Processor Architecture
ASSIGNMENT-1

AVIK BHATNAGAR
(IMT2018505)

INPUT INSTRUCTIONS:

LW R3, 0(R2)
00000000000000001001000011000011

DIV R2, R3, R4
00000010010000011100000100110011

MUL R1, R5, R6
00000010011000101000000010110011

ADD R3, R7, R8
00000000100000111000000110110011

MUL R1, R1, R3
00000010001100001000000010110011

SUB R4, R1, R5
01000000010100001000001000110011

ADD R1, R4, R2
00000000001000100000000010110011

```
Enter all the instructions in binary:
00000000000000001001000011000011
00000010010000011100000100110011
00000010011000101000000010110011
00000000100000111000000110110011
00000010001100001000000010110011
01000000010100001000001000110011
00000000001000100000000010110011
```

```
Input Instructions are:  ['00000000000000001001000011000011', '00000010010000011100000100110011', '00
000010011000101000000010110011', '00000000100000111000000110110011', '00000010001100001000000010110011
1', '01000000010100001000001000110011', '00000000001000100000000010110011']
```

INSTRUCTION BY INSTRUCTION RESULT:

```
load_store_rs:  [['00000000000000001001000011000011', 1, 'ROB1', 0, 2]]
RAT:  [12, 16, 'ROB1', 5, 3, 4, 1, 2, 2, 3]
Instruction Table:  [[1, 2, 6, 7, 8]]
ROB table:  [['ROB1', 'LOAD', 3, 15]]
```

```
mul_div_rs:  [['00000010010000011100000100110011', 1, 'ROB2', 3, 4, 'ROB1', 5]]
RAT:  [12, 'ROB2', 'ROB1', 5, 3, 4, 1, 2, 2, 3]
Instruction Table:  [[1, 2, 6, 7, 8], [2, 8, 47, 48, 49]]
ROB table:  [['ROB1', 'LOAD', 3, 15], ['ROB2', 'DIV', 2, 3.0]]
```

```
mul_div_rs:  [['00000010010000011100000100110011', 1, 'ROB2', 3, 4, 'ROB1', 5], ['0000001001100010100
0000010110011', 1, 'ROB3', 5, 6, 3, 4]]
RAT:  ['ROB3', 'ROB2', 'ROB1', 5, 3, 4, 1, 2, 2, 3]
Instruction Table:  [[1, 2, 6, 7, 8], [2, 8, 47, 48, 49], [3, 4, 13, 14, 50]]
ROB table:  [['ROB1', 'LOAD', 3, 15], ['ROB2', 'DIV', 2, 3.0], ['ROB3', 'MUL', 1, 12]]
```

```
add_sub_rs:  [['00000000100000111000000110110011', 1, 'ROB4', 7, 8, 1, 2]]
RAT:  ['ROB3', 'ROB2', 'ROB4', 5, 3, 4, 1, 2, 2, 3]
Instruction Table:  [[1, 2, 6, 7, 8], [2, 8, 47, 48, 49], [3, 4, 13, 14, 50], [4, 5, 5, 6, 51]]
ROB table:  [['ROB1', 'LOAD', 3, 15], ['ROB2', 'DIV', 2, 3.0], ['ROB3', 'MUL', 1, 12], ['ROB4', 'ADD'
, 3, 3]]
```

```
mul_div_rs:  [['00000010010000011100000100110011', 1, 'ROB2', 3, 4, 'ROB1', 5], ['0000001001100010100
0000010110011', 1, 'ROB3', 5, 6, 3, 4], ['00000010001100001000000010110011', 1, 'ROB5', 1, 3, 'ROB3',
 'ROB4']]
RAT:  ['ROB5', 'ROB2', 'ROB4', 5, 3, 4, 1, 2, 2, 3]
Instruction Table:  [[1, 2, 6, 7, 8], [2, 8, 47, 48, 49], [3, 4, 13, 14, 50], [4, 5, 5, 6, 51], [5, 1
5, 24, 25, 52]]
ROB table:  [['ROB1', 'LOAD', 3, 15], ['ROB2', 'DIV', 2, 3.0], ['ROB3', 'MUL', 1, 12], ['ROB4', 'ADD'
, 3, 3], ['ROB5', 'MUL', 1, 36]]
```

```
add_sub_rs:  [['00000000100000111000000110110011', 1, 'ROB4', 7, 8, 1, 2], ['0100000001010000100000010
00110011', 1, 'ROB6', 1, 5, 'ROB5', 3]]
RAT:  ['ROB5', 'ROB2', 'ROB4', 'ROB6', 3, 4, 1, 2, 2, 3]
Instruction Table:  [[1, 2, 6, 7, 8], [2, 8, 47, 48, 49], [3, 4, 13, 14, 50], [4, 5, 5, 6, 51], [5, 1
5, 24, 25, 52], [6, 26, 26, 27, 53]]
ROB table:  [['ROB1', 'LOAD', 3, 15], ['ROB2', 'DIV', 2, 3.0], ['ROB3', 'MUL', 1, 12], ['ROB4', 'ADD'
, 3, 3], ['ROB5', 'MUL', 1, 36], ['ROB6', 'SUB', 4, 33]]
```

```
add_sub_rs:  [['00000000100000111000000110110011', 1, 'ROB4', 7, 8, 1, 2], ['0100000001010000100000010
00110011', 1, 'ROB6', 1, 5, 'ROB5', 3], ['00000000001000100000000010110011', 1, 'ROB7', 4, 2, 'ROB6',
 'ROB2']]
RAT:  ['ROB7', 'ROB2', 'ROB4', 'ROB6', 3, 4, 1, 2, 2, 3]
Instruction Table:  [[1, 2, 6, 7, 8], [2, 8, 47, 48, 49], [3, 4, 13, 14, 50], [4, 5, 5, 6, 51], [5, 1
5, 24, 25, 52], [6, 26, 26, 27, 53], [7, 49, 49, 50, 54]]
ROB table:  [['ROB1', 'LOAD', 3, 15], ['ROB2', 'DIV', 2, 3.0], ['ROB3', 'MUL', 1, 12], ['ROB4', 'ADD'
, 3, 3], ['ROB5', 'MUL', 1, 36], ['ROB6', 'SUB', 4, 33], ['ROB7', 'ADD', 1, 36.0]]
```

FINAL VALUES:

```
Final RS entries
LOAD STORE RS:
['00000000000000001001000011000011', 1, 'ROB1', 0, 'R2']
ADD SUB RS
['00000000100000111000000110110011', 1, 'ROB4', 7, 8, 1, 2]
['01000000010100001000001000110011', 1, 'ROB6', 1, 5, 'ROB5', 3]
['00000000001000100000000010110011', 1, 'ROB7', 4, 2, 'ROB6', 'ROB2']
MUL DIV RS
['00000010010000011100000100110011', 1, 'ROB2', 3, 4, 'ROB1', 5]
['00000010001100001000000010110011', 1, 'ROB5', 1, 3, 'ROB3', 'ROB4']
```

```
Final ROB table entries
['ROB1', 'LOAD', 'R3', 15]
['ROB2', 'DIV', 'R2', 3.0]
['ROB3', 'MUL', 'R1', 12]
['ROB4', 'ADD', 'R3', 3]
['ROB5', 'MUL', 'R1', 36]
['ROB6', 'SUB', 'R4', 33]
['ROB7', 'ADD', 'R1', 36.0]
```

```
Final Instruction Table:
[1, 2, 6, 7, 8]
[2, 8, 47, 48, 49]
[3, 4, 13, 14, 50]
[4, 5, 5, 6, 51]
[5, 15, 24, 25, 52]
[6, 26, 26, 27, 53]
[7, 49, 49, 50, 54]
```

```
Final RAT:  ['ROB7', 'ROB2', 'ROB4', 'ROB6', 3, 4, 1, 2, 2, 3]


Final ARF:
36.0
3.0
3
33
3
4
1
2
2
3
```

FULL SCREENSHOT