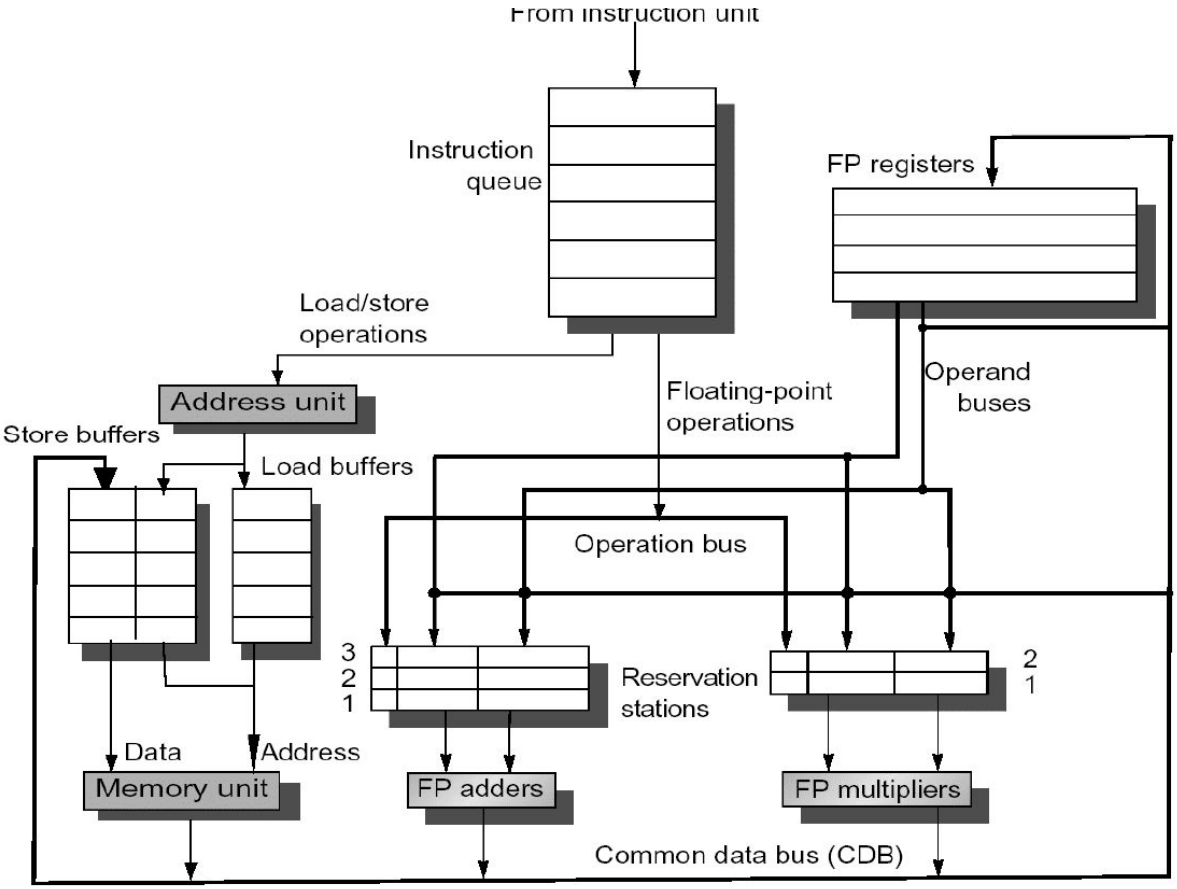
Tomasulo Implementation REPORT



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INTRODUCTION

Tomasulo's algorithm is a computer architecture hardware algorithm for dynamic scheduling of instructions that allows out of order execution and enables more efficient use of multiple execution units.

Features that differ from scoreboard:

Register Renaming

Reservation Station (each unit)

Common Data Bus(broadcast directly to R.S.)

Control and buffers distributed.

Hardware/Components

Common data bus: It connects reservation stations directly to functional units .F.U. can directly access the result without any wait.

Exception inorder: Exceptions due to sequence of instructions will occur in the same order as they would in order processor regardless of out of order execution making debugging easy.

Register Renaming: Scoreboard method of implementation waits for WAR hazard and prevents WAW hazard,but register renaming allows execution of instruction and prevents both hazards without stalling.

Read more at https://en.wikipedia.org/wiki/Tomasulo_algorithm

Simulation Explanation

SIMULATION

1.)Once instruction is parsed and syntactically corrected it will have to be separated according to opcode and register list(according to opcode).

2.)The syntactically corrected code will be operated in each cycle until it is completed.

It will have either two operand opcode(load store operation) or 3 operand opcode or HALT.

Reservation Station(register legend) ,Register Status and Instruction buffer will be initialized.

3.)Clock cycle execution will begin following the “first in first execute” pattern. Cycle Execution will include issue,execution,write back stages for each operation required hardware .

4.)Issue stage of instruction will include checking for availability of the issue stage of dedicated hardware.Else stall.

If available the further step will require to check for WAR , WAW hazard . Here Register will be renamed.

Accordingly reservation station and instruction status will be checked, if available (either renamed or not) it will be assigned to respective value.

Load and Store requires different check than rest operands. (only one register reservation station).

5.)Execution check execution unit of hardware is free or not.

If free ,instruction operands are checked (elimination of RAW) and operated upon.(If renamed data is stored in the buffer.)

6.)Write back stage include check of availability of write stage of hardware. If available check instruction status (Write register is not occupied by any other step/Although WAW hazard is prevented by renaming but if buffer is not empty). If not available, stall else store value.

At the end of each clock cycle completed instructions if holding any hardware(issue stage,execution stage,writeback stge) are freed .

All renamed register original sources are checked to see if they are free.Both War and Waw renamed register are set to there original register(buffer transfer) if original register is done with the process.

Read code https://raw.githubusercontent.com/Stenardt-9002/Tomasulo_algo_simulation/master/finalparser.py?token=AKL45BKPBOOGLH7ICLA72VS7ACHYO

MATRIX MULTIPLICATION

Hardware Specification /Functional Blocks	Assumed Time of block	Amount
1.)LOAD	4	1
2.)STORE	4	1
3.)FP ADDER	23	1
4.)FP MULTIPLIER	26	1

All value addition and multiplications are performed through floating point hardware.

Code Algorithm (in C++)

```
#include<iostream>

using namespace std;

int main()

{

   int arr1[3][3];

   int arr2[3][3];

   int arr3[3][3];

for(int i=0;i<3;i++)

{    for(int j=0;j<3;j++)   { cin>>arr1[i][j];   }}

for(int i=0;i<3;i++)

            {    for(int j=0;j<3;j++)    {         cin>>arr2[i][j];    }}

 for (int i = 0; i < 3; i++)

            {for (int j = 0; j < 3; j++)

                        {                           arr3[i][j] = 0;

                        for (int k = 0; k < 3; k++)

                        {               arr3[i][j] += arr1[i][k]*arr2[k][j];          }

            }

            }




return 0;

}
```

Disassembled Code

(NOTE :The above code is NOT used in the program because ‘for loop’ uses branches , instead code is unrolled into straight assign statement for proper conversion then given input in code.)

00000000000011e9 <main>:

```
11e9:   f3 0f 1e fa                 endbr64
11ed:   55                          push   %rbp
11ee:   48 89 e5                    mov    %rsp,%rbp
11f1:   48 81 ec c0 00 00 00        sub    $0xc0,%rsp
11f8:   64 48 8b 04 25 28 00        mov    %fs:0x28,%rax
11ff:   00 00
1201:   48 89 45 f8                 mov    %rax,-0x8(%rbp)
1205:   31 c0                       xor    %eax,%eax
1207:   c7 85 4c ff ff ff 00        movl   $0x0,-0xb4(%rbp)
120e:   00 00 00
1211:   83 bd 4c ff ff ff 02        cmpl   $0x2,-0xb4(%rbp)
1218:   7f 60                       jg     127a <main+0x91>
121a:   c7 85 50 ff ff ff 00        movl   $0x0,-0xb0(%rbp)
1221:   00 00 00
1224:   83 bd 50 ff ff ff 02        cmpl   $0x2,-0xb0(%rbp)
122b:   7f 44                       jg     1271 <main+0x88>
122d:   48 8d 8d 70 ff ff ff        lea    -0x90(%rbp),%rcx
1234:   8b 85 50 ff ff ff           mov    -0xb0(%rbp),%eax
123a:   48 63 f0                    movslq %eax,%rsi
123d:   8b 85 4c ff ff ff           mov    -0xb4(%rbp),%eax
1243:   48 63 d0                    movslq %eax,%rdx
1246:   48 89 d0                    mov    %rdx,%rax
1249:   48 01 c0                    add    %rax,%rax
124c:   48 01 d0                    add    %rdx,%rax
124f:   48 01 f0                    add    %rsi,%rax
1252:   48 c1 e0 02                 shl    $0x2,%rax
1256:   48 01 c8                    add    %rcx,%rax
1259:   48 89 c6                    mov    %rax,%rsi
125c:   48 8d 3d fd 2e 00 00        lea    0x2efd(%rip),%rdi        # 4160 <_ZSt3cin@@GLIBCXX_3.4>
1263:   e8 38 fe ff ff              callq  10a0 <_ZNSirsERi@plt>
1268:   83 85 50 ff ff ff 01        addl   $0x1,-0xb0(%rbp)
126f:   eb b3                       jmp    1224 <main+0x3b>
1271:   83 85 4c ff ff ff 01        addl   $0x1,-0xb4(%rbp)
1278:   eb 97                       jmp    1211 <main+0x28>
127a:   c7 85 54 ff ff ff 00        movl   $0x0,-0xac(%rbp)
1281:   00 00 00
1284:   83 bd 54 ff ff ff 02        cmpl   $0x2,-0xac(%rbp)
128b:   7f 5d                       jg     12ea <main+0x101>
128d:   c7 85 58 ff ff ff 00        movl   $0x0,-0xa8(%rbp)
1294:   00 00 00
1297:   83 bd 58 ff ff ff 02        cmpl   $0x2,-0xa8(%rbp)
129e:   7f 41                       jg     12e1 <main+0xf8>
12a0:   48 8d 4d a0                 lea    -0x60(%rbp),%rcx
12a4:   8b 85 58 ff ff ff           mov    -0xa8(%rbp),%eax
12aa:   48 63 f0                    movslq %eax,%rsi
12ad:   8b 85 54 ff ff ff           mov    -0xac(%rbp),%eax
```

```
12b3:    48 63 d0                    movslq %eax,%rdx
12b6:    48 89 d0                    mov    %rdx,%rax
12b9:    48 01 c0                    add    %rax,%rax
12bc:    48 01 d0                    add    %rdx,%rax
12bf:    48 01 f0                    add    %rsi,%rax
12c2:    48 c1 e0 02                 shl    $0x2,%rax
12c6:    48 01 c8                    add    %rcx,%rax
12c9:    48 89 c6                    mov    %rax,%rsi
12cc:    48 8d 3d 8d 2e 00 00     lea    0x2e8d(%rip),%rdi        # 4160 <_ZSt3cin@@GLIBCXX_3.4>
12d3:    e8 c8 fd ff ff              callq  10a0 <_ZNSirsERi@plt>
12d8:    83 85 58 ff ff ff 01     addl   $0x1,-0xa8(%rbp)
12df:    eb b6                       jmp    1297 <main+0xae>
12e1:    83 85 54 ff ff ff 01     addl   $0x1,-0xac(%rbp)
12e8:    eb 9a                       jmp    1284 <main+0x9b>
12ea:    c7 85 5c ff ff ff 00     movl   $0x0,-0xa4(%rbp)
12f1:    00 00 00
12f4:    83 bd 5c ff ff ff 02     cmpl   $0x2,-0xa4(%rbp)
12fb:    0f 8f 08 01 00 00     jg     1409 <main+0x220>
1301:    c7 85 60 ff ff ff 00     movl   $0x0,-0xa0(%rbp)
1308:    00 00 00
130b:    83 bd 60 ff ff ff 02     cmpl   $0x2,-0xa0(%rbp)
1312:    0f 8f e5 00 00 00     jg     13fd <main+0x214>
1318:    8b 85 60 ff ff ff     mov    -0xa0(%rbp),%eax
131e:    48 63 c8                    movslq %eax,%rcx
1321:    8b 85 5c ff ff ff     mov    -0xa4(%rbp),%eax
1327:    48 63 d0                    movslq %eax,%rdx
132a:    48 89 d0                    mov    %rdx,%rax
132d:    48 01 c0                    add    %rax,%rax
1330:    48 01 d0                    add    %rdx,%rax
1333:    48 01 c8                    add    %rcx,%rax
1336:    c7 44 85 d0 00 00 00 00  movl   $0x0,-0x30(%rbp,%rax,4)
133d:    00
133e:    c7 85 64 ff ff ff 00     movl   $0x0,-0x9c(%rbp)
1345:    00 00 00
1348:    83 bd 64 ff ff ff 02     cmpl   $0x2,-0x9c(%rbp)
134f:    0f 8f 9c 00 00 00     jg     13f1 <main+0x208>
1355:    8b 85 60 ff ff ff     mov    -0xa0(%rbp),%eax
135b:    48 63 c8                    movslq %eax,%rcx
135e:    8b 85 5c ff ff ff     mov    -0xa4(%rbp),%eax
1364:    48 63 d0                    movslq %eax,%rdx
1367:    48 89 d0                    mov    %rdx,%rax
136a:    48 01 c0                    add    %rax,%rax
136d:    48 01 d0                    add    %rdx,%rax
1370:    48 01 c8                    add    %rcx,%rax
1373:    8b 4c 85 d0                 mov    -0x30(%rbp,%rax,4),%ecx
1377:    8b 85 64 ff ff ff     mov    -0x9c(%rbp),%eax
137d:    48 63 f0                    movslq %eax,%rsi
1380:    8b 85 5c ff ff ff     mov    -0xa4(%rbp),%eax
1386:    48 63 d0                    movslq %eax,%rdx
1389:    48 89 d0                    mov    %rdx,%rax
138c:    48 01 c0                    add    %rax,%rax
138f:    48 01 d0                    add    %rdx,%rax
1392:    48 01 f0                    add    %rsi,%rax
1395:    8b b4 85 70 ff ff ff  mov    -0x90(%rbp,%rax,4),%esi
139c:    8b 85 60 ff ff ff     mov    -0xa0(%rbp),%eax
13a2:    48 63 f8                    movslq %eax,%rdi
13a5:    8b 85 64 ff ff ff     mov    -0x9c(%rbp),%eax
```

```
13ab:   48 63 d0                movslq %eax,%rdx
13ae:   48 89 d0                mov    %rdx,%rax
13b1:   48 01 c0                add    %rax,%rax
13b4:   48 01 d0                add    %rdx,%rax
13b7:   48 01 f8                add    %rdi,%rax
13ba:   8b 44 85 a0             mov    -0x60(%rbp,%rax,4),%eax
13be:   0f af c6                imul   %esi,%eax
13c1:   01 c1                   add    %eax,%ecx
13c3:   8b 85 60 ff ff ff       mov    -0xa0(%rbp),%eax
13c9:   48 63 f0                movslq %eax,%rsi
13cc:   8b 85 5c ff ff ff       mov    -0xa4(%rbp),%eax
13d2:   48 63 d0                movslq %eax,%rdx
13d5:   48 89 d0                mov    %rdx,%rax
13d8:   48 01 c0                add    %rax,%rax
13db:   48 01 d0                add    %rdx,%rax
13de:   48 01 f0                add    %rsi,%rax
13e1:   89 4c 85 d0             mov    %ecx,-0x30(%rbp,%rax,4)
13e5:   83 85 64 ff ff ff 01    addl   $0x1,-0x9c(%rbp)
13ec:   e9 57 ff ff ff          jmpq   1348 <main+0x15f>
13f1:   83 85 60 ff ff ff 01    addl   $0x1,-0xa0(%rbp)
13f8:   e9 0e ff ff ff          jmpq   130b <main+0x122>
13fd:   83 85 5c ff ff ff 01    addl   $0x1,-0xa4(%rbp)
1404:   e9 eb fe ff ff          jmpq   12f4 <main+0x10b>
1409:   c7 85 68 ff ff ff 00    movl   $0x0,-0x98(%rbp)
1410:   00 00 00
1413:   83 bd 68 ff ff ff 02    cmpl   $0x2,-0x98(%rbp)
141a:   7f 77                   jg     1493 <main+0x2aa>
141c:   48 8d 35 e2 0b 00 00    lea    0xbe2(%rip),%rsi        # 2005 <_ZStL19piecewise_construct+0x1>
1423:   48 8d 3d 16 2c 00 00    lea    0x2c16(%rip),%rdi       # 4040 <_ZSt4cout@@GLIBCXX_3.4>
142a:   e8 91 fc ff ff          callq  10c0 <_ZStlsISt11char_traitsIcEERSt13basic_ostreamIcT_ES5_PKc@plt>
142f:   c7 85 6c ff ff ff 00    movl   $0x0,-0x94(%rbp)
1436:   00 00 00
1439:   83 bd 6c ff ff ff 02    cmpl   $0x2,-0x94(%rbp)
1440:   7f 48                   jg     148a <main+0x2a1>
1442:   8b 85 6c ff ff ff       mov    -0x94(%rbp),%eax
1448:   48 63 c8                movslq %eax,%rcx
144b:   8b 85 68 ff ff ff       mov    -0x98(%rbp),%eax
1451:   48 63 d0                movslq %eax,%rdx
1454:   48 89 d0                mov    %rdx,%rax
1457:   48 01 c0                add    %rax,%rax
145a:   48 01 d0                add    %rdx,%rax
145d:   48 01 c8                add    %rcx,%rax
1460:   8b 44 85 d0             mov    -0x30(%rbp,%rax,4),%eax
1464:   89 c6                   mov    %eax,%esi
1466:   48 8d 3d d3 2b 00 00    lea    0x2bd3(%rip),%rdi       # 4040 <_ZSt4cout@@GLIBCXX_3.4>
146d:   e8 7e fc ff ff          callq  10f0 <_ZNSolsEi@plt>
1472:   48 8d 35 8e 0b 00 00    lea    0xb8e(%rip),%rsi        # 2007 <_ZStL19piecewise_construct+0x3>
1479:   48 89 c7                mov    %rax,%rdi
147c:   e8 3f fc ff ff          callq  10c0 <_ZStlsISt11char_traitsIcEERSt13basic_ostreamIcT_ES5_PKc@plt>
1481:   83 85 6c ff ff ff 01    addl   $0x1,-0x94(%rbp)
1488:   eb af                   jmp    1439 <main+0x250>
148a:   83 85 68 ff ff ff 01    addl   $0x1,-0x98(%rbp)
1491:   eb 80                   jmp    1413 <main+0x22a>
1493:   b8 00 00 00 00          mov    $0x0,%eax
1498:   48 8b 7d f8             mov    -0x8(%rbp),%rdi
149c:   64 48 33 3c 25 28 00    xor    %fs:0x28,%rdi
14a3:   00 00
```

```
14a5:   74 05                   je      14ac <main+0x2c3>
14a7:   e8 24 fc ff ff          callq  10d0 <__stack_chk_fail@plt>
14ac:   c9                      leaveq
14ad:   c3                      retq
```

Read code https://raw.githubusercontent.com/Stenardt-9002/Tomasulo_algo_simulation/master/armsapmle2.txt?token=AKL45BPQZJ6ORLXASDXTDWC7ACIDA

Code input in Simulation

NOTE:Assumption includes optimised compiler for interchanging steps for improving hardware usage and using the limited number of register present

The above code is translated MANUALLY to meet above requirements for given program (python simulation)

ALL LOAD instructions are interchanged for better optimization .

```
LD F1,1
LD F2,1 #assumed address for respective value register
MUL  F16,F1,F2
LD F3,2
LD F4,4
MUL F15,F3,F4
LD F5,3
LD F6,7
MUL F14,F5,F6
ADD F13,F15,F16
ADD F12,F13,F14
ST F12,1 #note store in address(assumed to be just 1)


LD F7,2
MUL F11,F1,F7
LD F8,5
MUL F10,F3,F8
LD F9,8
MUL F16,F5,F9
ADD F15,F10,F11
ADD F14,F15,F16
ST F14,2


LD F13,3
MUL F12,F1,F13
LD F11,6
MUL F10,F2,F11
LD F9,9
MUL F8,F3,F9
ADD F7,F8,F11
ADD F6,F7,F13
ST F6,3
```

```
LD F1,4
LD F2,1
MUL  F16,F1,F2
LD F3,5
LD F4,4
MUL F15,F3,F4
LD F5,6
LD F6,7
MUL F14,F5,F6
ADD F13,F15,F16
ADD F12,F13,F14
ST F12,4

LD F7,2
MUL F11,F1,F7
LD F8,5
MUL F10,F3,F8
LD F9,8
MUL F16,F5,F9
ADD F15,F10,F11
ADD F14,F15,F16
ST F14,5


LD F13,3
MUL F12,F1,F13
LD F11,6
MUL F10,F2,F11
LD F9,9
MUL F8,F3,F9
ADD F7,F8,F11
ADD F6,F7,F13
ST F6,6



LD F1,7
LD F2,1
MUL  F16,F1,F2
LD F3,8
LD F4,4
MUL F15,F3,F4
LD F5,9
LD F6,7
MUL F14,F5,F6
ADD F13,F15,F16
ADD F12,F13,F14
ST F12,7


LD F7,2
MUL F11,F1,F7
LD F8,5
```

```
MUL F10,F3,F8
LD F9,8
MUL F16,F5,F9
ADD F15,F10,F11
ADD F14,F15,F16
ST F14,8


LD F13,3
MUL F12,F1,F13
LD F11,6
MUL F10,F2,F11
LD F9,9
MUL F8,F3,F9
ADD F7,F8,F11
ADD F6,F7,F13
ST F6,9
```

NOTE THE ABOVE INPUT WHEN SUPPLIED TAKES MUCH MORE TIME . THUS FOR SIMULATION PURPOSES ONLY 17 of THE FIRST INSTRUCTIONS ARE SUPPLIED TO CODE INPUT.

Tracing

(Go to conclusion for final o/p)

1. CLOCK = 1 (only 17 else trace is large)X

Hardware Reservation Table

FP_MUL issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}
ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}
Hardware Reservation Table for Load Store Complement
LOAD1 issue : 1 operation: 0 vj : 0 qj: 0   LOAD1 issue : 0 operation : -1 vj : 0 qj : 0   LOAD1 issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS

issue : 1 exec : 0 writeback : 0 completed_yet : 3 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 8 key : ADD_W_C
issue : 0 exec : 0 writeback : 0 completed_yet : 8 key : ADD_W_C
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : STORE
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1

Register Status

{'F1': ['LOAD1', 0], 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': 0, 'F11': 0, 'F12': 0, 'F13': 0, 'F14': 0, 'F15': 0, 'F16': 0, 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

2. CLOCK = 2

Hardware Reservation Table

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}
FP_MUL issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}
Hardware Reservation Table for Load Store Complement
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0
STORE issue: 0 operation: -1 vj: 0 qj: 0
LOAD1 issue : 1 operation: 1 vj : 0 qj: 0 LOAD1 issue : 1 operation : 0 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS

issue : 1 exec : 2 writeback : 0 completed_yet : 2 key : LOAD1
issue : 2 exec : 0 writeback : 0 completed_yet : 3 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 8 key : ADD_W_C
issue : 0 exec : 0 writeback : 0 completed_yet : 8 key : ADD_W_C
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : STORE
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1

Register Status

{'F1': ['LOAD1', 0], 'F2': ['LOAD1', 1], 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': 0, 'F11': 0, 'F12': 0, 'F13': 0, 'F14': 0, 'F15': 0, 'F16': 0, 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

3. CLOCK = 3

Hardware Reservation Table

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}
FP_MUL issue {'busy': 1, 'op': 2, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 1, 'readytoexec': 1}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}
Hardware Reservation Table for Load Store Complement
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 0 operation: -1 vj: 0 qj: 0
LOAD1 issue : 1 operation: 1 vj : 0 qj: 0 LOAD1 issue : 1 operation : 0 vj : 0 qj : 0 LOAD1 issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS

issue : 1 exec : 3 writeback : 0 completed_yet : 1 key : LOAD1
issue : 2 exec : 0 writeback : 0 completed_yet : 3 key : LOAD1
issue : 3 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 8 key : ADD_W_C
issue : 0 exec : 0 writeback : 0 completed_yet : 8 key : ADD_W_C
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : STORE
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1

Register Status

{'F1': ['LOAD1', 0], 'F2': ['LOAD1', 1], 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': 0, 'F11': 0, 'F12': 0, 'F13': 0, 'F14': 0, 'F15': 0, 'F16': ['FP_MUL', 2], 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

4. CLOCK = 4

Hardware Reservation Table

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}
FP_MUL issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 1, 'op': 2, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 1, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}
Hardware Reservation Table for Load Store Complement
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 0 operation: -1 vj: 0 qj: 0
LOAD1 issue : 1 operation: 1 vj : 0 qj: 0 LOAD1 issue : 0 operation : -1 vj : 0 qj : 0 LOAD1 issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS

issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 0 writeback : 0 completed_yet : 3 key : LOAD1
issue : 3 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 8 key : ADD_W_C
issue : 0 exec : 0 writeback : 0 completed_yet : 8 key : ADD_W_C
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : STORE
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1

Register Status

{'F1': 0, 'F2': ['LOAD1', 1], 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': 0, 'F11': 0, 'F12': 0, 'F13': 0, 'F14': 0, 'F15': 0, 'F16': ['FP_MUL', 2], 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

5. CLOCK = 5

Hardware Reservation Table

FP_MUL issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 1, 'op': 2, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 1, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

LOAD1 issue : 1 operation: 3 vj : 0 qj: 0 LOAD1 issue : 1 operation : 1 vj : 0 qj : 0 LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS

issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 5 writeback : 0 completed_yet : 2 key : LOAD1
issue : 3 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 5 exec : 0 writeback : 0 completed_yet : 3 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 8 key : ADD_W_C
issue : 0 exec : 0 writeback : 0 completed_yet : 8 key : ADD_W_C
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : STORE
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1

Register Status

{'F1': 0, 'F2': ['LOAD1', 1], 'F3': ['LOAD1', 3], 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': 0, 'F11': 0, 'F12': 0, 'F13': 0, 'F14': 0, 'F15': 0, 'F16': ['FP_MUL', 2], 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

6. CLOCK = 7

Hardware Reservation Table

FP_MUL issue {'busy': 1, 'op': 5, 'vj': 0, 'vk': 'F4', 'qj': 3, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 2, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 1, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

LOAD1 issue : 1 operation: 3 vj : 0 qj: 0 LOAD1 issue : 0 operation : -1 vj : 0 qj : 0 LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS

issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 7 writeback : 0 completed_yet : 24 key : FP_MUL
issue : 5 exec : 0 writeback : 0 completed_yet : 3 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 6 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 8 key : ADD_W_C
issue : 0 exec : 0 writeback : 0 completed_yet : 8 key : ADD_W_C
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : STORE
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1

Register Status

{'F1': 0, 'F2': 0, 'F3': ['LOAD1', 3], 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': 0, 'F11': 0, 'F12': 0, 'F13': 0, 'F14': 0, 'F15': ['FP_MUL', 5], 'F16': ['FP_MUL', 2], 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

CLOCK = 9

Hardware Reservation Table

FP_MUL issue {'busy': 1, 'op': 5, 'vj': 0, 'vk': 'F4', 'qj': 3, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 2, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 1, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 1 operation: 4 vj : 0 qj: 0 LOAD1 issue : 1 operation : 3 vj : 0 qj : 0 LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS

issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 9 writeback : 0 completed_yet : 22 key : FP_MUL
issue : 5 exec : 9 writeback : 0 completed_yet : 1 key : LOAD1
issue : 8 exec : 0 writeback : 0 completed_yet : 3 key : LOAD1
issue : 6 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 8 key : ADD_W_C
issue : 0 exec : 0 writeback : 0 completed_yet : 8 key : ADD_W_C
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : STORE
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 F16 ,F1 ,F2 ,
1111 F3 ,2 ,
1111 F4 ,4 ,
0111 F15 ,F3 ,F4 ,
1111 F5 ,3 ,
1111 F6 ,7 ,
0111 F14 ,F5 ,F6 ,
0001 F13 ,F15 ,F16 ,
0001 F12 ,F13 ,F14 ,
1110 F12 ,1 ,
1111 F7 ,2 ,
0111 F11 ,F1 ,F7 ,
1111 F8 ,5 ,
0111 F10 ,F3 ,F8 ,
1111 F9 ,8 ,

Register Status
{'F1': 0, 'F2': 0, 'F3': ['LOAD1', 3], 'F4': ['LOAD1', 4], 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': 0, 'F11': 0, 'F12': 0, 'F13': 0, 'F14': 0, 'F15': ['FP_MUL', 5], 'F16': ['FP_MUL', 2], 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list

CLOCK= 10

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 5, 'vj': 0, 'vk': 'F4', 'qj': 3, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 2, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 1, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 1, 'op': 9, 'vj': 0, 'vk': 0, 'qj': 5, 'qk': 2, 'readytoexec': 1}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 1 operation: 4 vj : 0 qj: 0   LOAD1 issue : 0 operation : -1 vj : 0 qj : 0   LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0   STORE issue : 0 operation : -1 vj : 0 qj : 0   STORE issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1

issue : 3 exec : 10 writeback : 0 completed_yet : 21 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 0 writeback : 0 completed_yet : 3 key : LOAD1
issue : 6 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 10 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 0 exec : 0 writeback : 0 completed_yet : 8 key : ADD_W_C
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : STORE
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 F16 ,F1 ,F2 ,
1111 is now completed
1111 F4 ,4 ,
0111 F15 ,F3 ,F4 ,
1111 F5 ,3 ,
1111 F6 ,7 ,
0111 F14 ,F5 ,F6 ,
0001 F13 ,F15 ,F16 ,
0001 F12 ,F13 ,F14 ,
1110 F12 ,1 ,
1111 F7 ,2 ,
0111 F11 ,F1 ,F7 ,
1111 F8 ,5 ,
0111 F10 ,F3 ,F8 ,
1111 F9 ,8 ,

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': ['LOAD1', 4], 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': 0, 'F11': 0, 'F12': 0, 'F13': ['ADD_W_C', 9], 'F14': 0, 'F15': ['FP_MUL', 5], 'F16': ['FP_MUL', 2], 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list

CLOCK = 10

CLOCK = 11

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 5, 'vj': 0, 'vk': 'F4', 'qj': 3, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 2, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 1, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 1, 'op': 10, 'vj': 0, 'vk': 'F14', 'qj': 9, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 9, 'vj': 0, 'vk': 0, 'qj': 5, 'qk': 2, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 1 operation: 6 vj : 0 qj: 0 LOAD1 issue : 1 operation : 4 vj : 0 qj : 0 LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 11 writeback : 0 completed_yet : 20 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 11 writeback : 0 completed_yet : 2 key : LOAD1
issue : 6 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 11 exec : 0 writeback : 0 completed_yet : 3 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 10 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 11 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : STORE
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 F16 ,F1 ,F2 ,
1111 is now completed
1111 F4 ,4 ,
0111 F15 ,F3 ,F4 ,
1111 F5 ,3 ,
1111 F6 ,7 ,
0111 F14 ,F5 ,F6 ,

0001 F13 ,F15 ,F16 ,
0001 F12 ,F13 ,F14 ,
1110 F12 ,1 ,
1111 F7 ,2 ,
0111 F11 ,F1 ,F7 ,
1111 F8 ,5 ,
0111 F10 ,F3 ,F8 ,
1111 F9 ,8 ,

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': ['LOAD1', 4], 'F5': ['LOAD1', 6], 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': 0, 'F11': 0, 'F12': ['ADD_W_C', 10], 'F13': ['ADD_W_C', 9], 'F14': 0, 'F15': ['FP_MUL', 5], 'F16': ['FP_MUL', 2], 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list

CLOCK = 12

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 5, 'vj': 0, 'vk': 'F4', 'qj': 3, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 2, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 1, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 1, 'op': 10, 'vj': 0, 'vk': 'F14', 'qj': 9, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 9, 'vj': 0, 'vk': 0, 'qj': 5, 'qk': 2, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 1 operation: 6 vj : 0 qj: 0 LOAD1 issue : 1 operation : 4 vj : 0 qj : 0 LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 1 operation: 11 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 12 writeback : 0 completed_yet : 19 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 0 completed_yet : 1 key : LOAD1
issue : 6 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 11 exec : 0 writeback : 0 completed_yet : 3 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1

issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 10 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 11 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 12 exec : 0 writeback : 0 completed_yet : 3 key : STORE
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 F16 ,F1 ,F2 ,
1111 is now completed
1111 F4 ,4 ,
0111 F15 ,F3 ,F4 ,
1111 F5 ,3 ,
1111 F6 ,7 ,
0111 F14 ,F5 ,F6 ,
0001 F13 ,F15 ,F16 ,
0001 F12 ,F13 ,F14 ,
1110 R1 ,1 ,
1111 F7 ,2 ,
0111 F11 ,F1 ,F7 ,
1111 F8 ,5 ,
0111 F10 ,F3 ,F8 ,
1111 F9 ,8 ,

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': ['LOAD1', 4], 'F5': ['LOAD1', 6], 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': 0, 'F11': 0, 'F12': ['ADD_W_C', 10], 'F13': ['ADD_W_C', 9], 'F14': 0, 'F15': ['FP_MUL', 5], 'F16': ['FP_MUL', 2], 'R1': ['STORE', 11], 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list
Instruction 12 F12 is renamed to R1 Renamed For WAW

map_table

{'F12': ['R1', 11]}

CLOCK= 13

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 5, 'vj': 0, 'vk': 'F4', 'qj': 3, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 2, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 1, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 1, 'op': 10, 'vj': 0, 'vk': 'F14', 'qj': 9, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 9, 'vj': 0, 'vk': 0, 'qj': 5, 'qk': 2, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 1 operation: 6 vj : 0 qj: 0 LOAD1 issue : 0 operation : -1 vj : 0 qj : 0 LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 1 operation : 11 vj : 0 qj : 0 STORE issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 13 writeback : 0 completed_yet : 18 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 11 exec : 0 writeback : 0 completed_yet : 3 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 10 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 11 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 12 exec : 13 writeback : 0 completed_yet : 2 key : STORE
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 F16 ,F1 ,F2 ,
1111 is now completed
1111 is now completed
0111 F15 ,F3 ,F4 ,
1111 F5 ,3 ,

1111 F6 ,7 ,
0111 F14 ,F5 ,F6 ,
0001 F13 ,F15 ,F16 ,
0001 F12 ,F13 ,F14 ,
1110 R1 ,1 ,
1111 F7 ,2 ,
0111 F11 ,F1 ,F7 ,
1111 F8 ,5 ,
0111 F10 ,F3 ,F8 ,
1111 F9 ,8 ,

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': ['LOAD1', 6], 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': 0, 'F11': 0, 'F12': ['ADD_W_C', 10], 'F13': ['ADD_W_C', 9], 'F14': 0, 'F15': ['FP_MUL', 5], 'F16': ['FP_MUL', 2], 'R1': ['STORE', 11], 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list
Instruction 12 F12 is renamed to R1 Renamed For WAW

map_table

{'F12': ['R1', 11]}

CLOCK = 14

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 5, 'vj': 0, 'vk': 'F4', 'qj': 3, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 2, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 1, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 1, 'op': 10, 'vj': 0, 'vk': 'F14', 'qj': 9, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 9, 'vj': 0, 'vk': 0, 'qj': 5, 'qk': 2, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 1 operation: 7 vj : 0 qj: 0 LOAD1 issue : 1 operation : 6 vj : 0 qj : 0 LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 1 operation : 11 vj : 0 qj : 0 STORE issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS

issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 14 writeback : 0 completed_yet : 17 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 11 exec : 14 writeback : 0 completed_yet : 2 key : LOAD1
issue : 14 exec : 0 writeback : 0 completed_yet : 3 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 10 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 11 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 12 exec : 14 writeback : 0 completed_yet : 1 key : STORE
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 F16 ,F1 ,F2 ,
1111 is now completed
1111 is now completed
0111 F15 ,F3 ,F4 ,
1111 F5 ,3 ,
1111 F6 ,7 ,
0111 F14 ,F5 ,F6 ,
0001 F13 ,F15 ,F16 ,
0001 F12 ,F13 ,F14 ,
1110 R1 ,1 ,
1111 F7 ,2 ,
0111 F11 ,F1 ,F7 ,
1111 F8 ,5 ,
0111 F10 ,F3 ,F8 ,
1111 F9 ,8 ,

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': ['LOAD1', 6], 'F6': ['LOAD1', 7], 'F7': 0, 'F8': 0, 'F9': 0, 'F10': 0, 'F11': 0, 'F12': ['ADD_W_C', 10], 'F13': ['ADD_W_C', 9], 'F14': 0, 'F15': ['FP_MUL', 5], 'F16': ['FP_MUL', 2], 'R1': ['STORE', 11], 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list
Instruction 12 F12 is renamed to R1 Renamed For WAW

map_table

{'F12': ['R1', 11]}

CLOCK = 20

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 5, 'vj': 0, 'vk': 'F4', 'qj': 3, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 2, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 1, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 1, 'op': 10, 'vj': 0, 'vk': 'F14', 'qj': 9, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 9, 'vj': 0, 'vk': 0, 'qj': 5, 'qk': 2, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 1 operation: 14 vj : 0 qj: 0 LOAD1 issue : 1 operation : 12 vj : 0 qj : 0 LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 1 operation: 11 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 20 writeback : 0 completed_yet : 11 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 10 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 11 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 12 exec : 14 writeback : 0 completed_yet : 1 key : STORE
issue : 17 exec : 20 writeback : 0 completed_yet : 2 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 20 exec : 0 writeback : 0 completed_yet : 3 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 F16 ,F1 ,F2 ,

1111 is now completed
1111 is now completed
0111 F15 ,F3 ,F4 ,
1111 is now completed
1111 is now completed
0111 F14 ,F5 ,F6 ,
0001 F13 ,F15 ,F16 ,
0001 F12 ,F13 ,F14 ,
1110 R1 ,1 ,
1111 F7 ,2 ,
0111 F11 ,F1 ,F7 ,
1111 F8 ,5 ,
0111 F10 ,F3 ,F8 ,
1111 F9 ,8 ,

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': ['LOAD1', 12], 'F8': ['LOAD1', 14], 'F9': 0, 'F10': 0, 'F11': 0, 'F12': ['ADD_W_C', 10], 'F13': ['ADD_W_C', 9], 'F14': 0, 'F15': ['FP_MUL', 5], 'F16': ['FP_MUL', 2], 'R1': ['STORE', 11], 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list
Instruction 12 F12 is renamed to R1 Renamed For WAW

map_table

{'F12': ['R1', 11]}

CLOCK= 21

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 5, 'vj': 0, 'vk': 'F4', 'qj': 3, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 2, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 1, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 1, 'op': 10, 'vj': 0, 'vk': 'F14', 'qj': 9, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 9, 'vj': 0, 'vk': 0, 'qj': 5, 'qk': 2, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 1 operation: 14 vj : 0 qj: 0   LOAD1 issue : 1 operation : 12 vj : 0 qj : 0   LOAD1 issue:

0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 1 operation: 11 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 21 writeback : 0 completed_yet : 10 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 10 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 11 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 12 exec : 14 writeback : 0 completed_yet : 1 key : STORE
issue : 17 exec : 21 writeback : 0 completed_yet : 1 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 20 exec : 0 writeback : 0 completed_yet : 3 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 F16 ,F1 ,F2 ,
1111 is now completed
1111 is now completed
0111 F15 ,F3 ,F4 ,
1111 is now completed
1111 is now completed
0111 F14 ,F5 ,F6 ,
0001 F13 ,F15 ,F16 ,
0001 F12 ,F13 ,F14 ,
1110 R1 ,1 ,
1111 F7 ,2 ,
0111 F11 ,F1 ,F7 ,
1111 F8 ,5 ,
0111 F10 ,F3 ,F8 ,
1111 F9 ,8 ,

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': ['LOAD1', 12], 'F8': ['LOAD1', 14], 'F9': 0, 'F10': 0, 'F11': 0, 'F12': ['ADD_W_C', 10], 'F13': ['ADD_W_C', 9], 'F14': 0, 'F15': ['FP_MUL', 5], 'F16': ['FP_MUL', 2], 'R1': ['STORE', 11], 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list
Instruction 12 F12 is renamed to R1 Renamed For WAW

map_table

{'F12': ['R1', 11]}

CLOCK = 22

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 5, 'vj': 0, 'vk': 'F4', 'qj': 3, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 2, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 1, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 1, 'op': 10, 'vj': 0, 'vk': 'F14', 'qj': 9, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 9, 'vj': 0, 'vk': 0, 'qj': 5, 'qk': 2, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 1 operation: 14 vj : 0 qj: 0 LOAD1 issue : 0 operation : -1 vj : 0 qj : 0 LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 1 operation: 11 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 22 writeback : 0 completed_yet : 9 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 10 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 11 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 12 exec : 14 writeback : 0 completed_yet : 1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 20 exec : 0 writeback : 0 completed_yet : 3 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL

issue : 0 exec : 0 writeback : 0 completed_yet : 4 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 F16 ,F1 ,F2 ,
1111 is now completed
1111 is now completed
0111 F15 ,F3 ,F4 ,
1111 is now completed
1111 is now completed
0111 F14 ,F5 ,F6 ,
0001 F13 ,F15 ,F16 ,
0001 F12 ,F13 ,F14 ,
1110 R1 ,1 ,
1111 is now completed
0111 F11 ,F1 ,F7 ,
1111 F8 ,5 ,
0111 F10 ,F3 ,F8 ,
1111 F9 ,8 ,

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': ['LOAD1', 14], 'F9': 0, 'F10': 0, 'F11': 0, 'F12': ['ADD_W_C', 10], 'F13': ['ADD_W_C', 9], 'F14': 0, 'F15': ['FP_MUL', 5], 'F16': ['FP_MUL', 2], 'R1': ['STORE', 11], 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list
Instruction 12 F12 is renamed to R1 Renamed For WAW

map_table

{'F12': ['R1', 11]}

CLOCK= 23

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 5, 'vj': 0, 'vk': 'F4', 'qj': 3, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 2, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 1, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 1, 'op': 10, 'vj': 0, 'vk': 'F14', 'qj': 9, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 9, 'vj': 0, 'vk': 0, 'qj': 5, 'qk': 2, 'readytowrite': 0}

write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 1 operation: 16 vj : 0 qj: 0   LOAD1 issue : 1 operation : 14 vj : 0 qj : 0   LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0   STORE issue : 0 operation : -1 vj : 0 qj : 0   STORE issue: 1 operation: 11 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 23 writeback : 0 completed_yet : 8 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 10 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 11 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 12 exec : 14 writeback : 0 completed_yet : 1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 20 exec : 23 writeback : 0 completed_yet : 2 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 23 exec : 0 writeback : 0 completed_yet : 3 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 F16 ,F1 ,F2 ,
1111 is now completed
1111 is now completed
0111 F15 ,F3 ,F4 ,
1111 is now completed
1111 is now completed
0111 F14 ,F5 ,F6 ,
0001 F13 ,F15 ,F16 ,
0001 F12 ,F13 ,F14 ,
1110 R1 ,1 ,
1111 is now completed
0111 F11 ,F1 ,F7 ,
1111 F8 ,5 ,
0111 F10 ,F3 ,F8 ,
1111 F9 ,8 ,

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': ['LOAD1', 14], 'F9': ['LOAD1', 16], 'F10': 0, 'F11': 0, 'F12': ['ADD_W_C', 10], 'F13': ['ADD_W_C', 9], 'F14': 0, 'F15': ['FP_MUL', 5], 'F16': ['FP_MUL', 2], 'R1': ['STORE', 11], 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list
Instruction 12 F12 is renamed to R1 Renamed For WAW

map_table

{'F12': ['R1', 11]}

CLOCK = 24

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 5, 'vj': 0, 'vk': 'F4', 'qj': 3, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 2, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 1, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 1, 'op': 10, 'vj': 0, 'vk': 'F14', 'qj': 9, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 9, 'vj': 0, 'vk': 0, 'qj': 5, 'qk': 2, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 1 operation: 16 vj : 0 qj: 0 LOAD1 issue : 1 operation : 14 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 1 operation: 11 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 24 writeback : 0 completed_yet : 7 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 10 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C

issue : 11 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 12 exec : 14 writeback : 0 completed_yet : 1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 20 exec : 24 writeback : 0 completed_yet : 1 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 23 exec : 0 writeback : 0 completed_yet : 3 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 F16 ,F1 ,F2 ,
1111 is now completed
1111 is now completed
0111 F15 ,F3 ,F4 ,
1111 is now completed
1111 is now completed
0111 F14 ,F5 ,F6 ,
0001 F13 ,F15 ,F16 ,
0001 F12 ,F13 ,F14 ,
1110 R1 ,1 ,
1111 is now completed
0111 F11 ,F1 ,F7 ,
1111 F8 ,5 ,
0111 F10 ,F3 ,F8 ,
1111 F9 ,8 ,

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': ['LOAD1', 14], 'F9': ['LOAD1', 16], 'F10': 0, 'F11': 0, 'F12': ['ADD_W_C', 10], 'F13': ['ADD_W_C', 9], 'F14': 0, 'F15': ['FP_MUL', 5], 'F16': ['FP_MUL', 2], 'R1': ['STORE', 11], 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list
Instruction 12 F12 is renamed to R1 Renamed For WAW

map_table

{'F12': ['R1', 11]}

CLOCK = 25

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 5, 'vj': 0, 'vk': 'F4', 'qj': 3, 'qk': 0, 'readytoexec': 1}

execute {'busy': 1, 'op': 2, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 1, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 1, 'op': 10, 'vj': 0, 'vk': 'F14', 'qj': 9, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 9, 'vj': 0, 'vk': 0, 'qj': 5, 'qk': 2, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 1 operation: 16 vj : 0 qj: 0 LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 1 operation: 11 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 25 writeback : 0 completed_yet : 6 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 10 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 11 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 12 exec : 14 writeback : 0 completed_yet : 1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 23 exec : 0 writeback : 0 completed_yet : 3 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 F16 ,F1 ,F2 ,
1111 is now completed
1111 is now completed
0111 F15 ,F3 ,F4 ,
1111 is now completed
1111 is now completed
0111 F14 ,F5 ,F6 ,
0001 F13 ,F15 ,F16 ,
0001 F12 ,F13 ,F14 ,
1110 R1 ,1 ,

1111 is now completed
0111 F11 ,F1 ,F7 ,
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 F9 ,8 ,

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': ['LOAD1', 16], 'F10': 0, 'F11': 0, 'F12': ['ADD_W_C', 10], 'F13': ['ADD_W_C', 9], 'F14': 0, 'F15': ['FP_MUL', 5], 'F16': ['FP_MUL', 2], 'R1': ['STORE', 11], 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list
Instruction 12 F12 is renamed to R1 Renamed For WAW

map_table

{'F12': ['R1', 11]}

CLOCK = 31

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 5, 'vj': 0, 'vk': 'F4', 'qj': 3, 'qk': 0, 'readytoexec': 1}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 1, 'op': 10, 'vj': 0, 'vk': 'F14', 'qj': 9, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 9, 'vj': 0, 'vk': 0, 'qj': 5, 'qk': 2, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0   LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0   STORE issue : 0 operation : -1 vj : 0 qj : 0   STORE issue: 1 operation: 11 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1

issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 10 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 11 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 12 exec : 14 writeback : 0 completed_yet : 1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 F15 ,F3 ,F4 ,
1111 is now completed
1111 is now completed
0111 F14 ,F5 ,F6 ,
0001 F13 ,F15 ,F16 ,
0001 F12 ,F13 ,F14 ,
1110 R1 ,1 ,
1111 is now completed
0111 F11 ,F1 ,F7 ,
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': 0, 'F11': 0, 'F12': ['ADD_W_C', 10], 'F13': ['ADD_W_C', 9], 'F14': 0, 'F15': ['FP_MUL', 5], 'F16': 0, 'R1': ['STORE', 11], 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list
Instruction 12 F12 is renamed to R1 Renamed For WAW

map_table

{'F12': ['R1', 11]}

CLOCK = 32

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 8, 'vj': 'F5', 'vk': 'F6', 'qj': 0, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 5, 'vj': 0, 'vk': 'F4', 'qj': 3, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 1, 'op': 10, 'vj': 0, 'vk': 'F14', 'qj': 9, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 9, 'vj': 0, 'vk': 0, 'qj': 5, 'qk': 2, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0 LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 1 operation: 11 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 32 writeback : 0 completed_yet : 24 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 10 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 11 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 12 exec : 14 writeback : 0 completed_yet : 1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 F15 ,F3 ,F4 ,
1111 is now completed
1111 is now completed
0111 F14 ,F5 ,F6 ,
0001 F13 ,F15 ,F16 ,

0001 F12 ,F13 ,F14 ,
1110 R1 ,1 ,
1111 is now completed
0111 F11 ,F1 ,F7 ,
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': 0, 'F11': 0, 'F12': ['ADD_W_C', 10], 'F13': ['ADD_W_C', 9], 'F14': ['FP_MUL', 8], 'F15': ['FP_MUL', 5], 'F16': 0, 'R1': ['STORE', 11], 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list
Instruction 12 F12 is renamed to R1 Renamed For WAW

map_table

{'F12': ['R1', 11]}

CLOCK = 58

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 13, 'vj': 'F1', 'vk': 'F7', 'qj': 0, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 8, 'vj': 'F5', 'vk': 'F6', 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 1, 'op': 10, 'vj': 0, 'vk': 'F14', 'qj': 9, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 9, 'vj': 0, 'vk': 0, 'qj': 5, 'qk': 2, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0 LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 1 operation: 11 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL

issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 58 writeback : 0 completed_yet : 23 key : FP_MUL
issue : 10 exec : 58 writeback : 0 completed_yet : 4 key : ADD_W_C
issue : 11 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 12 exec : 14 writeback : 0 completed_yet : 1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 57 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 F14 ,F5 ,F6 ,
0001 F13 ,F15 ,F16 ,
0001 F12 ,F13 ,F14 ,
1110 R1 ,1 ,
1111 is now completed
0111 F11 ,F1 ,F7 ,
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': 0, 'F11': ['FP_MUL', 13], 'F12': ['ADD_W_C', 10], 'F13': ['ADD_W_C', 9], 'F14': ['FP_MUL', 8], 'F15': 0, 'F16': 0, 'R1': ['STORE', 11], 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list
Instruction 12 F12 is renamed to R1 Renamed For WAW

map_table

{'F12': ['R1', 11]}

CLOCK = 59

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 13, 'vj': 'F1', 'vk': 'F7', 'qj': 0, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 8, 'vj': 'F5', 'vk': 'F6', 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 1, 'op': 10, 'vj': 0, 'vk': 'F14', 'qj': 9, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 9, 'vj': 0, 'vk': 0, 'qj': 5, 'qk': 2, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0 LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 1 operation: 11 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 59 writeback : 0 completed_yet : 22 key : FP_MUL
issue : 10 exec : 59 writeback : 0 completed_yet : 3 key : ADD_W_C
issue : 11 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 12 exec : 14 writeback : 0 completed_yet : 1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 57 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed

1111 is now completed
0111 F14 ,F5 ,F6 ,
0001 F13 ,F15 ,F16 ,
0001 F12 ,F13 ,F14 ,
1110 R1 ,1 ,
1111 is now completed
0111 F11 ,F1 ,F7 ,
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': 0, 'F11': ['FP_MUL', 13], 'F12': ['ADD_W_C', 10], 'F13': ['ADD_W_C', 9], 'F14': ['FP_MUL', 8], 'F15': 0, 'F16': 0, 'R1': ['STORE', 11], 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list
Instruction 12 F12 is renamed to R1 Renamed For WAW

map_table

{'F12': ['R1', 11]}

CLOCK = 60

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 13, 'vj': 'F1', 'vk': 'F7', 'qj': 0, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 8, 'vj': 'F5', 'vk': 'F6', 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 1, 'op': 10, 'vj': 0, 'vk': 'F14', 'qj': 9, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 9, 'vj': 0, 'vk': 0, 'qj': 5, 'qk': 2, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0   LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0   STORE issue : 0 operation : -1 vj : 0 qj : 0   STORE issue: 1 operation: 11 vj: 0 qj: 0

Instruction STATUS

issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 60 writeback : 0 completed_yet : 21 key : FP_MUL
issue : 10 exec : 60 writeback : 0 completed_yet : 2 key : ADD_W_C
issue : 11 exec : 0 writeback : 0 completed_yet : 7 key : ADD_W_C
issue : 12 exec : 14 writeback : 0 completed_yet : 1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 57 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 F14 ,F5 ,F6 ,
0001 F13 ,F15 ,F16 ,
0001 F12 ,F13 ,F14 ,
1110 R1 ,1 ,
1111 is now completed
0111 F11 ,F1 ,F7 ,
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': 0, 'F11': ['FP_MUL', 13], 'F12': ['ADD_W_C', 10], 'F13': ['ADD_W_C', 9], 'F14': ['FP_MUL', 8], 'F15': 0, 'F16': 0, 'R1': ['STORE', 11], 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list
Instruction 12 F12 is renamed to R1 Renamed For WAW

map_table

{'F12': ['R1', 11]}

CLOCK = 81

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 13, 'vj': 'F1', 'vk': 'F7', 'qj': 0, 'qk': 0, 'readytoexec': 1}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 1, 'op': 10, 'vj': 0, 'vk': 'F14', 'qj': 9, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0 LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 1 operation: 11 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 80 writeback : 81 completed_yet : -1 key : FP_MUL
issue : 10 exec : 61 writeback : 62 completed_yet : -1 key : ADD_W_C
issue : 11 exec : 81 writeback : 0 completed_yet : 6 key : ADD_W_C
issue : 12 exec : 14 writeback : 0 completed_yet : 1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 57 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 0 exec : 0 writeback : 0 completed_yet : 26 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed

0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
0001 is now completed
0001 F12 ,F13 ,F14 ,
1110 R1 ,1 ,
1111 is now completed
0111 F11 ,F1 ,F7 ,
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': 0, 'F11': ['FP_MUL',
 13], 'F12': ['ADD_W_C', 10], 'F13': 0, 'F14': 0, 'F15': 0, 'F16': 0, 'R1': ['STORE', 11], 'R2': 0, 'R3':
 0, 'R4': 0, 'R5': 0}

Renamed Register list
Instruction 12 F12 is renamed to R1 Renamed For WAW

map_table

{'F12': ['R1', 11]}

CLOCK= 82

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 15, 'vj': 'F3', 'vk': 'F8', 'qj': 0, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 13, 'vj': 'F1', 'vk': 'F7', 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 1, 'op': 10, 'vj': 0, 'vk': 'F14', 'qj': 9, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0   LOAD1 issue : 0 operation : -1 vj : 0 qj : 0

LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 1 operation: 11 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 80 writeback : 81 completed_yet : -1 key : FP_MUL
issue : 10 exec : 61 writeback : 62 completed_yet : -1 key : ADD_W_C
issue : 11 exec : 82 writeback : 0 completed_yet : 5 key : ADD_W_C
issue : 12 exec : 14 writeback : 0 completed_yet : 1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 57 exec : 82 writeback : 0 completed_yet : 24 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 82 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
0001 is now completed
0001 F12 ,F13 ,F14 ,
1110 R1 ,1 ,
1111 is now completed
0111 F11 ,F1 ,F7 ,
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': ['FP_MUL', 15], 'F11': ['FP_MUL', 13], 'F12': ['ADD_W_C', 10], 'F13': 0, 'F14': 0, 'F15': 0, 'F16': 0, 'R1': ['STORE', 11], 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list
Instruction 12 F12 is renamed to R1 Renamed For WAW

map_table

{'F12': ['R1', 11]}

CLOCK = 83

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 15, 'vj': 'F3', 'vk': 'F8', 'qj': 0, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 13, 'vj': 'F1', 'vk': 'F7', 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 1, 'op': 10, 'vj': 0, 'vk': 'F14', 'qj': 9, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0 LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE
issue: 1 operation: 11 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 80 writeback : 81 completed_yet : -1 key : FP_MUL
issue : 10 exec : 61 writeback : 62 completed_yet : -1 key : ADD_W_C
issue : 11 exec : 83 writeback : 0 completed_yet : 4 key : ADD_W_C
issue : 12 exec : 14 writeback : 0 completed_yet : 1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 57 exec : 83 writeback : 0 completed_yet : 23 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 82 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
0001 is now completed
0001 F12 ,F13 ,F14 ,
1110 R1 ,1 ,
1111 is now completed
0111 F11 ,F1 ,F7 ,
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': ['FP_MUL', 15], 'F11': ['FP_MUL', 13], 'F12': ['ADD_W_C', 10], 'F13': 0, 'F14': 0, 'F15': 0, 'F16': 0, 'R1': ['STORE', 11], 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list
Instruction 12 F12 is renamed to R1 Renamed For WAW

map_table

{'F12': ['R1', 11]}

CLOCK= 84

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 15, 'vj': 'F3', 'vk': 'F8', 'qj': 0, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 13, 'vj': 'F1', 'vk': 'F7', 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 1, 'op': 10, 'vj': 0, 'vk': 'F14', 'qj': 9, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0 LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 1 operation: 11 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 80 writeback : 81 completed_yet : -1 key : FP_MUL
issue : 10 exec : 61 writeback : 62 completed_yet : -1 key : ADD_W_C
issue : 11 exec : 84 writeback : 0 completed_yet : 3 key : ADD_W_C
issue : 12 exec : 14 writeback : 0 completed_yet : 1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 57 exec : 84 writeback : 0 completed_yet : 22 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 82 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
0001 is now completed
0001 F12 ,F13 ,F14 ,
1110 R1 ,1 ,
1111 is now completed
0111 F11 ,F1 ,F7 ,
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status

{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': ['FP_MUL', 15], 'F11': ['FP_MUL', 13], 'F12': ['ADD_W_C', 10], 'F13': 0, 'F14': 0, 'F15': 0, 'F16': 0, 'R1': ['STORE', 11], 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list
Instruction 12 F12 is renamed to R1 Renamed For WAW

map_table

{'F12': ['R1', 11]}

CLOCK = 85

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 15, 'vj': 'F3', 'vk': 'F8', 'qj': 0, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 13, 'vj': 'F1', 'vk': 'F7', 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 1, 'op': 10, 'vj': 0, 'vk': 'F14', 'qj': 9, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0 LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 1 operation: 11 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 80 writeback : 81 completed_yet : -1 key : FP_MUL
issue : 10 exec : 61 writeback : 62 completed_yet : -1 key : ADD_W_C
issue : 11 exec : 85 writeback : 0 completed_yet : 2 key : ADD_W_C
issue : 12 exec : 14 writeback : 0 completed_yet : 1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1

issue : 57 exec : 85 writeback : 0 completed_yet : 21 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 82 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
0001 is now completed
0001 F12 ,F13 ,F14 ,
1110 R1 ,1 ,
1111 is now completed
0111 F11 ,F1 ,F7 ,
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': ['FP_MUL', 15], 'F11': ['FP_MUL', 13], 'F12': ['ADD_W_C', 10], 'F13': 0, 'F14': 0, 'F15': 0, 'F16': 0, 'R1': ['STORE', 11], 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list
Instruction 12 F12 is renamed to R1 Renamed For WAW

map_table

{'F12': ['R1', 11]}

CLOCK = 86

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 15, 'vj': 'F3', 'vk': 'F8', 'qj': 0, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 13, 'vj': 'F1', 'vk': 'F7', 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 1, 'op': 10, 'vj': 0, 'vk': 'F14', 'qj': 9, 'qk': 0, 'readytowrite': 1}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0 LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 1 operation: 11 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 80 writeback : 81 completed_yet : -1 key : FP_MUL
issue : 10 exec : 61 writeback : 62 completed_yet : -1 key : ADD_W_C
issue : 11 exec : 86 writeback : 0 completed_yet : 1 key : ADD_W_C
issue : 12 exec : 14 writeback : 0 completed_yet : 1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 57 exec : 86 writeback : 0 completed_yet : 20 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 82 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
0001 is now completed
0001 F12 ,F13 ,F14 ,
1110 R1 ,1 ,
1111 is now completed
0111 F11 ,F1 ,F7 ,

1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': ['FP_MUL', 15], 'F11': ['FP_MUL', 13], 'F12': ['ADD_W_C', 10], 'F13': 0, 'F14': 0, 'F15': 0, 'F16': 0, 'R1': ['STORE', 11], 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list
Instruction 12 F12 is renamed to R1 Renamed For WAW

map_table

{'F12': ['R1', 11]}

CLOCK = 87

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 15, 'vj': 'F3', 'vk': 'F8', 'qj': 0, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 13, 'vj': 'F1', 'vk': 'F7', 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0   LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0   STORE issue : 0 operation : -1 vj : 0 qj : 0   STORE issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1

issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 80 writeback : 81 completed_yet : -1 key : FP_MUL
issue : 10 exec : 61 writeback : 62 completed_yet : -1 key : ADD_W_C
issue : 11 exec : 86 writeback : 87 completed_yet : -1 key : ADD_W_C
issue : 12 exec : 14 writeback : 87 completed_yet : -1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 57 exec : 87 writeback : 0 completed_yet : 19 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 82 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
0001 is now completed
0001 is now completed
1110 is now completed
1111 is now completed
0111 F11 ,F1 ,F7 ,
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': ['FP_MUL', 15], 'F11': ['FP_MUL', 13], 'F12': 0, 'F13': 0, 'F14': 0, 'F15': 0, 'F16': 0, 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list

map_table

{'F12': ['R1', 11]}

EXCEPTION Handled Messages
Write register done F12
BUFFER TRANSFER FROM to R1 to its original register

CLOCK = 88

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 15, 'vj': 'F3', 'vk': 'F8', 'qj': 0, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 13, 'vj': 'F1', 'vk': 'F7', 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0 LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 80 writeback : 81 completed_yet : -1 key : FP_MUL
issue : 10 exec : 61 writeback : 62 completed_yet : -1 key : ADD_W_C
issue : 11 exec : 86 writeback : 87 completed_yet : -1 key : ADD_W_C
issue : 12 exec : 14 writeback : 87 completed_yet : -1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 57 exec : 88 writeback : 0 completed_yet : 18 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 82 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed

1111 is now completed
0111 is now completed
0001 is now completed
0001 is now completed
1110 is now completed
1111 is now completed
0111 F11 ,F1 ,F7 ,
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': ['FP_MUL', 15], 'F11': ['FP_MUL', 13], 'F12': 0, 'F13': 0, 'F14': 0, 'F15': 0, 'F16': 0, 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list

EXCEPTION Handled Messages
REGISTER RENAMED F12 to its original name

CLOCK = 89

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 15, 'vj': 'F3', 'vk': 'F8', 'qj': 0, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 13, 'vj': 'F1', 'vk': 'F7', 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0   LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0   STORE issue : 0 operation : -1 vj : 0 qj : 0   STORE issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1

issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 80 writeback : 81 completed_yet : -1 key : FP_MUL
issue : 10 exec : 61 writeback : 62 completed_yet : -1 key : ADD_W_C
issue : 11 exec : 86 writeback : 87 completed_yet : -1 key : ADD_W_C
issue : 12 exec : 14 writeback : 87 completed_yet : -1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 57 exec : 89 writeback : 0 completed_yet : 17 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 82 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
0001 is now completed
0001 is now completed
1110 is now completed
1111 is now completed
0111 F11 ,F1 ,F7 ,
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': ['FP_MUL', 15], 'F11': ['FP_MUL', 13], 'F12': 0, 'F13': 0, 'F14': 0, 'F15': 0, 'F16': 0, 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list

CLOCK = 90

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 15, 'vj': 'F3', 'vk': 'F8', 'qj': 0, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 13, 'vj': 'F1', 'vk': 'F7', 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0 LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 80 writeback : 81 completed_yet : -1 key : FP_MUL
issue : 10 exec : 61 writeback : 62 completed_yet : -1 key : ADD_W_C
issue : 11 exec : 86 writeback : 87 completed_yet : -1 key : ADD_W_C
issue : 12 exec : 14 writeback : 87 completed_yet : -1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 57 exec : 90 writeback : 0 completed_yet : 16 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 82 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
0001 is now completed
0001 is now completed
1110 is now completed
1111 is now completed
0111 F11 ,F1 ,F7 ,

1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': ['FP_MUL', 15], 'F11': ['FP_MUL', 13], 'F12': 0, 'F13': 0, 'F14': 0, 'F15': 0, 'F16': 0, 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list

CLOCK = 105

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 15, 'vj': 'F3', 'vk': 'F8', 'qj': 0, 'qk': 0, 'readytoexec': 1}
execute {'busy': 1, 'op': 13, 'vj': 'F1', 'vk': 'F7', 'qj': 0, 'qk': 0, 'readytowrite': 1}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0   LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0   STORE issue : 0 operation : -1 vj : 0 qj : 0   STORE issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 80 writeback : 81 completed_yet : -1 key : FP_MUL
issue : 10 exec : 61 writeback : 62 completed_yet : -1 key : ADD_W_C
issue : 11 exec : 86 writeback : 87 completed_yet : -1 key : ADD_W_C
issue : 12 exec : 14 writeback : 87 completed_yet : -1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 57 exec : 105 writeback : 0 completed_yet : 1 key : FP_MUL

issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 82 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
0001 is now completed
0001 is now completed
1110 is now completed
1111 is now completed
0111 F11 ,F1 ,F7 ,
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': ['FP_MUL', 15], 'F11': ['FP_MUL', 13], 'F12': 0, 'F13': 0, 'F14': 0, 'F15': 0, 'F16': 0, 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list

CLOCK = 106

Hardware Reservation Table
FP_MUL issue {'busy': 1, 'op': 15, 'vj': 'F3', 'vk': 'F8', 'qj': 0, 'qk': 0, 'readytoexec': 1}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0 LOAD1 issue : 0 operation : -1 vj : 0 qj : 0

LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0   STORE issue : 0 operation : -1 vj : 0 qj : 0   STORE issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 80 writeback : 81 completed_yet : -1 key : FP_MUL
issue : 10 exec : 61 writeback : 62 completed_yet : -1 key : ADD_W_C
issue : 11 exec : 86 writeback : 87 completed_yet : -1 key : ADD_W_C
issue : 12 exec : 14 writeback : 87 completed_yet : -1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 57 exec : 105 writeback : 106 completed_yet : -1 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 82 exec : 0 writeback : 0 completed_yet : 25 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
0001 is now completed
0001 is now completed
1110 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': ['FP_MUL', 15], 'F11': 0, 'F12': 0, 'F13': 0, 'F14': 0, 'F15': 0, 'F16': 0, 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list

CLOCK = 107

Hardware Reservation Table
FP_MUL issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 1, 'op': 15, 'vj': 'F3', 'vk': 'F8', 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0 LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 80 writeback : 81 completed_yet : -1 key : FP_MUL
issue : 10 exec : 61 writeback : 62 completed_yet : -1 key : ADD_W_C
issue : 11 exec : 86 writeback : 87 completed_yet : -1 key : ADD_W_C
issue : 12 exec : 14 writeback : 87 completed_yet : -1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 57 exec : 105 writeback : 106 completed_yet : -1 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 82 exec : 107 writeback : 0 completed_yet : 24 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed

0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
0001 is now completed
0001 is now completed
1110 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': ['FP_MUL', 15], 'F11': 0, 'F12': 0, 'F13': 0, 'F14': 0, 'F15': 0, 'F16': 0, 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list

CLOCK = 122

Hardware Reservation Table
FP_MUL issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 1, 'op': 15, 'vj': 'F3', 'vk': 'F8', 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0   LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0   STORE issue : 0 operation : -1 vj : 0 qj : 0   STORE issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL

issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 80 writeback : 81 completed_yet : -1 key : FP_MUL
issue : 10 exec : 61 writeback : 62 completed_yet : -1 key : ADD_W_C
issue : 11 exec : 86 writeback : 87 completed_yet : -1 key : ADD_W_C
issue : 12 exec : 14 writeback : 87 completed_yet : -1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 57 exec : 105 writeback : 106 completed_yet : -1 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 82 exec : 122 writeback : 0 completed_yet : 9 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
0001 is now completed
0001 is now completed
1110 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': ['FP_MUL', 15], 'F11': 0, 'F12': 0, 'F13': 0, 'F14': 0, 'F15': 0, 'F16': 0, 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list

CLOCK = 123

Hardware Reservation Table
FP_MUL issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}

execute {'busy': 1, 'op': 15, 'vj': 'F3', 'vk': 'F8', 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0 LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0

STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 80 writeback : 81 completed_yet : -1 key : FP_MUL
issue : 10 exec : 61 writeback : 62 completed_yet : -1 key : ADD_W_C
issue : 11 exec : 86 writeback : 87 completed_yet : -1 key : ADD_W_C
issue : 12 exec : 14 writeback : 87 completed_yet : -1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 57 exec : 105 writeback : 106 completed_yet : -1 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 82 exec : 123 writeback : 0 completed_yet : 8 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
0001 is now completed
0001 is now completed

1110 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': ['FP_MUL', 15], 'F11': 0, 'F12': 0, 'F13': 0, 'F14': 0, 'F15': 0, 'F16': 0, 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list

CLOCK = 124

Hardware Reservation Table
FP_MUL issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 1, 'op': 15, 'vj': 'F3', 'vk': 'F8', 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0   LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0   STORE issue : 0 operation : -1 vj : 0 qj : 0   STORE issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 80 writeback : 81 completed_yet : -1 key : FP_MUL
issue : 10 exec : 61 writeback : 62 completed_yet : -1 key : ADD_W_C
issue : 11 exec : 86 writeback : 87 completed_yet : -1 key : ADD_W_C
issue : 12 exec : 14 writeback : 87 completed_yet : -1 key : STORE

issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 57 exec : 105 writeback : 106 completed_yet : -1 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 82 exec : 124 writeback : 0 completed_yet : 7 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
0001 is now completed
0001 is now completed
1110 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': ['FP_MUL', 15], 'F11': 0, 'F12': 0, 'F13': 0, 'F14': 0, 'F15': 0, 'F16': 0, 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list

CLOCK = 125

Hardware Reservation Table
FP_MUL issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 1, 'op': 15, 'vj': 'F3', 'vk': 'F8', 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0   LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0

STORE issue : 0 operation: -1 vj : 0 qj: 0   STORE issue : 0 operation : -1 vj : 0 qj : 0   STORE issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 80 writeback : 81 completed_yet : -1 key : FP_MUL
issue : 10 exec : 61 writeback : 62 completed_yet : -1 key : ADD_W_C
issue : 11 exec : 86 writeback : 87 completed_yet : -1 key : ADD_W_C
issue : 12 exec : 14 writeback : 87 completed_yet : -1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 57 exec : 105 writeback : 106 completed_yet : -1 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 82 exec : 125 writeback : 0 completed_yet : 6 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
0001 is now completed
0001 is now completed
1110 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': ['FP_MUL', 15], 'F11':

0, 'F12': 0, 'F13': 0, 'F14': 0, 'F15': 0, 'F16': 0, 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list

CLOCK = 126

Hardware Reservation Table
FP_MUL issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 1, 'op': 15, 'vj': 'F3', 'vk': 'F8', 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0 LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE
issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 80 writeback : 81 completed_yet : -1 key : FP_MUL
issue : 10 exec : 61 writeback : 62 completed_yet : -1 key : ADD_W_C
issue : 11 exec : 86 writeback : 87 completed_yet : -1 key : ADD_W_C
issue : 12 exec : 14 writeback : 87 completed_yet : -1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 57 exec : 105 writeback : 106 completed_yet : -1 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 82 exec : 126 writeback : 0 completed_yet : 5 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
0001 is now completed
0001 is now completed
1110 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': ['FP_MUL', 15], 'F11': 0, 'F12': 0, 'F13': 0, 'F14': 0, 'F15': 0, 'F16': 0, 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list

CLOCK = 127

Hardware Reservation Table
FP_MUL issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 1, 'op': 15, 'vj': 'F3', 'vk': 'F8', 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0   LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0   STORE issue : 0 operation : -1 vj : 0 qj : 0   STORE issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS

issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 80 writeback : 81 completed_yet : -1 key : FP_MUL
issue : 10 exec : 61 writeback : 62 completed_yet : -1 key : ADD_W_C
issue : 11 exec : 86 writeback : 87 completed_yet : -1 key : ADD_W_C
issue : 12 exec : 14 writeback : 87 completed_yet : -1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 57 exec : 105 writeback : 106 completed_yet : -1 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 82 exec : 127 writeback : 0 completed_yet : 4 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
0001 is now completed
0001 is now completed
1110 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': ['FP_MUL', 15], 'F11': 0, 'F12': 0, 'F13': 0, 'F14': 0, 'F15': 0, 'F16': 0, 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list

CLOCK = 128

Hardware Reservation Table
FP_MUL issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 1, 'op': 15, 'vj': 'F3', 'vk': 'F8', 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0 LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 80 writeback : 81 completed_yet : -1 key : FP_MUL
issue : 10 exec : 61 writeback : 62 completed_yet : -1 key : ADD_W_C
issue : 11 exec : 86 writeback : 87 completed_yet : -1 key : ADD_W_C
issue : 12 exec : 14 writeback : 87 completed_yet : -1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 57 exec : 105 writeback : 106 completed_yet : -1 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 82 exec : 128 writeback : 0 completed_yet : 3 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed

0001 is now completed
0001 is now completed
1110 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': ['FP_MUL', 15], 'F11': 0, 'F12': 0, 'F13': 0, 'F14': 0, 'F15': 0, 'F16': 0, 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list

CLOCK = 129

Hardware Reservation Table
FP_MUL issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 1, 'op': 15, 'vj': 'F3', 'vk': 'F8', 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0   LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0   STORE issue : 0 operation : -1 vj : 0 qj : 0   STORE issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 80 writeback : 81 completed_yet : -1 key : FP_MUL
issue : 10 exec : 61 writeback : 62 completed_yet : -1 key : ADD_W_C

issue : 11 exec : 86 writeback : 87 completed_yet : -1 key : ADD_W_C
issue : 12 exec : 14 writeback : 87 completed_yet : -1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 57 exec : 105 writeback : 106 completed_yet : -1 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 82 exec : 129 writeback : 0 completed_yet : 2 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
0001 is now completed
0001 is now completed
1110 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': ['FP_MUL', 15], 'F11': 0, 'F12': 0, 'F13': 0, 'F14': 0, 'F15': 0, 'F16': 0, 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list

CLOCK = 130

Hardware Reservation Table
FP_MUL issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 1, 'op': 15, 'vj': 'F3', 'vk': 'F8', 'qj': 0, 'qk': 0, 'readytowrite': 1}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0 LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 80 writeback : 81 completed_yet : -1 key : FP_MUL
issue : 10 exec : 61 writeback : 62 completed_yet : -1 key : ADD_W_C
issue : 11 exec : 86 writeback : 87 completed_yet : -1 key : ADD_W_C
issue : 12 exec : 14 writeback : 87 completed_yet : -1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 57 exec : 105 writeback : 106 completed_yet : -1 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 82 exec : 130 writeback : 0 completed_yet : 1 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
0001 is now completed
0001 is now completed
1110 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
0111 F10 ,F3 ,F8 ,
1111 is now completed

Register Status

{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': ['FP_MUL', 15], 'F11': 0, 'F12': 0, 'F13': 0, 'F14': 0, 'F15': 0, 'F16': 0, 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list

CLOCK = 131

Hardware Reservation Table
FP_MUL issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

ADD_W_C issue {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytoexec': 0}
execute {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0, 'readytowrite': 0}
write back {'busy': 0, 'op': -1, 'vj': 0, 'vk': 0, 'qj': 0, 'qk': 0}

Hardware Reservation Table for Load Store Complement
LOAD1 issue : 0 operation: -1 vj : 0 qj: 0 LOAD1 issue : 0 operation : -1 vj : 0 qj : 0
LOAD1 issue: 0 operation: -1 vj: 0 qj: 0
STORE issue : 0 operation: -1 vj : 0 qj: 0 STORE issue : 0 operation : -1 vj : 0 qj : 0 STORE issue: 0 operation: -1 vj: 0 qj: 0

Instruction STATUS
issue : 1 exec : 3 writeback : 4 completed_yet : -1 key : LOAD1
issue : 2 exec : 6 writeback : 7 completed_yet : -1 key : LOAD1
issue : 3 exec : 30 writeback : 31 completed_yet : -1 key : FP_MUL
issue : 5 exec : 9 writeback : 10 completed_yet : -1 key : LOAD1
issue : 8 exec : 12 writeback : 13 completed_yet : -1 key : LOAD1
issue : 6 exec : 55 writeback : 56 completed_yet : -1 key : FP_MUL
issue : 11 exec : 15 writeback : 16 completed_yet : -1 key : LOAD1
issue : 14 exec : 18 writeback : 19 completed_yet : -1 key : LOAD1
issue : 32 exec : 80 writeback : 81 completed_yet : -1 key : FP_MUL
issue : 10 exec : 61 writeback : 62 completed_yet : -1 key : ADD_W_C
issue : 11 exec : 86 writeback : 87 completed_yet : -1 key : ADD_W_C
issue : 12 exec : 14 writeback : 87 completed_yet : -1 key : STORE
issue : 17 exec : 21 writeback : 22 completed_yet : -1 key : LOAD1
issue : 57 exec : 105 writeback : 106 completed_yet : -1 key : FP_MUL
issue : 20 exec : 24 writeback : 25 completed_yet : -1 key : LOAD1
issue : 82 exec : 130 writeback : 131 completed_yet : -1 key : FP_MUL
issue : 23 exec : 27 writeback : 28 completed_yet : -1 key : LOAD1

Instructions Input

1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
1111 is now completed
0111 is now completed
0001 is now completed
0001 is now completed
1110 is now completed
1111 is now completed
0111 is now completed
1111 is now completed
0111 is now completed
1111 is now completed

Register Status
{'F1': 0, 'F2': 0, 'F3': 0, 'F4': 0, 'F5': 0, 'F6': 0, 'F7': 0, 'F8': 0, 'F9': 0, 'F10': 0, 'F11': 0, 'F12': 0, 'F13': 0, 'F14': 0, 'F15': 0, 'F16': 0, 'R1': 0, 'R2': 0, 'R3': 0, 'R4': 0, 'R5': 0}

Renamed Register list

FINISHING CLOCK = 131
Done With Execution of program

tempuser@tempuser-i7works:~/Desktop/tepfor/Tomasulo_algo_simulation$

CONCLUSION

- **Total Number of cycle** required for instruction execution = 131
- **Order of completion** : Out of order(1,2,4,5,7,8,13,15,17,3,6,8,9,11,12,14,13)
- **STALLS**

  NOTE:(Stalls are accounted if any incomplete instruction in any cycle is not executed)

  Due to number of Hardware

  LOAD: 24 cycles

  MULT: 51 cycles

  ADDER: 5 cycles

  STORE: 0 (luckily store is called only once)

  RAW Hazard: 44 cycles

  NOTE : The above cycles are **NOT** disjoint ,multiple instructions may be stalled in one cycle due to multiple reasons.

- **HAZARDS PREVENTED**

  RAW hazard prevented at cycle 13 by stalling.

  WAW hazard prevented at cycle 12 by register renaming.

REFERENCES

1. https://en.wikipedia.org/wiki/Tomasulo_algorithm
2. https://people.eecs.berkeley.edu/~pattrsn/252F96/Lecture04.pdf
3. https://github.com/Stenardt-9002/Tomasulo_algo_simulation/blob/master/Tumosolo.ipynb

RUN ANY SAMPLE PRESENT IN

https://raw.githubusercontent.com/Stenardt-9002/Tomasulo_algo_simulation/master/SampleInputlist.txt?token=AKL45BIOLOSN4JFKJBWRJ4K7ACS7W in following code

https://raw.githubusercontent.com/Stenardt-9002/Tomasulo_algo_simulation/master/main.py?token=AKL45BLJTFOWYPFZ7FLPKXS7ACTCS

To test simulation for various examples