

3 2 + 1

1. ADDI $F_1, F_2, 1$
2. SUB F_1, F_3, F_4
3. DIV F_1, F_2, F_3
4. MUL F_1, F_3, F_4
5. ADD F_2, F_4, F_2
6. ADDI $F_4, F_1, 2$
7. MUL F_5, F_5, F_5
8. ADD F_1, F_1, F_4

RF

| | |
|----|---|
| F1 | 0 |
| F2 | 2 |
| F3 | 4 |
| F4 | 6 |
| F5 | 8 |

RAT

| | |
|-----|--|
| Rs1 | |
| | |
| | |
| | |
| | |

Rs2 F_1, F_3, F_4

Rs3

RS(+)

| | | | |
|-----|---|---|---|
| Rs1 | + | 2 | 1 |
| 3 | - | 4 | 6 |

Buffer

(X, 1)

| | | | |
|--|--|--|--|
| | | | |
| | | | |

Issue Ex WB

A 1. 2 4

S 2. 4 6

D 3. 4 4

M 4. 4 4

A 5. 5 5

A 6. 4 5

M 4 5 4

A 4 5 4

sub.add:2

Mul:10

DIV:40

System all need

Rs1 $F_1, F_2, 1$

Rs# F_1, F_2, F_3, F_4

Rs1 F_3, F_4, F_5

Rs2 F_1, F_2, F_3

Rs3 F_1, F_2, F_3, F_4, F_5

Rs4 F_1, F_2, F_3

Rs5 F_1, F_2, F_3

Rs6 F_1, F_2, F_3

Rs7 F_1, F_2, F_3

Rs8 F_1, F_2, F_3

Rs9 F_1, F_2, F_3

Rs10 F_1, F_2, F_3

Rs11 F_1, F_2, F_3

Rs12 F_1, F_2, F_3

Rs13 F_1, F_2, F_3

Rs14 F_1, F_2, F_3

Rs15 F_1, F_2, F_3

Rs16 F_1, F_2, F_3

Rs17 F_1, F_2, F_3

Rs18 F_1, F_2, F_3

Rs19 F_1, F_2, F_3

Rs20 F_1, F_2, F_3

Rs21 F_1, F_2, F_3

Rs22 F_1, F_2, F_3

Rs23 F_1, F_2, F_3

Rs24 F_1, F_2, F_3

Rs25 F_1, F_2, F_3

Rs26 F_1, F_2, F_3

Rs27 F_1, F_2, F_3

Rs28 F_1, F_2, F_3

Rs29 F_1, F_2, F_3

Rs30 F_1, F_2, F_3

Rs31 F_1, F_2, F_3

Rs32 F_1, F_2, F_3

Rs33 F_1, F_2, F_3

Rs34 F_1, F_2, F_3

Rs35 F_1, F_2, F_3

Rs36 F_1, F_2, F_3

Rs37 F_1, F_2, F_3

Rs38 F_1, F_2, F_3

Rs39 F_1, F_2, F_3

Rs40 F_1, F_2, F_3

Rs41 F_1, F_2, F_3

Rs42 F_1, F_2, F_3

Rs43 F_1, F_2, F_3

Rs44 F_1, F_2, F_3

Rs45 F_1, F_2, F_3

Rs46 F_1, F_2, F_3

Rs47 F_1, F_2, F_3

Rs48 F_1, F_2, F_3

Rs49 F_1, F_2, F_3

Rs50 F_1, F_2, F_3

Rs51 F_1, F_2, F_3

Rs52 F_1, F_2, F_3

Rs53 F_1, F_2, F_3

Rs54 F_1, F_2, F_3

Rs55 F_1, F_2, F_3

Rs56 F_1, F_2, F_3

Rs57 F_1, F_2, F_3

Rs58 F_1, F_2, F_3

Rs59 F_1, F_2, F_3

Rs60 F_1, F_2, F_3

Rs61 F_1, F_2, F_3

Rs62 F_1, F_2, F_3

Rs63 F_1, F_2, F_3

Rs64 F_1, F_2, F_3

Rs65 F_1, F_2, F_3

Rs66 F_1, F_2, F_3

Rs67 F_1, F_2, F_3

Rs68 F_1, F_2, F_3

Rs69 F_1, F_2, F_3

Rs70 F_1, F_2, F_3

Rs71 F_1, F_2, F_3

Rs72 F_1, F_2, F_3

Rs73 F_1, F_2, F_3

Rs74 F_1, F_2, F_3

Rs75 F_1, F_2, F_3

Rs76 F_1, F_2, F_3

Rs77 F_1, F_2, F_3

Rs78 F_1, F_2, F_3

Rs79 F_1, F_2, F_3

Rs80 F_1, F_2, F_3

Rs81 F_1, F_2, F_3

Rs82 F_1, F_2, F_3

Rs83 F_1, F_2, F_3

Rs84 F_1, F_2, F_3

Rs85 F_1, F_2, F_3

Rs86 F_1, F_2, F_3

Rs87 F_1, F_2, F_3

Rs88 F_1, F_2, F_3

Rs89 F_1, F_2, F_3

Rs90 F_1, F_2, F_3

Rs91 F_1, F_2, F_3

Rs92 F_1, F_2, F_3

Rs93 F_1, F_2, F_3

Rs94 F_1, F_2, F_3

Rs95 F_1, F_2, F_3

Rs96 F_1, F_2, F_3

Rs97 F_1, F_2, F_3

Rs98 F_1, F_2, F_3

Rs99 F_1, F_2, F_3

Rs100 F_1, F_2, F_3

Rs101 F_1, F_2, F_3

Rs102 F_1, F_2, F_3

Rs103 F_1, F_2, F_3

Rs104 F_1, F_2, F_3

Rs105 F_1, F_2, F_3

Rs106 F_1, F_2, F_3

Rs107 F_1, F_2, F_3

Rs108 F_1, F_2, F_3

Rs109 F_1, F_2, F_3

Rs110 F_1, F_2, F_3

Rs111 F_1, F_2, F_3

Rs112 F_1, F_2, F_3

Rs113 F_1, F_2, F_3

Rs114 F_1, F_2, F_3

Rs115 F_1, F_2, F_3

Rs116 F_1, F_2, F_3

Rs117 F_1, F_2, F_3

Rs118 F_1, F_2, F_3

Rs119 F_1, F_2, F_3

Rs120 F_1, F_2, F_3

Rs121 F_1, F_2, F_3

Rs122 F_1, F_2, F_3

Rs123 F_1, F_2, F_3

Rs124 F_1, F_2, F_3

Rs125 F_1, F_2, F_3

Rs126 F_1, F_2, F_3

Rs127 F_1, F_2, F_3

Rs128 F_1, F_2, F_3

Rs129 F_1, F_2, F_3

Rs130 F_1, F_2, F_3

Rs131 F_1, F_2, F_3

Rs132 F_1, F_2, F_3

Rs133 F_1, F_2, F_3

Rs134 F_1, F_2, F_3

Rs135 F_1, F_2, F_3

Rs136 F_1, F_2, F_3

Rs137 F_1, F_2, F_3

Rs138 F_1, F_2, F_3

Rs139 F_1, F_2, F_3

Rs140 F_1, F_2, F_3

Rs141 F_1, F_2, F_3

Rs142 F_1, F_2, F_3

Rs143 F_1, F_2, F_3

Rs144 F_1, F_2, F_3

Rs145 F_1, F_2, F_3

Rs146 F_1, F_2, F_3 </

```
#include<iostream>
#include<string.h>
#include<vector>
using namespace::std;
const int Num_ADD_RS = 2;
const int Num_SUB_RS = 2;
const int Num_MULT_RS = 10;
const int Num_DIV_RS = 40;
```

```

string input[8] = { "ADDI F1, F2, 1","SUB F1, F3, F4","DIV F1, F2, F3","MUL F2, F3, F4","ADD
F2, F4, F2","ADDI F4, F1, 2","MUL F5, F5, F5","ADD F1, F4, F4" };
    int F1 = 0,F2=2,F3=4,F4=6,F5=8;
    int RS1 = 0, RS2 = 0, RS3 = 0, RS4 = 0, RS5 = 0;
    string F1_RAT = "    ", F2_RAT = "    ", F3_RAT = "    ", F4_RAT = "    ", F5_RAT =
"    ";
    string RS1_1="  ", RS1_2="  ", RS1_3="  ", RS2_1="  ", RS2_2="  ", RS2_3="  ",
RS3_1="  ", RS3_2="  ", RS3_3="  ";
    string RS4_1 = "  ", RS4_2 = "  ", RS4_3 = "  ", RS5_1 = "  ", RS5_2 = "  ", RS5_3 = "
";
    string ALU_plus = " ", ALU_mult = " ";
bool changedetect(int time){
    if (time == 1 || time == 2 || time == 3 || time == 4 || time == 5 || time == 6 || time ==
44 || time == 45 || time == 47 || time == 48 || time == 50 || time == 54 || time == 55 ||
time == 57 || time == 64)
        return true;
    else
        return false;
}
void buffer_alu(int a,int time) { //excute
    if (a == 0) {
        if (2==time || time==3) {
            ALU_plus = "(RS1) 2+1";
        }
        else if (4==time || time== 5) {
            ALU_plus = "(RS2) 4-6";
        }
        else if (55==time || time == 56) {
            ALU_plus = "(RS1) 6+24"; //F2=6*4=24 wr
        }
        else if (45==time || time == 46) {
            ALU_plus = "(RS2) 0+2"; //
        }
        else if (48== time || time == 49) {
            ALU_plus = "(RS2) 2+2"; //F4=
        }
        else
            ALU_plus = "empty";
    }
}

```

```

    }
    else if (a == 1) {
        if (time >= 4 && time <= 43) {
            ALU_mult = "(RS4) 2/4";
        }
        else if (time >= 44 && time <= 53) {
            ALU_mult = "(RS5) 4*6";
        }
        else if (time >= 54 && time <= 63) {
            ALU_mult = "(RS4) 8*8";
        }
        else{
            ALU_mult = "empty";
        }
    }
}

void issue(int time) {
    if (time == 1) { //放 RS1(4)
        F1_RAT = "RS1";
        RS1_1 = "+";
        RS1_2 = "2";
        RS1_3 = "1";
    }
    else if (time==2) { //放 RS2(6)
        F1_RAT = "RS2";
        RS2_1 = "-";
        RS2_2 = "4";
        RS2_3 = "6";
    }
    else if (time == 3) { //放 RS4(44)
        F1_RAT = "RS4";
        RS4_1 = "/";
        RS4_2 = "2";
        RS4_3 = "4";
    }
    else if (time == 4) { //放 RS5(54)
        F2_RAT = "RS5";
        RS5_1 = "*";
    }
}

```

```

        RS5_2 = "4";
        RS5_3 = "6";
    }
    else if (time == 5) { //放 RS1(56)因為 RS1(4)WB
        F2_RAT = "RS1";
        RS1_1 = "+";
        RS1_2 = "6";
        RS1_3 = "RS5";
    }
    else if (time == 6) { //放 RS2(58)因為 RS2(6)WB
        F4_RAT = "RS2";
        RS2_1 = "+";
        RS2_2 = "RS4";
        RS2_3 = "2";
    }
    else if (time == 44) { //放 RS4(64)因為 RS4(44)WB
        F5_RAT = "RS4";
        RS4_1 = "*";
        RS4_2 = "8";
        RS4_3 = "8";
    }
    else if (time == 45) { //放 RS3
        F1_RAT = "RS3";
        RS3_1 = "+";
        RS3_2 = "RS2";
        RS3_3 = "RS2";
    }
}

/*void excute(int time) {
    //if(time==2)
}*/

void detectwriteback(int time) {
    if (time == 4) { //RS1=3
        //F1_RAT = " ";不用清空因為不是他的 RS12 覆蓋掉了所以也不用改 RF 值
        RS1_1 = " ";
        RS1_2 = " ";
        RS1_3 = " ";
    }
}

```

```

    F1 = 0;

}
else if (time == 6) { //RS2=-2
    // F1_RAT = " ";同上不用清空因為不是他的 RS13 覆蓋掉了所以也不用改 RF 值
    RS2_1 = " ";
    RS2_2 = " ";
    RS2_3 = " ";
    F1 = 0;
}
else if (time == 44) { //RS4=0
    F1_RAT = " ";
    RS4_1 = " ";
    RS4_2 = " ";
    RS4_3 = " ";
    F1 = 0;
    RS2_2 = " 0 ";
}
else if (time == 54) { //RS5=24 同上不用清空因為不是他的 RS18 等他執行完就覆蓋
掉了所以也不用改 RF 值只需要改 I5
    //F2_RAT = " ";
    RS5_1 = " ";
    RS5_2 = " ";
    RS5_3 = " ";
    F2 = 2;
    RS1_3 = " 24 ";
}
else if (time == 57) { //RS1=30
    F2_RAT = " ";
    RS1_1 = " ";
    RS1_2 = " ";
    RS1_3 = " ";
    F2 = 30;
}
else if (time == 47) { //RS2=2
    F4_RAT = " ";
    RS2_1 = " ";
    RS2_2 = " ";

```

```

        RS2_3 = "    ";
        F4 = 2;
        RS3_2 = " 2  ";
        RS3_3 = " 2  ";
    }
    else if (time == 64) { //RS4=64
        F5_RAT = "    ";
        RS4_1 = "    ";
        RS4_2 = "    ";
        RS4_3 = "    ";
        F5 = 64;
    }
    else if (time == 50) { //RS3=4
        F1_RAT = "    ";
        RS3_1 = "    ";
        RS3_2 = "    ";
        RS3_3 = "    ";
        F1 = 4;
    }
}

int main() {
    int clock = 1;
    while(clock<=64){

        if( changedetect(clock)==1){
            detectwriteback(clock);
            if (clock == 1 || clock == 2 || clock == 3 || clock == 4 || clock == 5 || clock == 6
|| clock == 44 || clock == 45)
                issue(clock);

            //if(clock)
                cout << "Cycle: " << clock<<"\n";
            cout <<"    _RF__ " <<"\n";
            cout << "F1 | " << F1 << " | " << "\n";
            cout << "F2 | " << F2 << " | " << "\n";
            cout << "F3 | " << F3 << " | " << "\n";
            cout << "F4 | " << F4 << " | " << "\n";
            cout << "F5 | " << F5 << " | " << "\n";

```

```

cout << "    -----" << "\n" << "\n";
cout << "    _ RAT___ " << "\n";
cout << "F1 |    " << F1_RAT << " |" << "\n";
cout << "F2 |    " << F2_RAT << " |" << "\n";
cout << "F3 |    " << F3_RAT << " |" << "\n";
cout << "F4 |    " << F4_RAT << " |" << "\n";
cout << "F5 |    " << F5_RAT << " |" << "\n";
cout << "    -----" << "\n" << "\n";
cout << "    _ RS _____ " << "\n";
cout << "RS1 |    " << RS1_1 << " |" << RS1_2 << " |" << RS1_3 << " |" << "\n";
cout << "RS2 |    " << RS2_1 << " |" << RS2_2 << " |" << RS2_3 << " |" << "\n";
cout << "RS3 |    " << RS3_1 << " |" << RS3_2 << " |" << RS3_3 << " |" << "\n";
cout << "    -----" << "\n" << "\n";

buffer_alu(0,clock);
cout << "BUFFER: " << ALU_plus;
cout << "\n";
cout << "    _____ " << "\n";
cout << "RS4 |    " << RS4_1 << " |" << RS4_2 << " |" << RS4_3 << " |" << "\n";
cout << "RS5 |    " << RS5_1 << " |" << RS5_2 << " |" << RS5_3 << " |" << "\n";
cout << "    -----" << "\n" << "\n";

buffer_alu(1,clock);
cout << "BUFFER: " << ALU_mult;
cout << "\n";
}
    clock++;
}
}

```

執行結果:

