VLSI SYSTEMS AND ARCHITECTURE

2021-22

Lecture 8

Hardware Flowcharts Part-3

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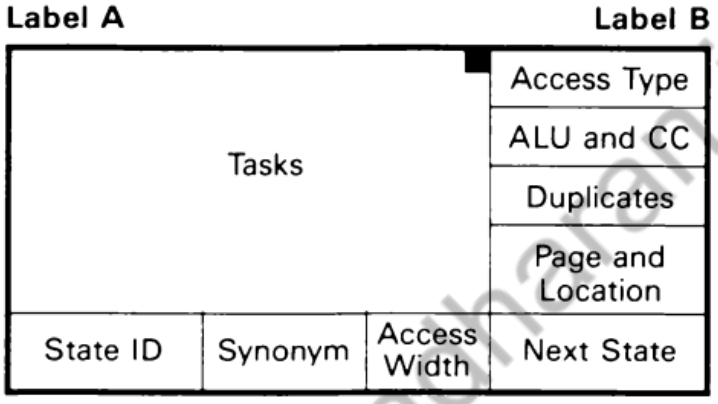
Hardware Flowchart

State Identifiers



Sequence Label A
Operation format or instruction type

Example: **rx op ry→ry**
rx op mem→mem

Sequence Label B
Operation sequence or address mode sequence

Example: **ADD, AND, SUB**
Register Indirect
Indexed

Access Type

DR	Data Read
DW	Data Write
IR	Instruction Read
NA	No Access

ALU and CC (ALU function and Condition Code setting)

Example: ADD, AND, or OP condition codes

S	Set
N	Not set
X	Don't care

Duplicates
(Not used in MIN)

Page and Location
(Not used in MIN)

Next State

BC	Branch Conditionally
IB	Instruction Branch
SB	Sequence Branch
State ID	Direct transfer

Access Width
(Not used in MIN)

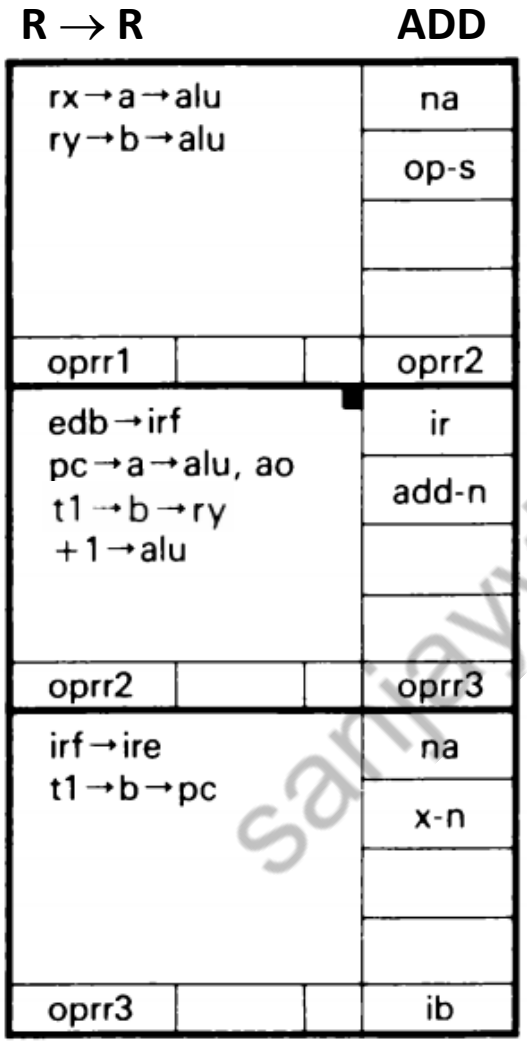
Synonym
(Not used in MIN)

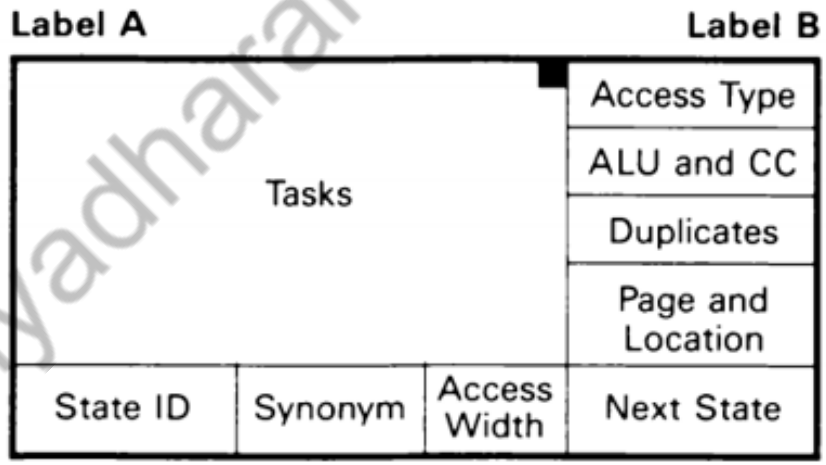
State ID
State Identification

■ indicates external bus activity

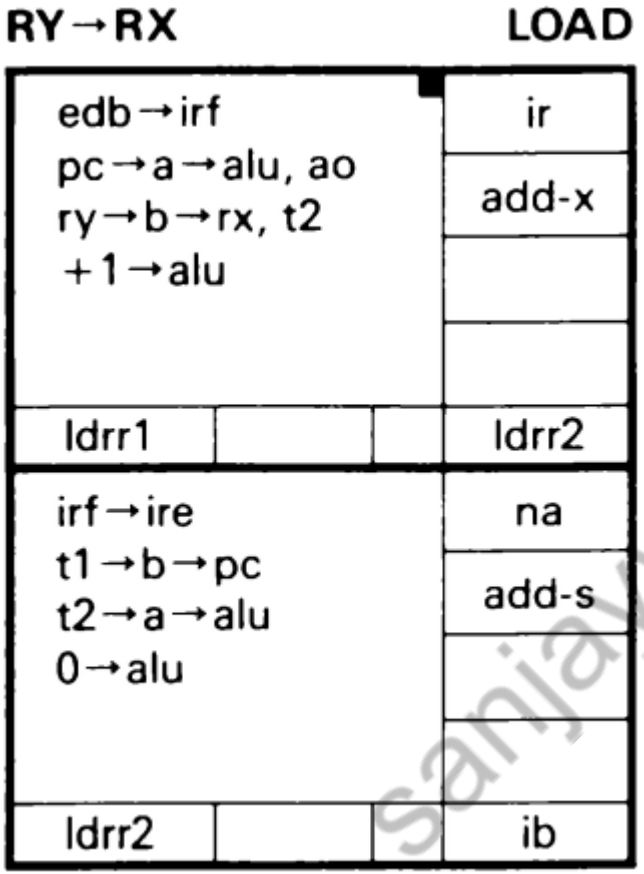
Hardware Flowchart

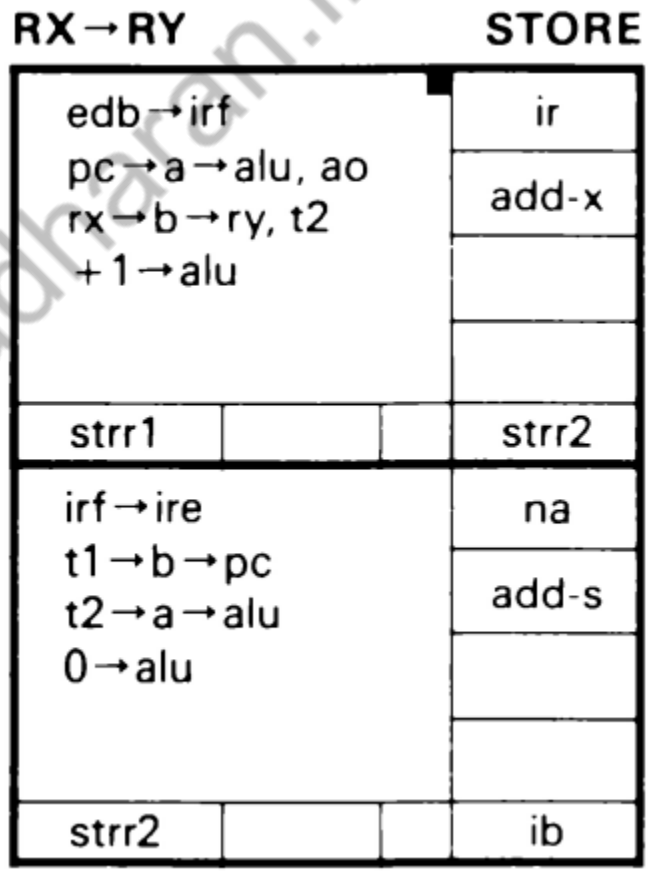
Example 1: ADD RX AR RY





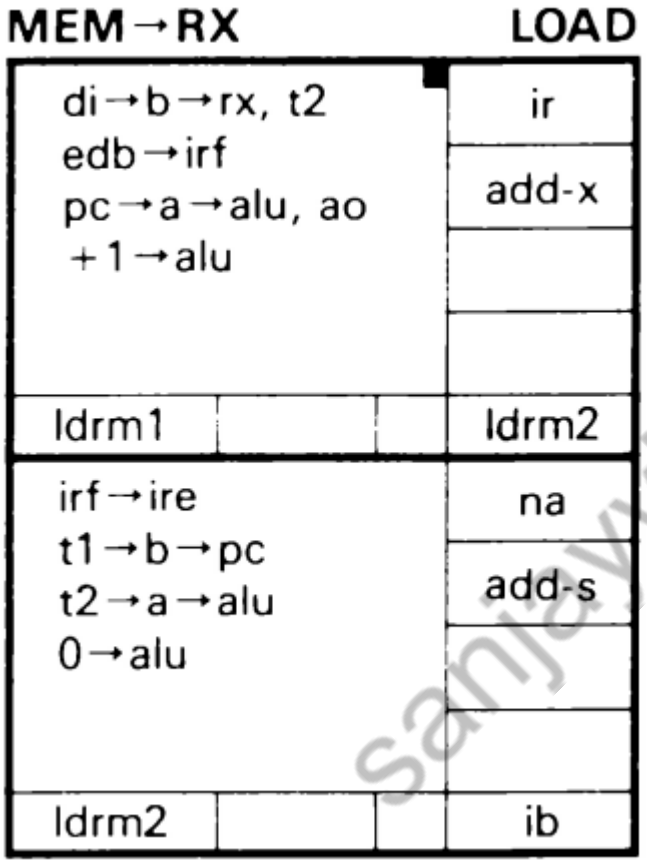
Hardware Flowchart

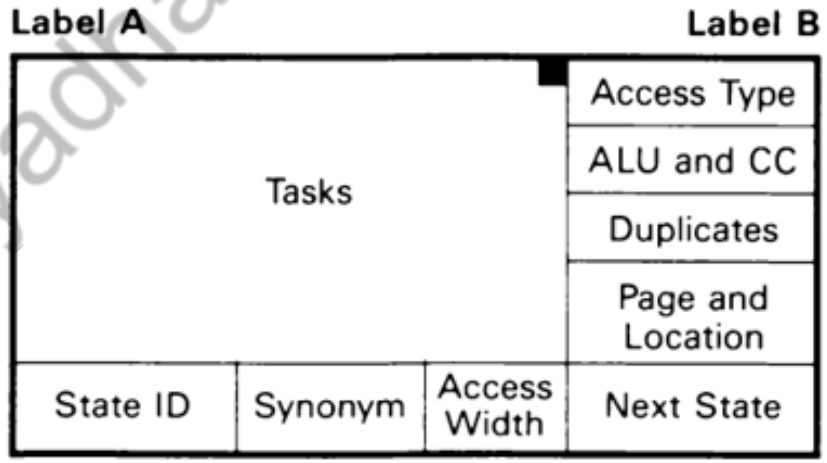




Hardware Flowchart

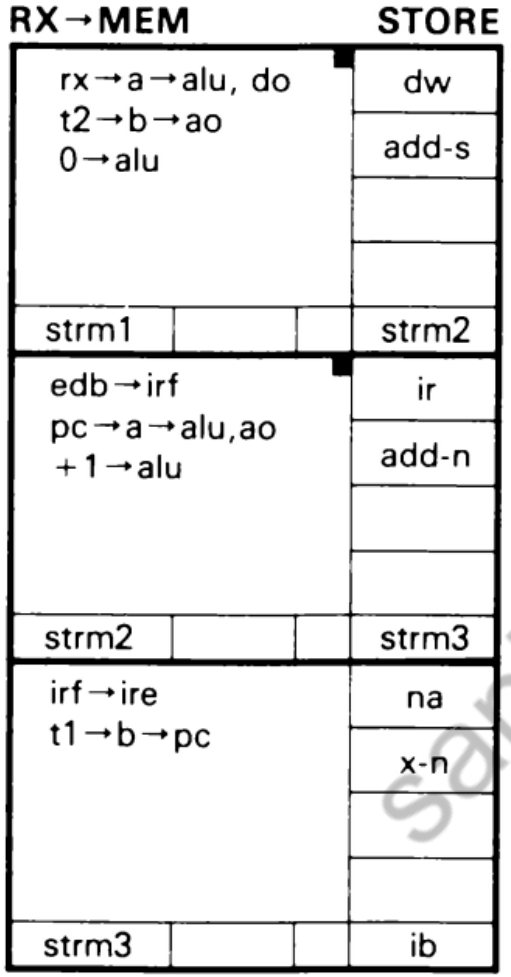
Execution Sequences with a Memory Operand Reference

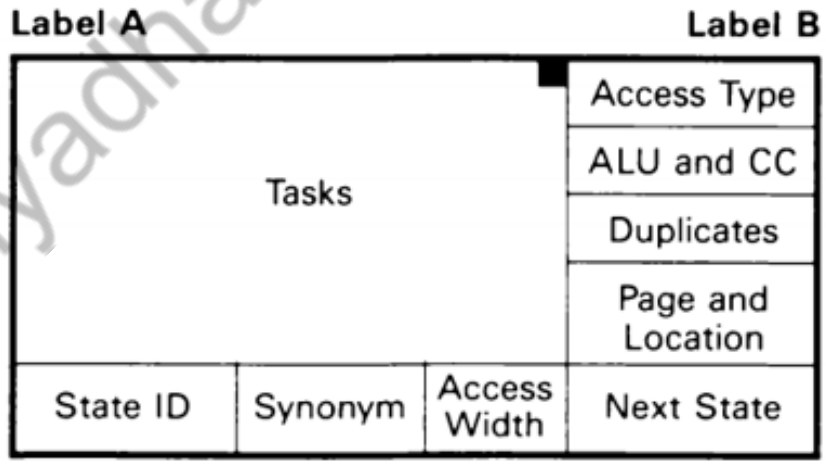




Hardware Flowchart

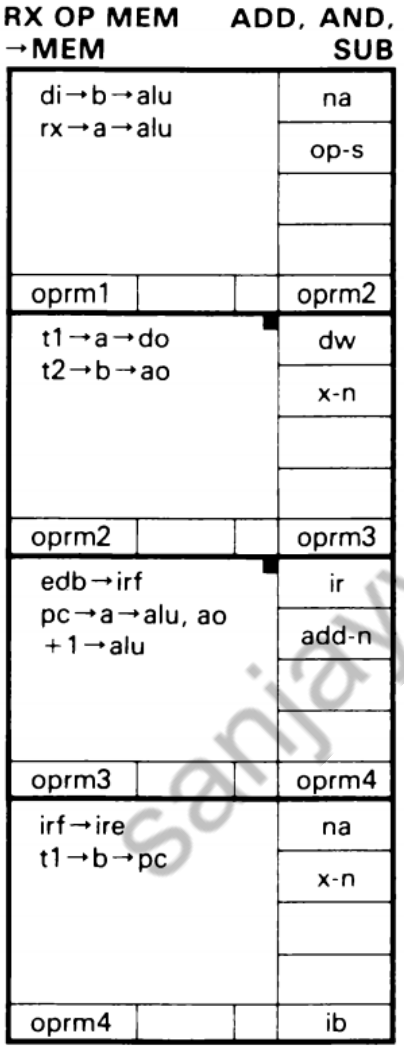
Execution Sequences with a Memory Operand Reference

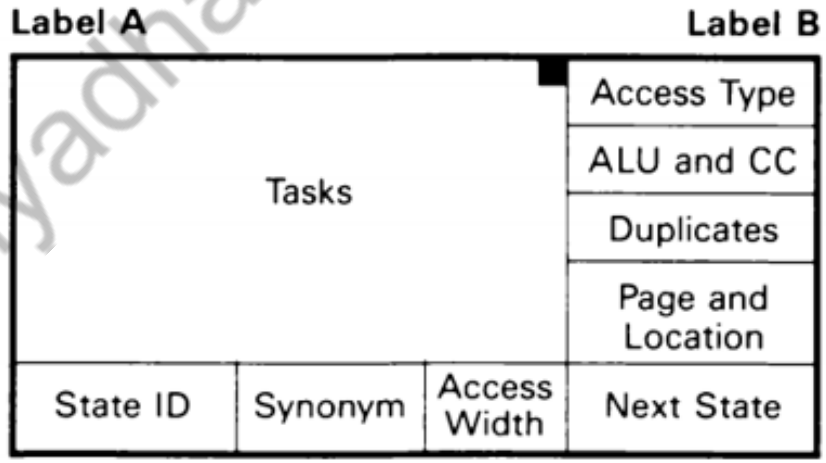




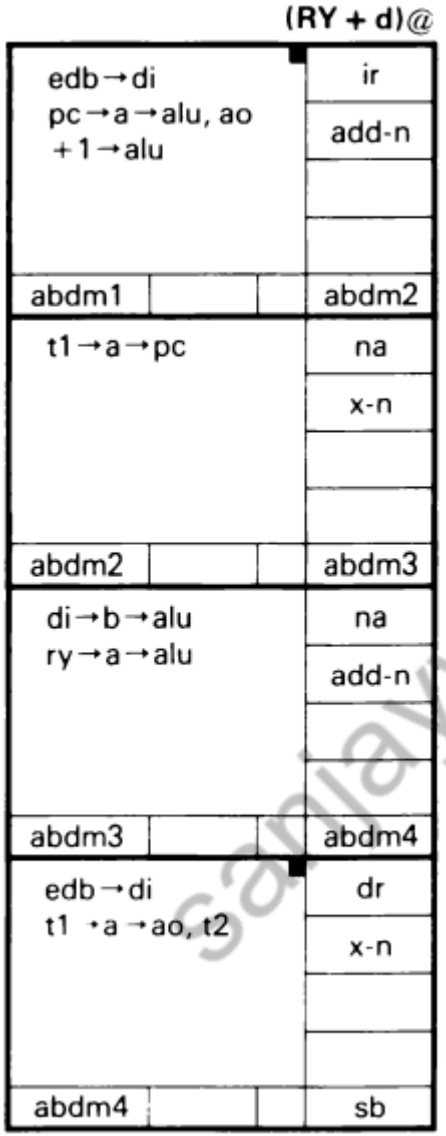
Hardware Flowchart

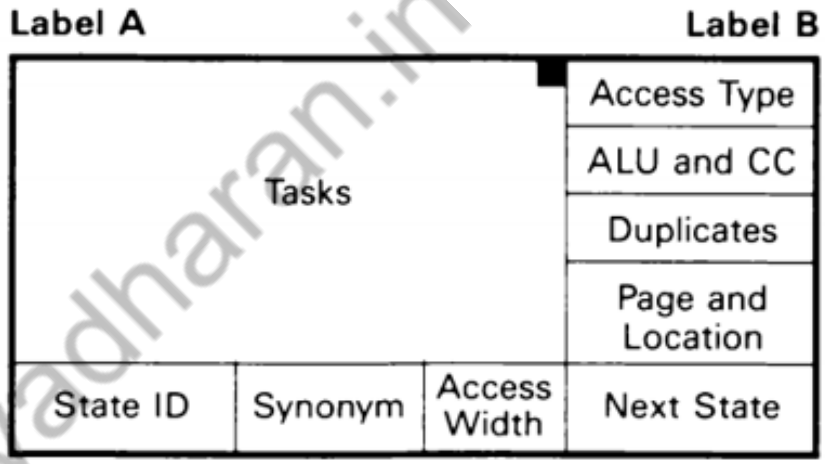
Execution Sequences with a Memory Operand Reference





Hardware Flowchart





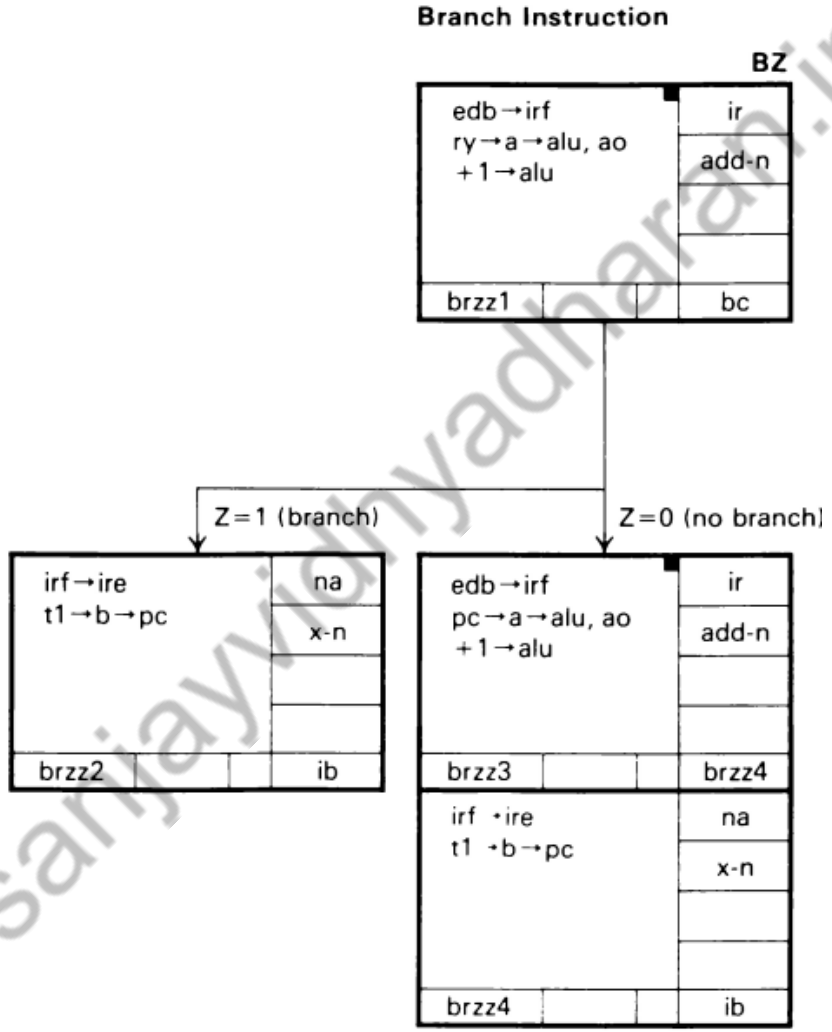
Next State

BC	Branch Conditionally
IB	Instruction Branch
SB	Sequence Branch
State ID	Direct transfer

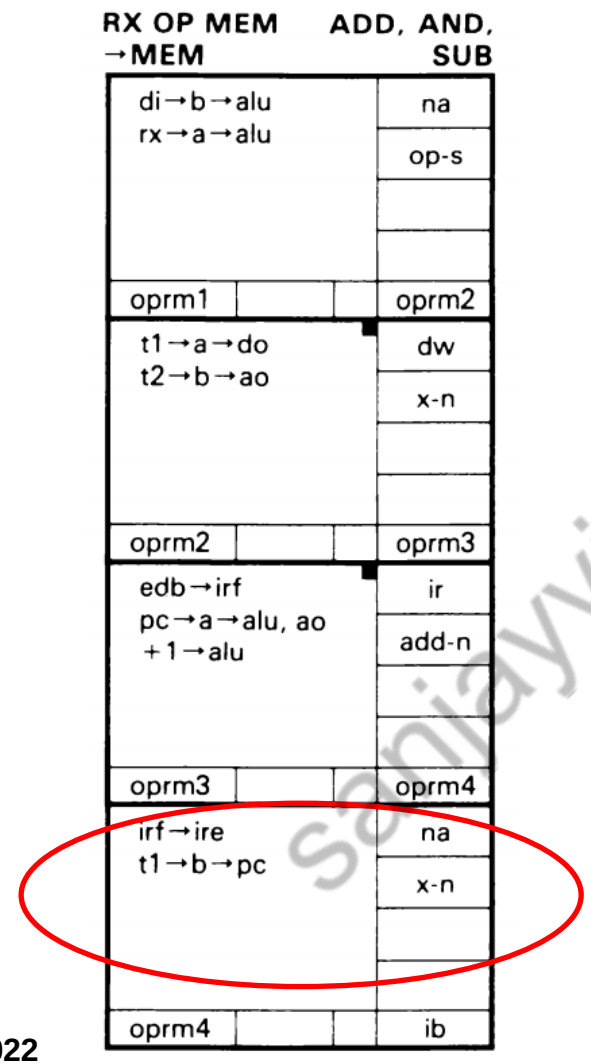
Hardware Flowchart

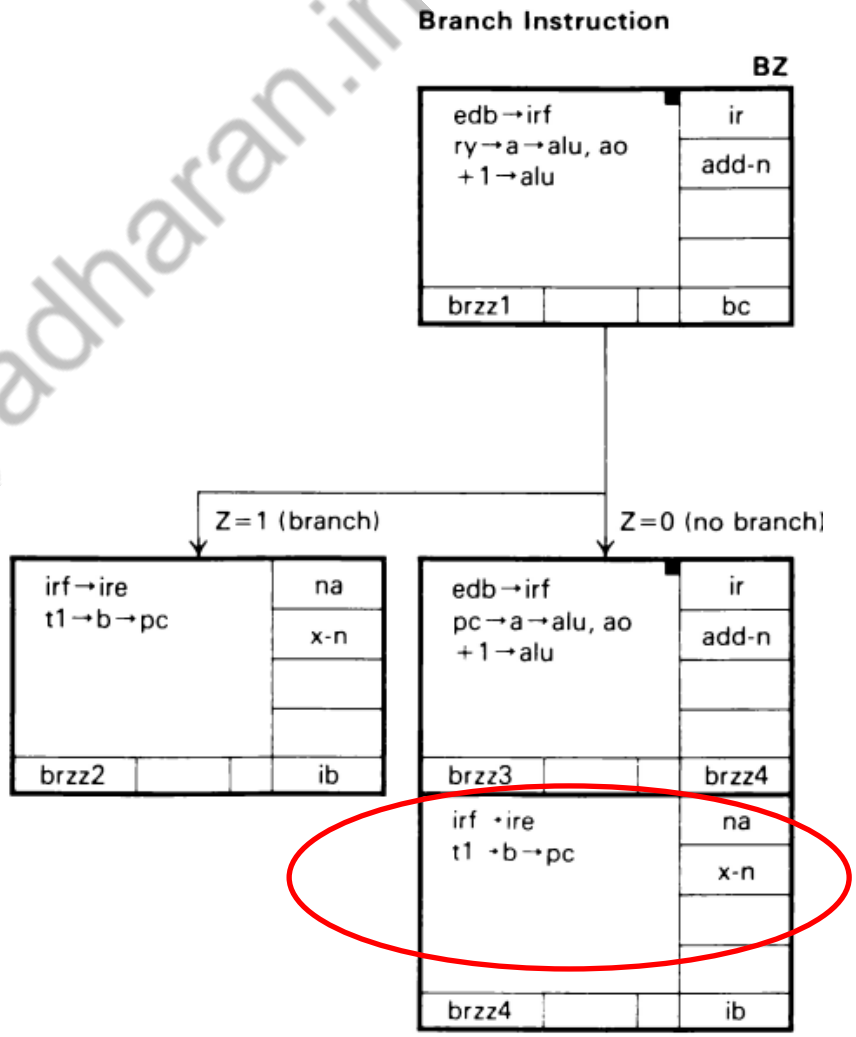
Z : Zero Flag

JZ (RY)



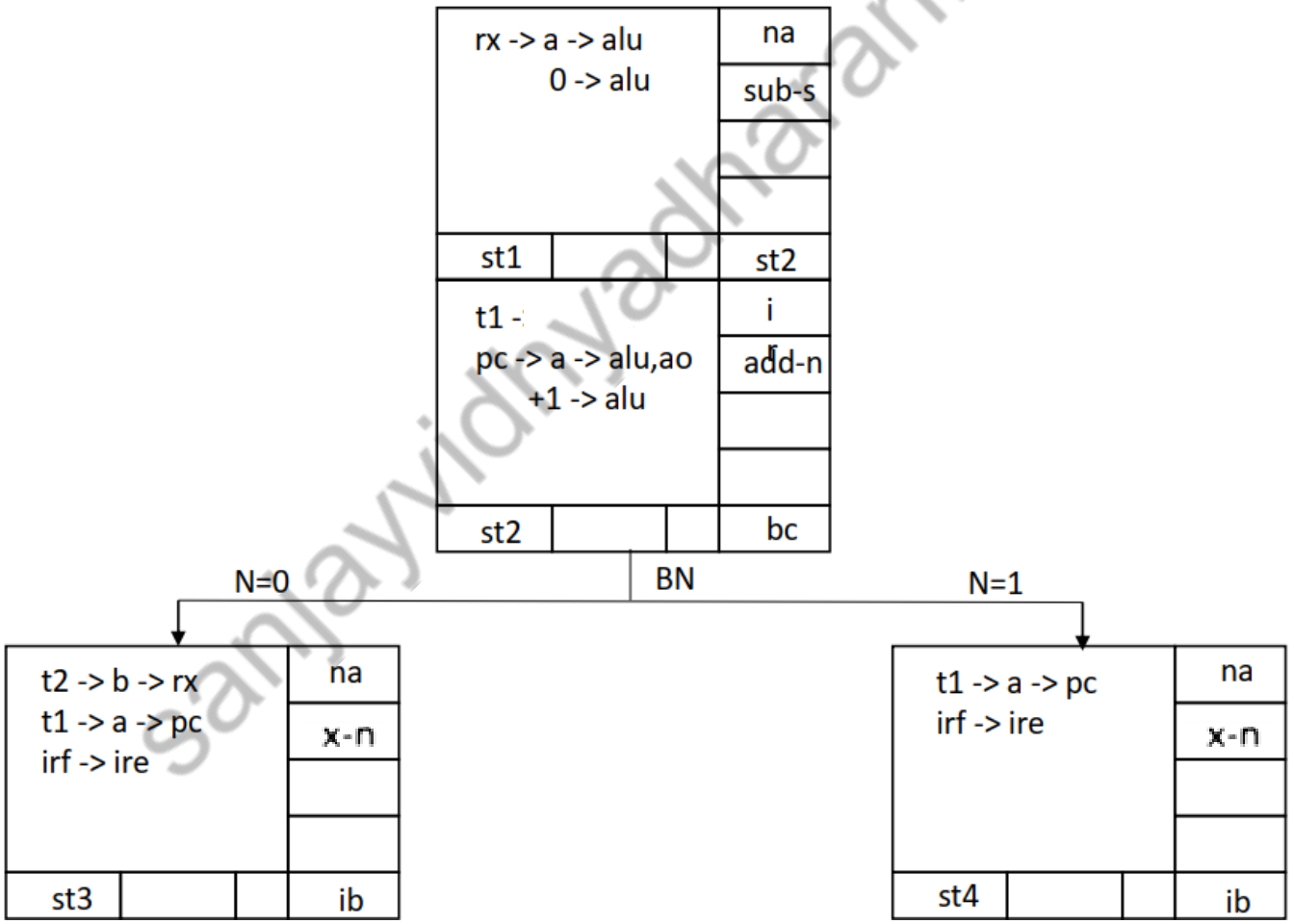
Hardware Flowchart





Hardware Flowchart

MAG RX: This instruction examines the number stored in register RX and stores back the magnitude value of the number in register RX



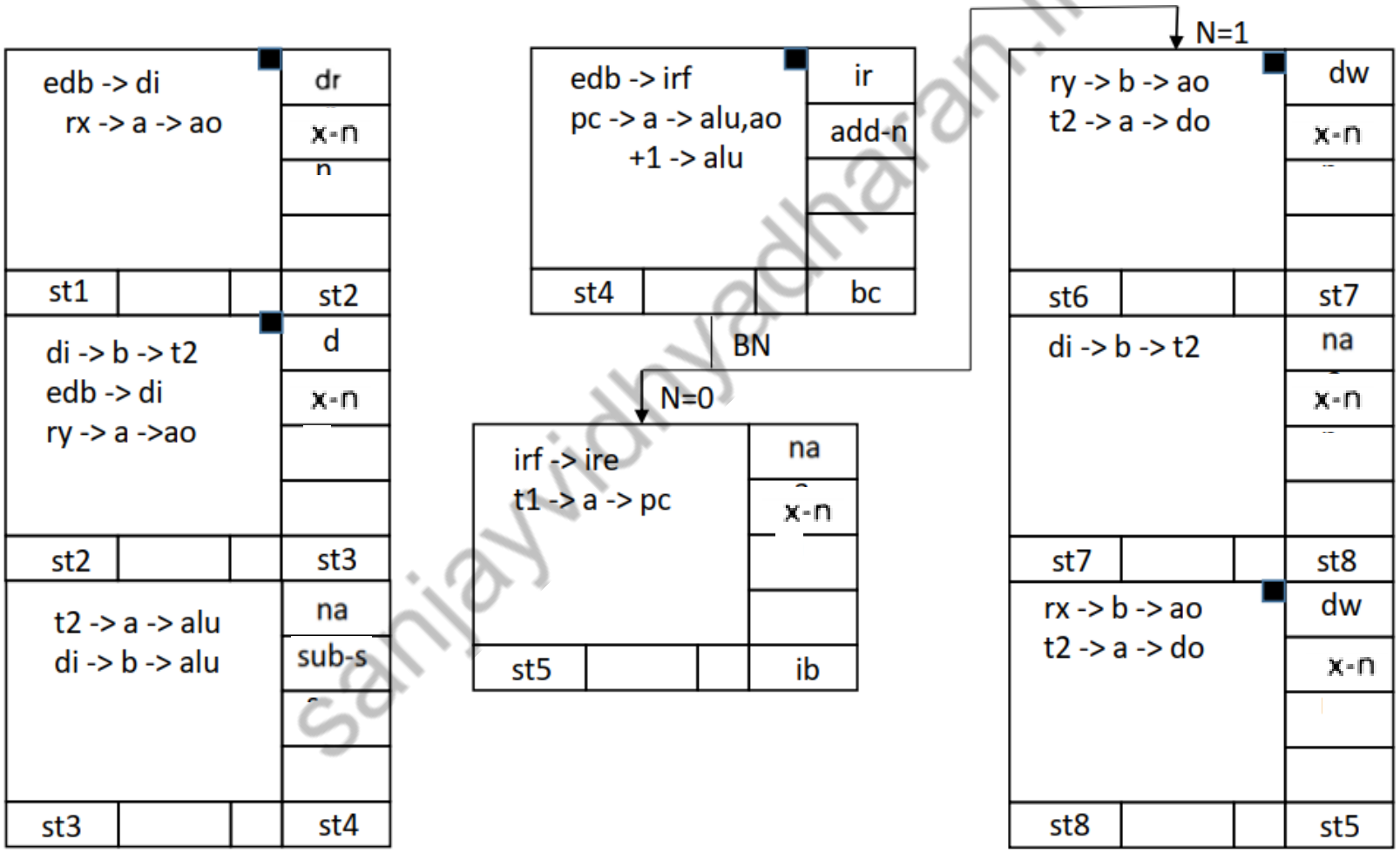
Hardware Flowchart

SORT @RX @RY :

This instruction compares the two numbers stored in memory at addresses provided by registers RX and RY. It swaps the numbers in the two memory locations if the number at the memory address provided by RY is smaller than the other number.

Hardware Flowchart

SORT @RX @RY :



Thank you