_A R_B R_C$

S_1

↓

If (Z = 1)

- $IR_{11-9} \rightarrow RF - A_1$
- $IR_{8-6} \rightarrow RF - A_2$
- $RF - D_1 \rightarrow T_1$
- $RF - D_2 \rightarrow T_2$

S_8

↓

If (Z = 1)

- $T_1 \rightarrow ALU - A$
- $T_1 \rightarrow ALU - B$
- $ALU-OUT \rightarrow T_3$

S_9

↓

If (Z = 1)

- $T_3 \rightarrow RF - D_3$
- $IR_{5-3} \rightarrow RF - A_3$

S_{10}

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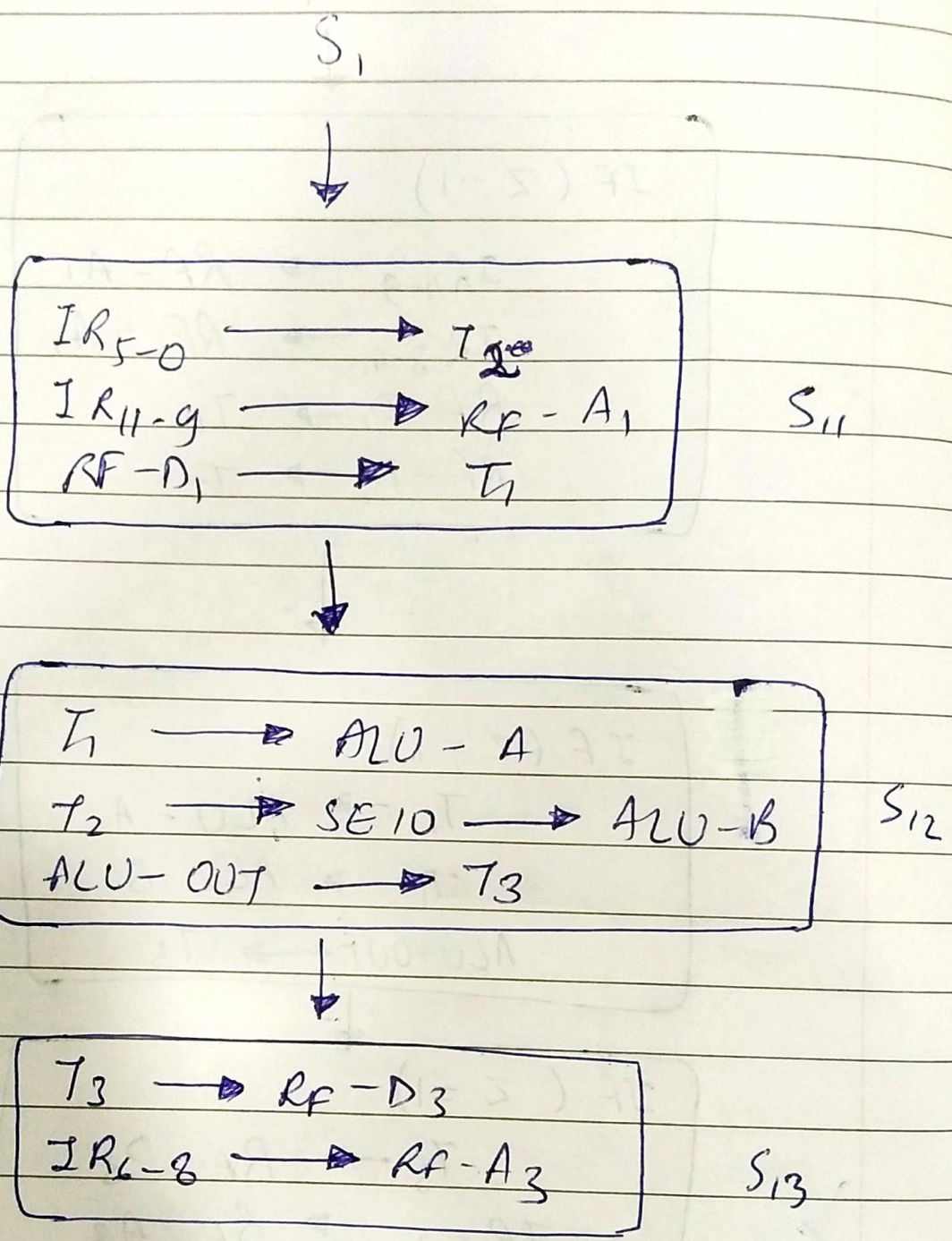
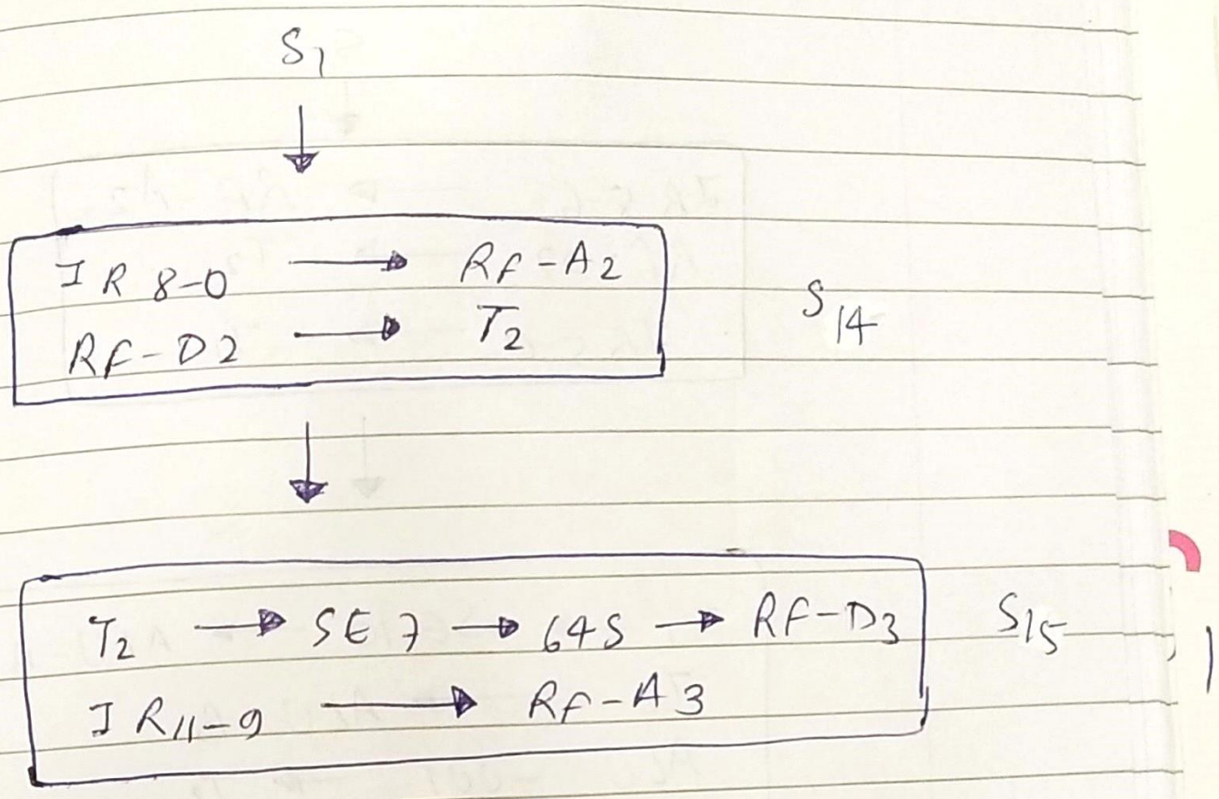
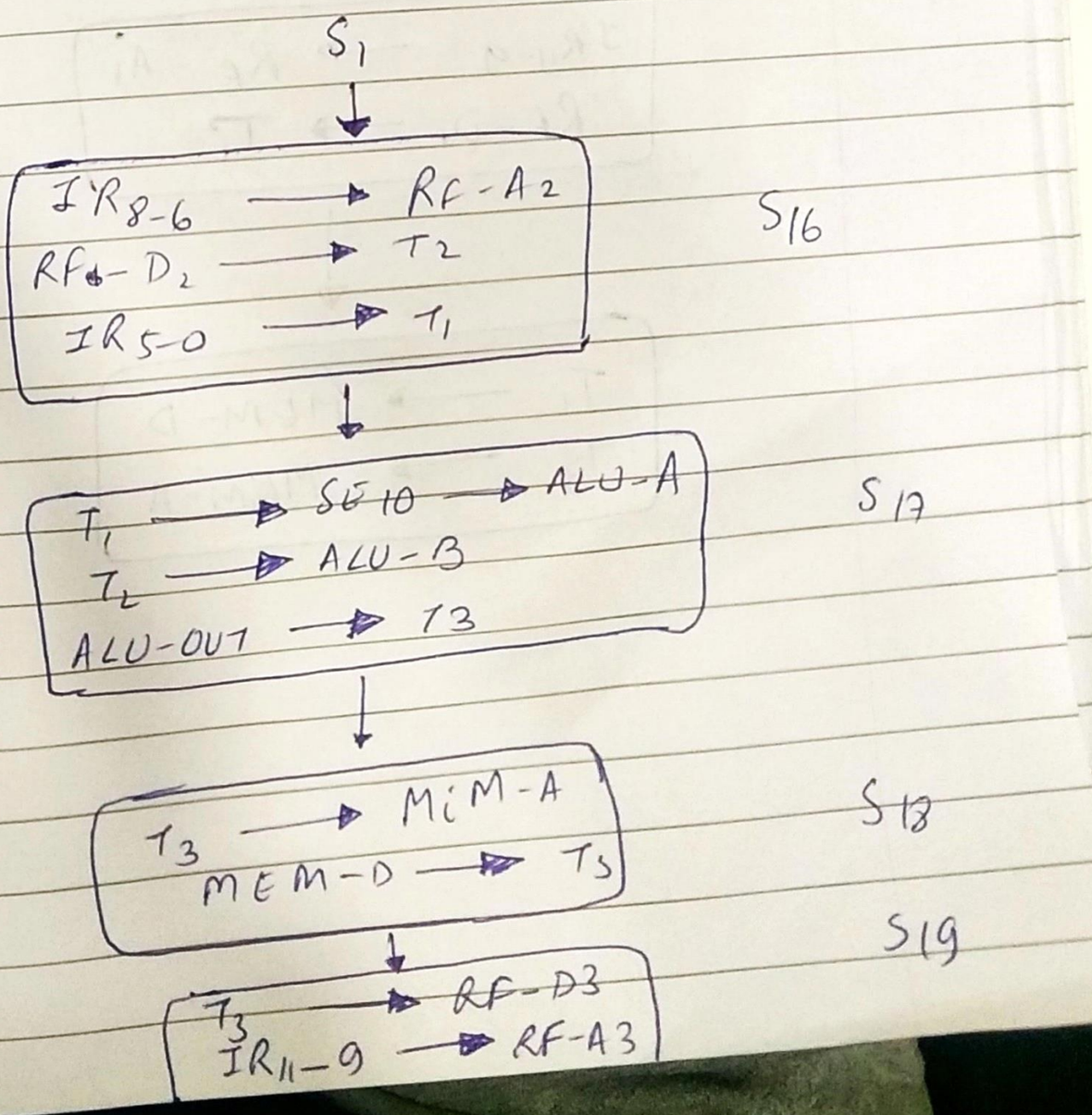
4. ADI R_B, R_A, IMM6



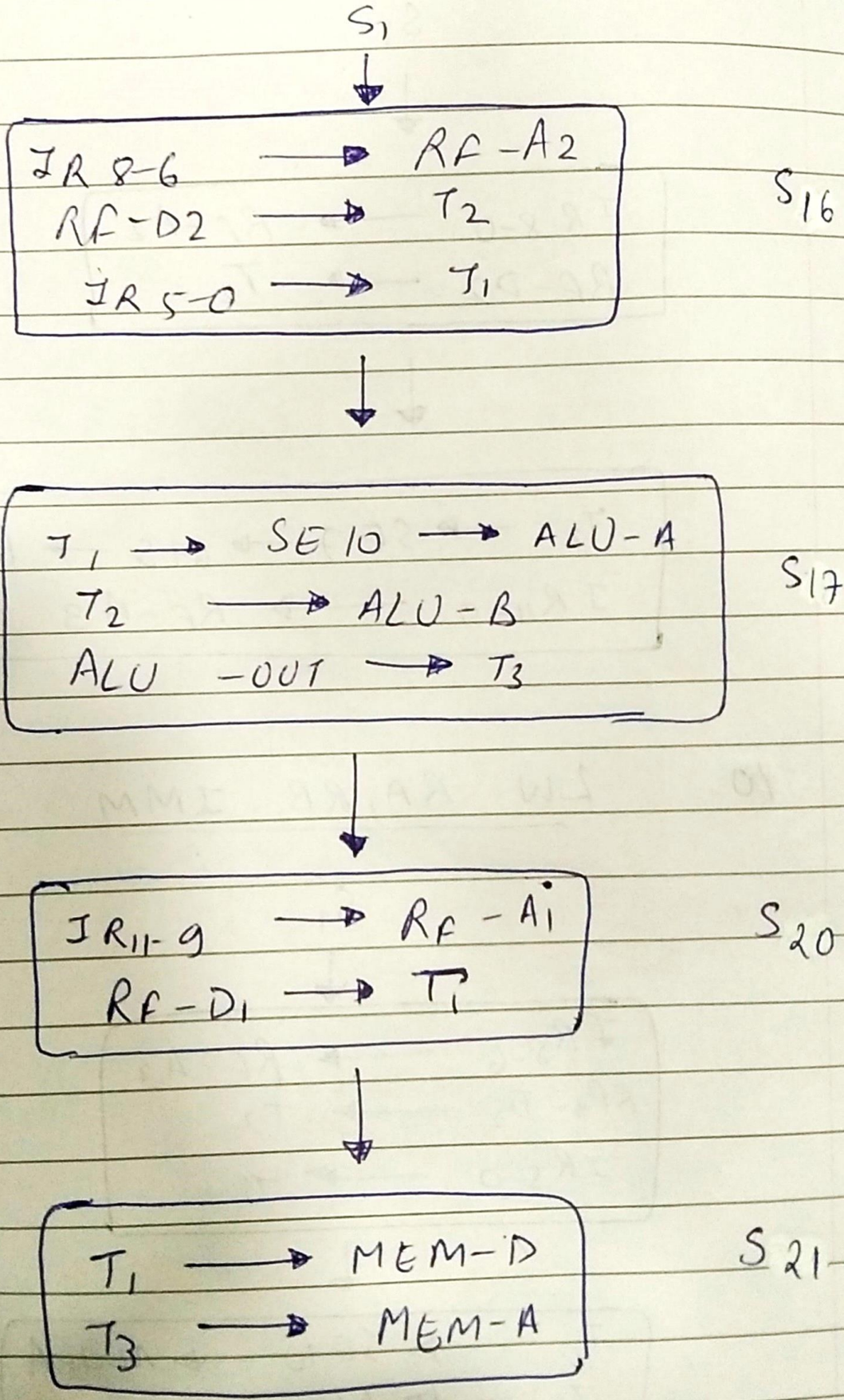
8. LHI RA, IMM



9. LW RA, RB, IMM



10. SW RA, RB, IMM



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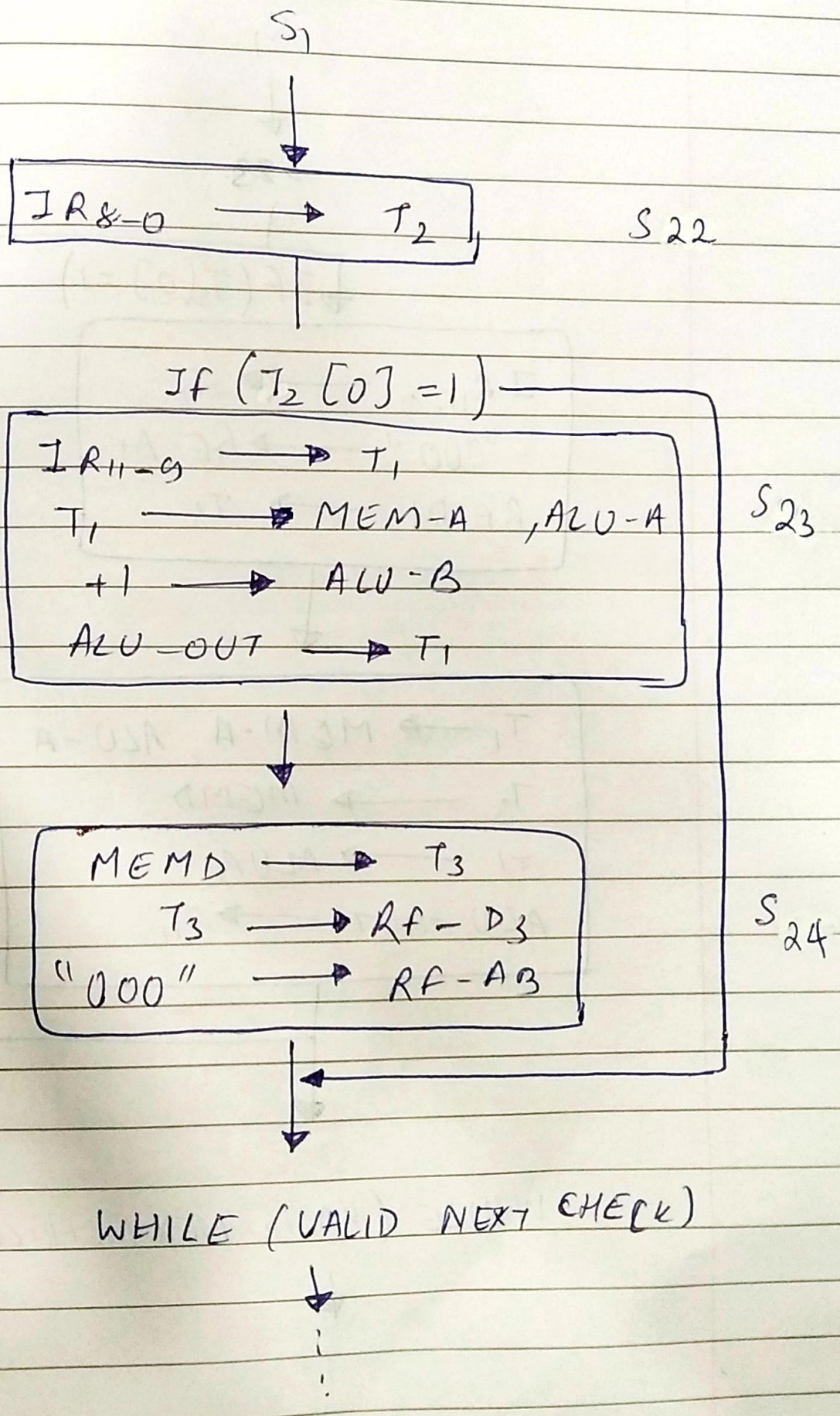
11. LM RA, IMM



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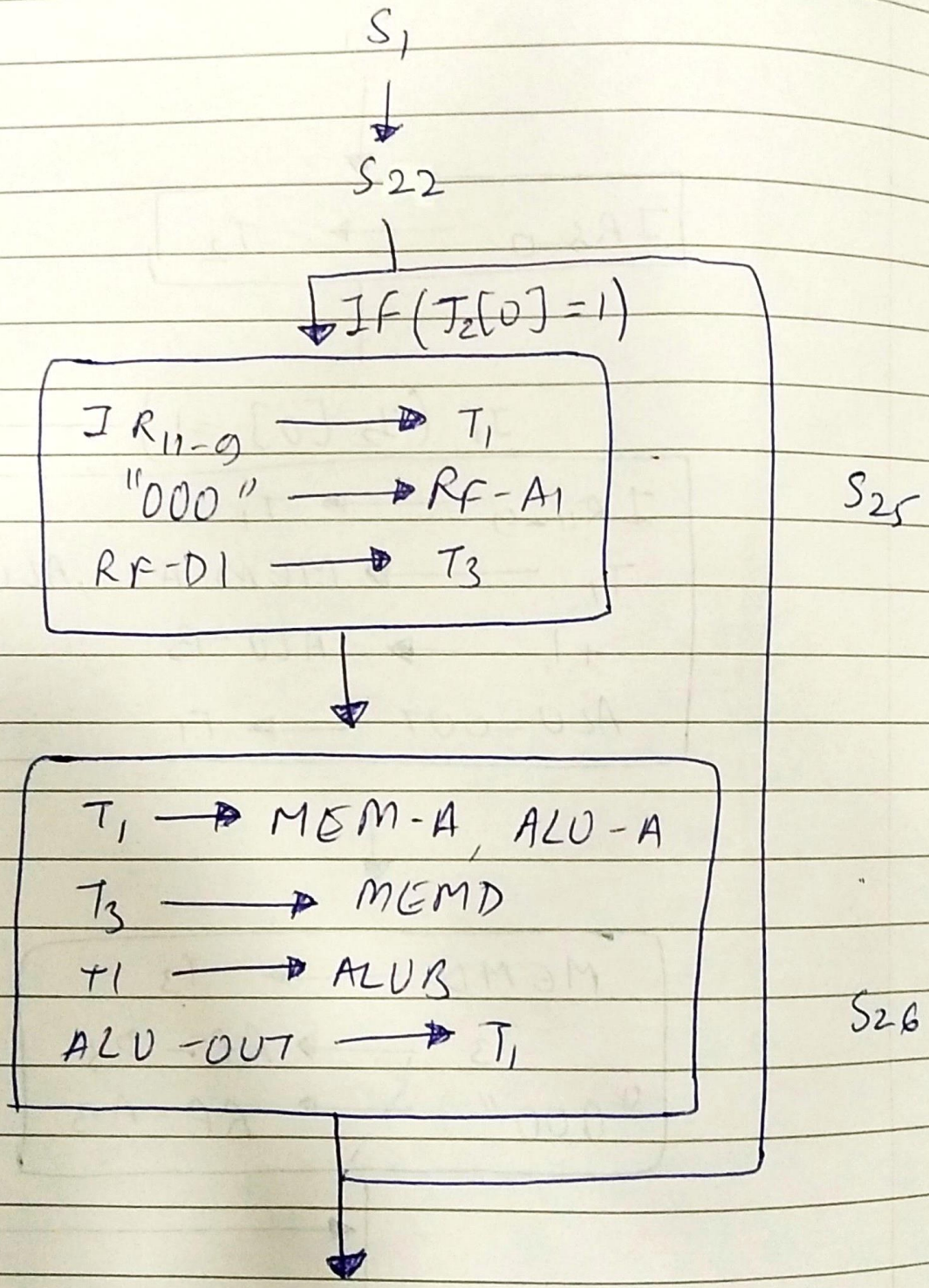
12 SM RA, IMM



WHILE (VALID NEXT CHECK)

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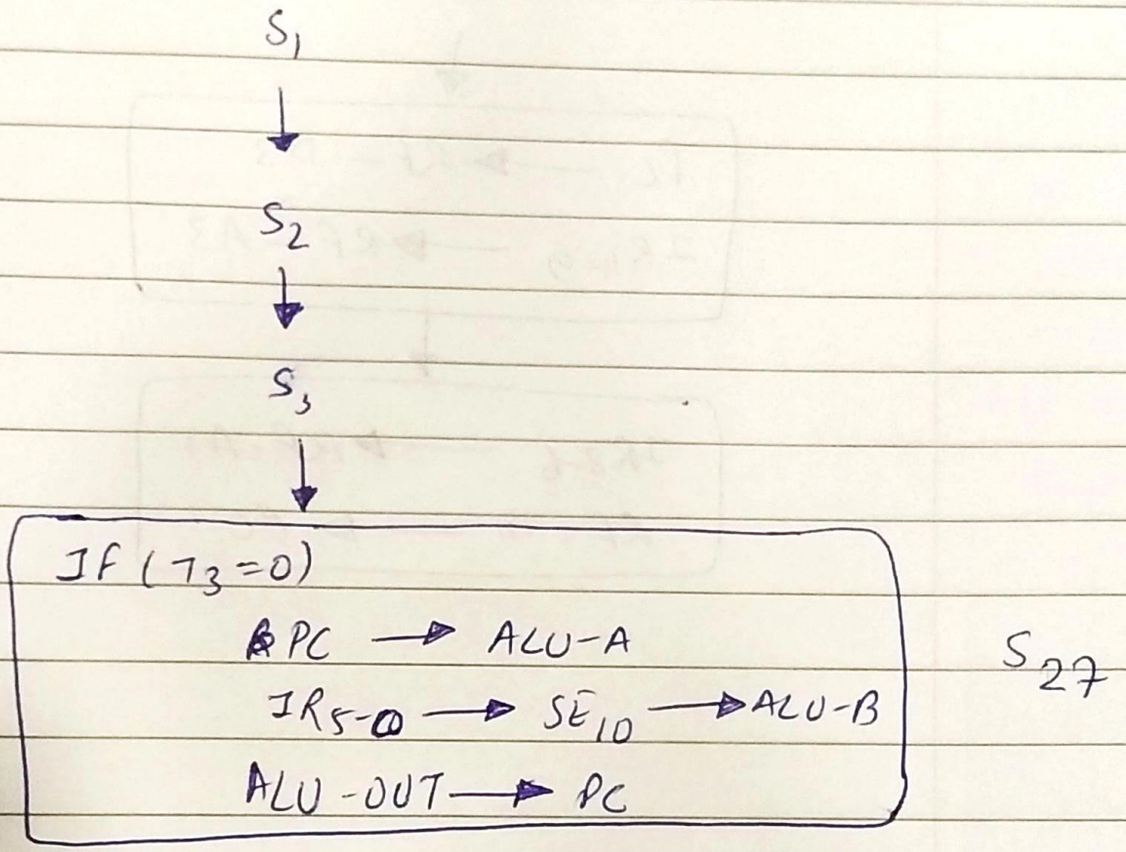
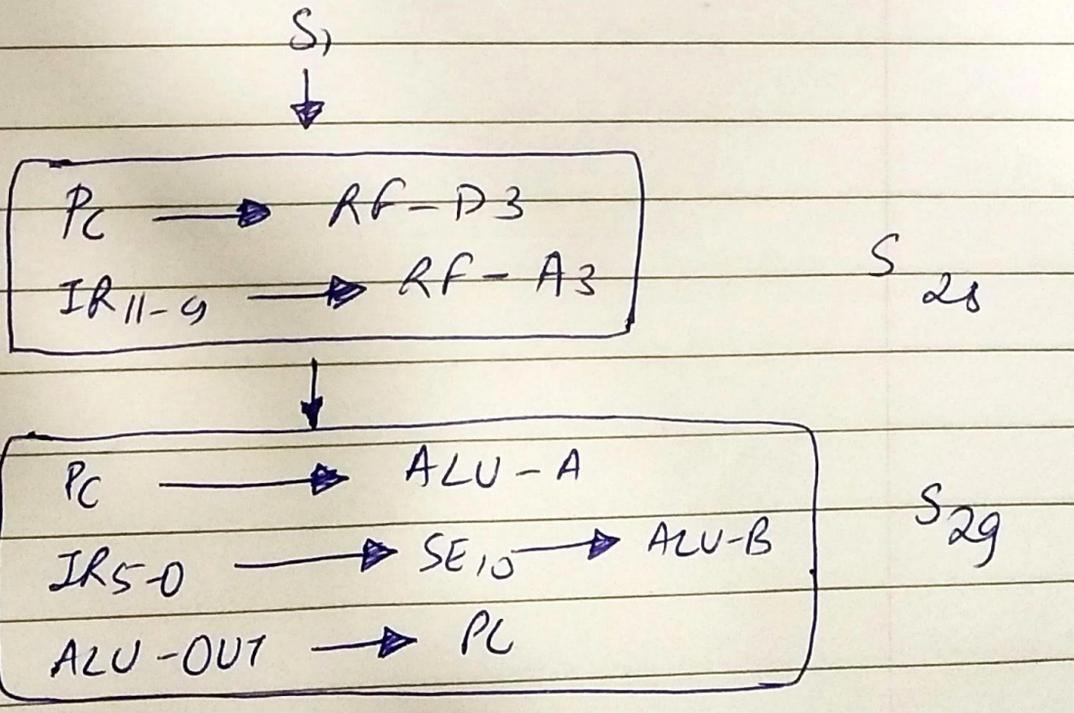
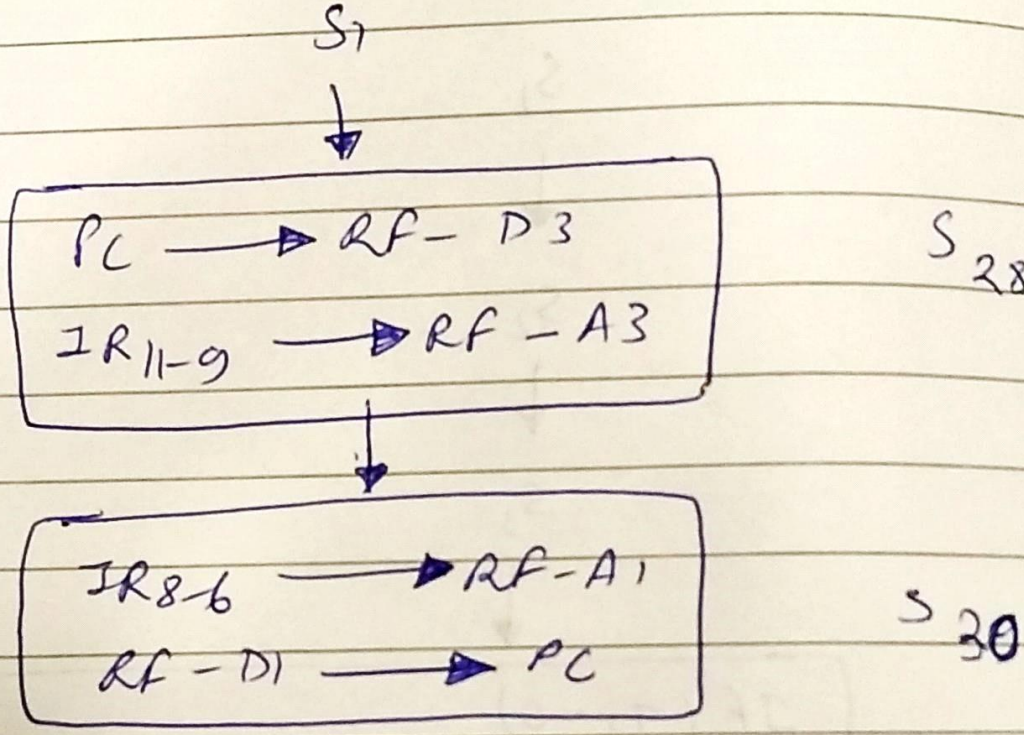
13 BEQ, RA, RB, IMM



14 JAL RA, IMM



15 JLR RA, RB



① ALU

The ALU performs basic operations like OR, XOR, AND, etc. by taking two inputs ALU-A & ALU-B of 16 bits each. It's output is represented by ALU-out. The instructions are given directly & multiple control lines are used to control the activities inside ALU.

② Temporary Registers (T_1, T_2, T_3)

Temporary registers store the values for future use. They are all of 16 bits each.

③ MEMORY (MEM)

Memory stores various data at particular locations called addresses. We can access data by providing the address as input (16-bit) through MEM-A & accessing it through MEM-D. We can also store data in memory by providing data to be stored in MEM-D & address in MEM-A.

④ SE7, SE10 (SIGN EXTENDER)

The sign extender places the corresponding number of zeroes (7 & 10 resp) to the left of input so as to make it a 16-bit input.

(5) REGISTER FILE (RF)

It include all the registers (R_0 to R_7). It has 3 address selection lines (A_1, A_2, A_3) & 3 data output lines D_1, D_2, D_3. To access a values inside register, we have to pass the address of that register in one of the two address lines A_1 or A_2. and the corresponding output is recieved at D_1/D_2.

To store a data in a register the data is sent to the D_3 selection line & the address of the register is sent as input in A_3.

R_7 register stores the values of Program Counter (PC)

(6) INSTRUCTION REGISTER (IR)

IR is a special purpose register which is used to recieve the 16 bits of intruction. There are three different types of Intruction format (R, I & J type) which allot bits differently to various operands.

Following is the bit distribution.

R - type

R_C → IR_{5-3}

R_B → IR_{8-6}

R_A → IR_{11-9}

I - type

IMM → IR_{0-5}

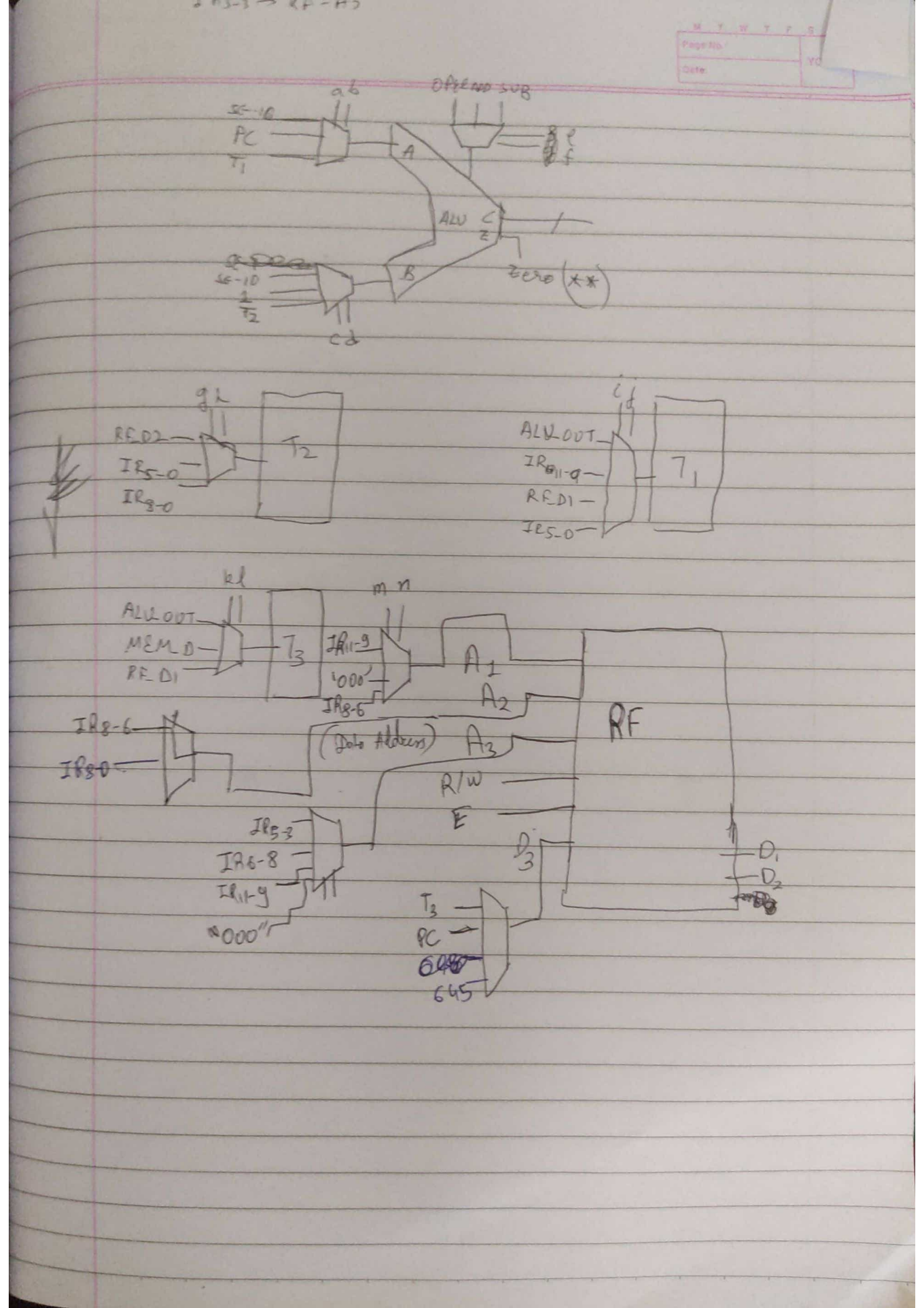
R_B → IR_{8-6}

R_A → IR_{11-9}

J - type

JMM → IR_{8-0}

R_A → IR_{11-9}


a b
Offset SUB
IR-10
PC
T1
A
B
ALU
C
Z
Zero
(**)
IR-10
1
T2
c d
g h
RF_D2
IR5-0
IR8-0
T2
e
f
ALU_OUT
IR11-9
RF_D1
IR5-0
T1
c d
k l
ALU_OUT
MEM_D
RF_D1
T3
m n
IR11-9
'000'
IR8-6
A1
A2
A3
(Data Address)
R/W
E
RF
D1
D2
IR8-6
IR8-0
IR5-3
IR6-8
IR11-9
"000"
T3
PC
645
D3