Computer Organization Project

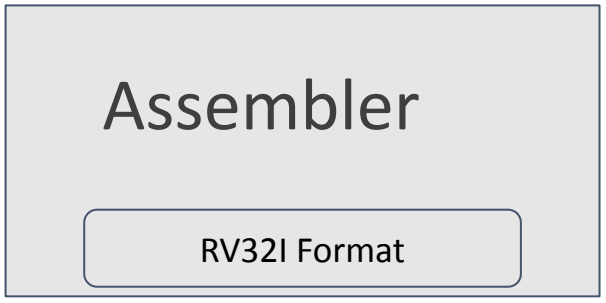
Part I: Assembler

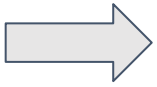
INDRAPRASTHA INSTITUTE *of*
INFORMATION TECHNOLOGY
DELHI

Assembler Task

```
addi    a0,zero,-5
addi    a1,zero,3
sltiu   t0,a0,-1
sltiu   t1,a1,2
sll t2,a0,a1
sub a0,a0,a1
slt t3,zero,a0
beq zero,zero,0
```

< Input Assembly code file

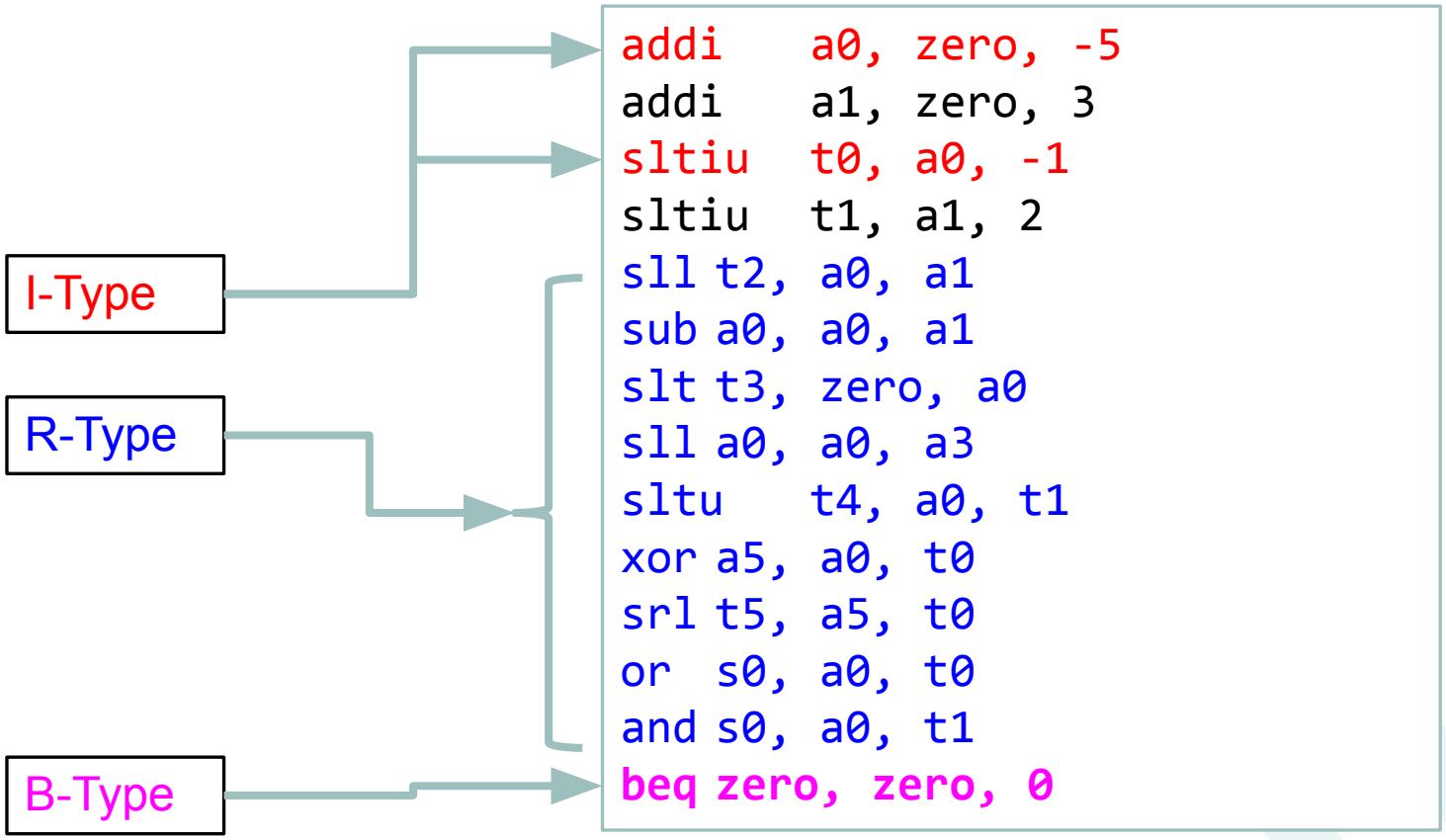




```
11111111101100000000010100010011
00000000001100000000010110010011
11111111111101010011001010010011
00000000001001011011001100010011
00000000101101010001001110110011
01000000101101010000010100110011
00000000101000000010111000110011
00000000000000000000000001100011
```

Output Binary Code File

Instruction Types



Instruction Encoding

R-Type Instruction

[31:25]	[24:20]	[19:15]	[14:12]	[11:7]	[6:0]	Instruction
funct7	**rs2**	**rs1**	**funct3**	**rd**	**opcode**	
0000000	rs2	rs1	000	rd	0110011	add

8.2 Assembly Instruction encoding examples

1. R-type instruction encoding.
   {Instruction_code}{Space}{Destination_Register(ABI)}{,}{Source_Register1(ABI)}{,}{Source_Register2(ABI)}
   Example: add s1,s2,s3

[31:25]	[24:20]	[19:15]	[14:12]	[11:7]	[6:0]	Instruction
funct7	s3	s2	add	s1	opcode	add
0000000	10011	10010	000	01001	0110011	

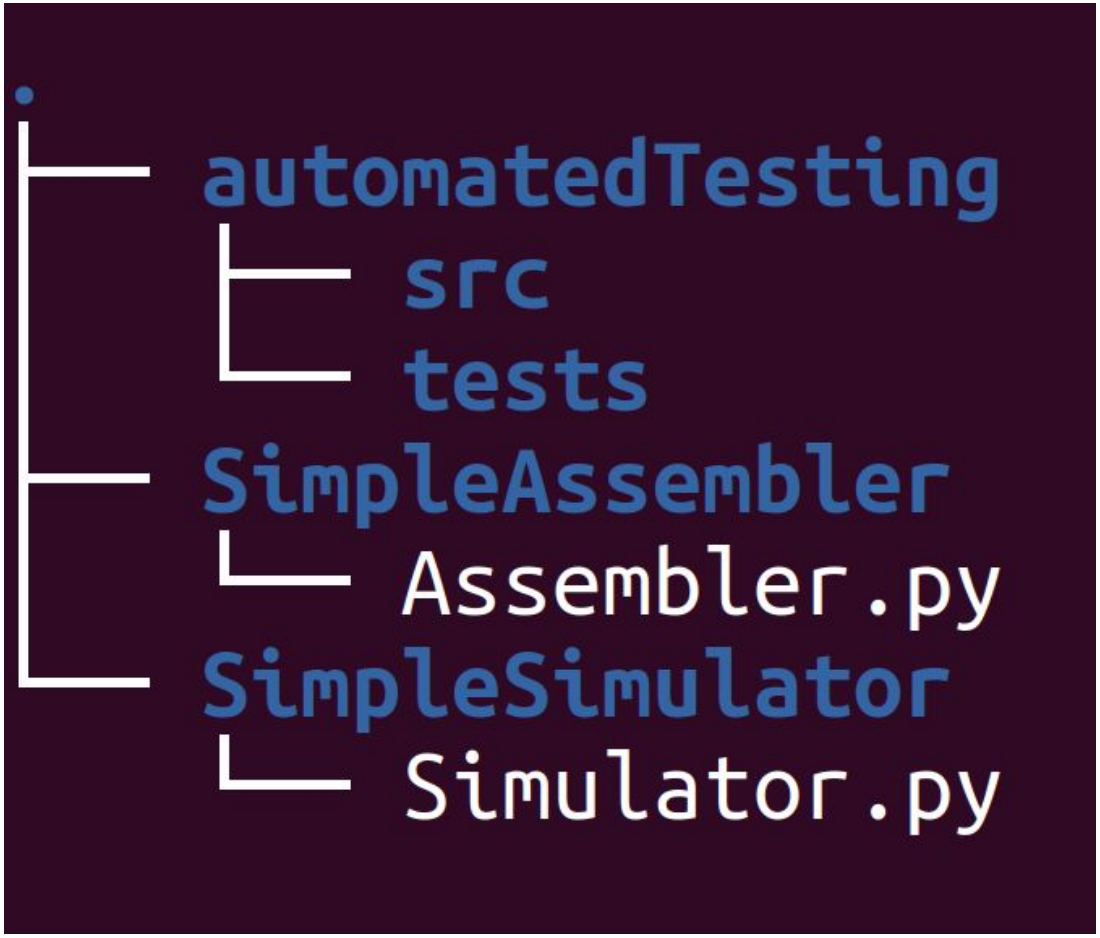
Label in Instruction

Address	Instruction	
0x00	start: add ra,sp,gp	add ra,sp,gp
0x04	jalr t0,t1,4	jalr t0,t1,4
0x08	beq ra,sp,start	beq ra,sp,-8
0x0C	beq zero,zero,0	beq zero,zero,0

Note on "label":

1. start is initialized with Instruction Address =0x00
2. start is decoded as start - current PC. And, keep in decimal format.
   a. decode result = 0x00 - 0x08
3. If label is negative convert into 2's complement format.

Assembler Evaluation



Pink arrow indicate where you should put assembler and simulator

Assembler Evaluation

Step 1: Put your assembler in
`/evaluation_framework/SimpleAssembler/Assembler.py`

Step 2 : Rename your assembler code file as "*`Assembler.py`*"

Step 3 : Go to :
`evaluation_framework/automatedTesting`

Step 4 :
linux users: $ `python3 src/main.py --no-sim --linux`
windows user: > `python3 src\main.py --no-sim --windows`

Note: Refer to readme file in the project description.

Where to Raise query

Project TA
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Thanks