Pipelined Datapath & Control Operation without data or control dependencies, yet

University of Crete
Dept. of Computer Science
CS–225 (HY–225)
Computer ORganization
Spring 2020 semester

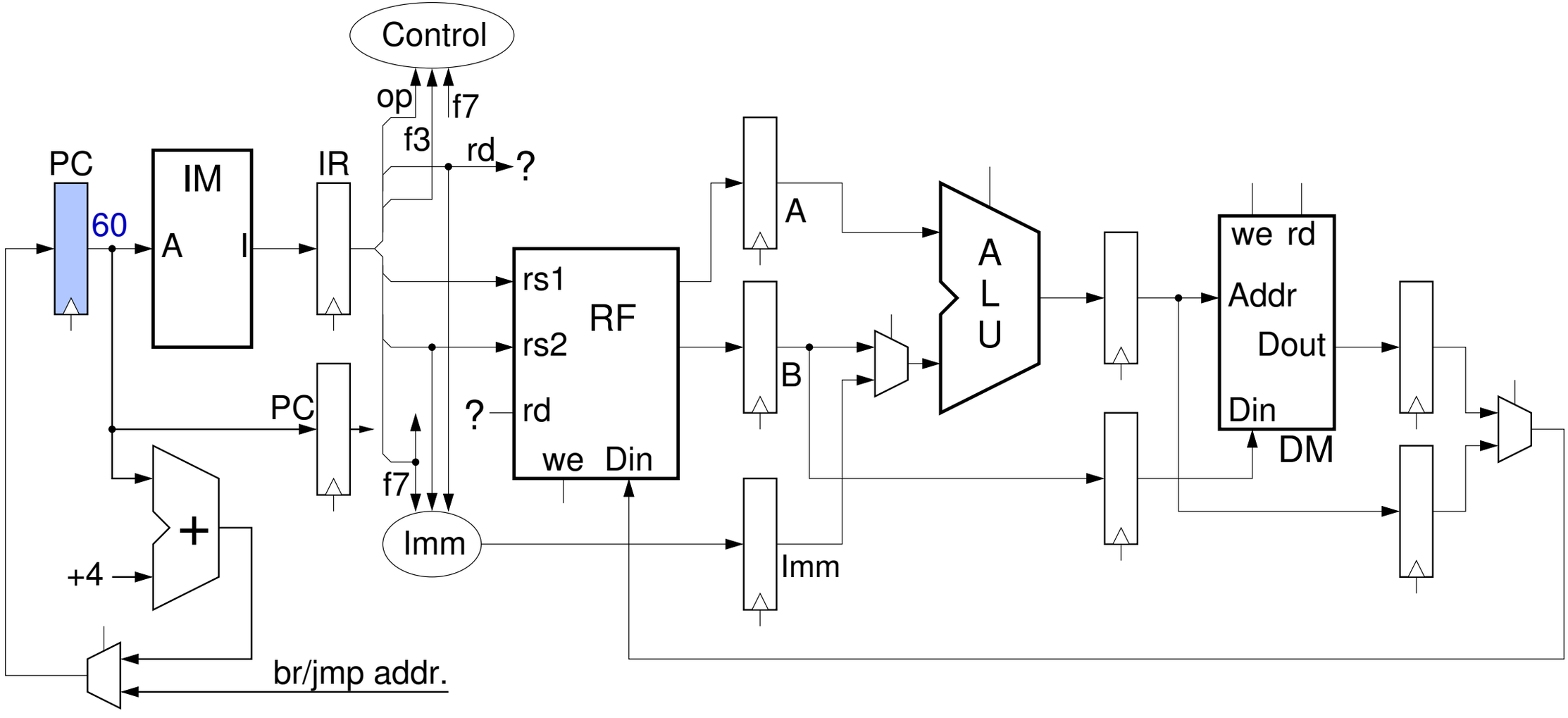
Slides for §9.3 – 9.5

§9.3 Pipelined Datapath Operation
§9.4 Control for the Pipelined Datapath
§9.5 Graphical representation: time–work

Start of Cycle 1

```
60:  ld   x10, 40(x1)
64:  sub  x11, x2, x3
68:  add  x12, x3, x4
72:  ld   x13, 48(x1)
76:  add  x14, x5, x6
```

x1	100
x2	200
x3	300
x4	400



End of Cycle 1

```
60:  ld   x10, 40(x1)
64:  sub  x11, x2, x3
68:  add  x12, x3, x4
72:  ld   x13, 48(x1)
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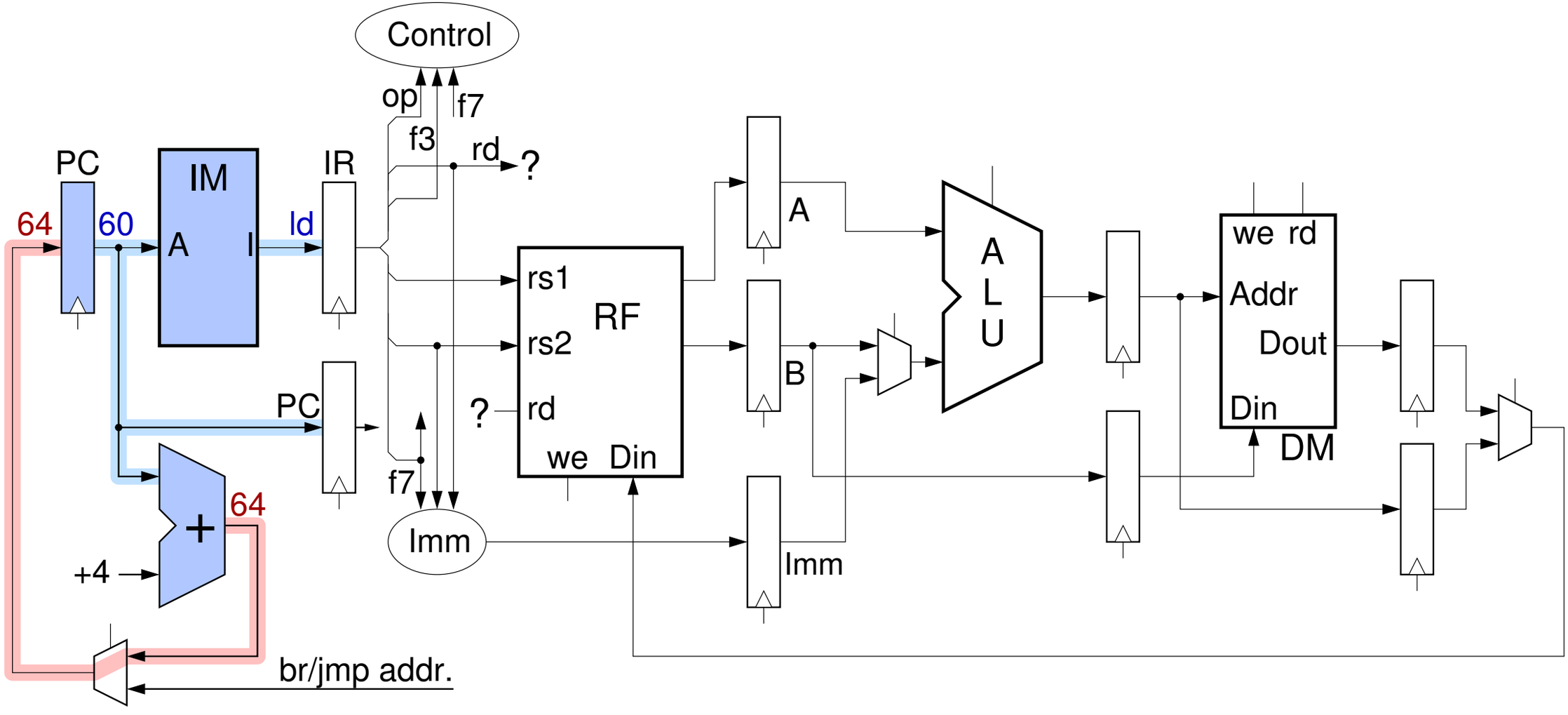
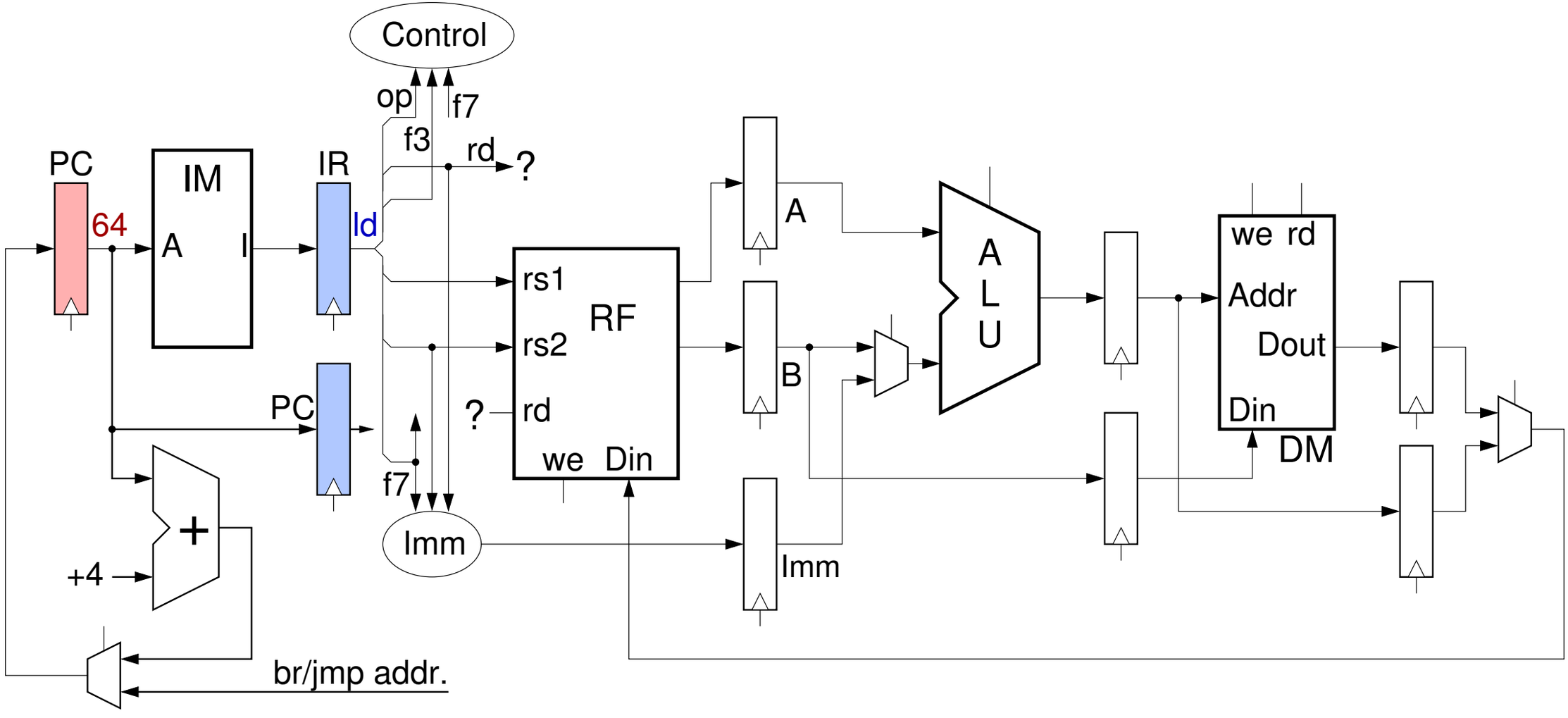


Start of Cycle 2

```
60:  ld   x10, 40(x1)
64:  sub  x11, x2, x3
68:  add  x12, x3, x4
72:  ld   x13, 48(x1)
76:  add  x14, x5, x6
```

x1	100
x2	200
x3	300
x4	400



End of Cycle 2

```
60:  ld   x10, 40(x1)
64:  sub  x11, x2, x3
68:  add  x12, x3, x4
72:  ld   x13, 48(x1)
76:  add  x14, x5, x6
```

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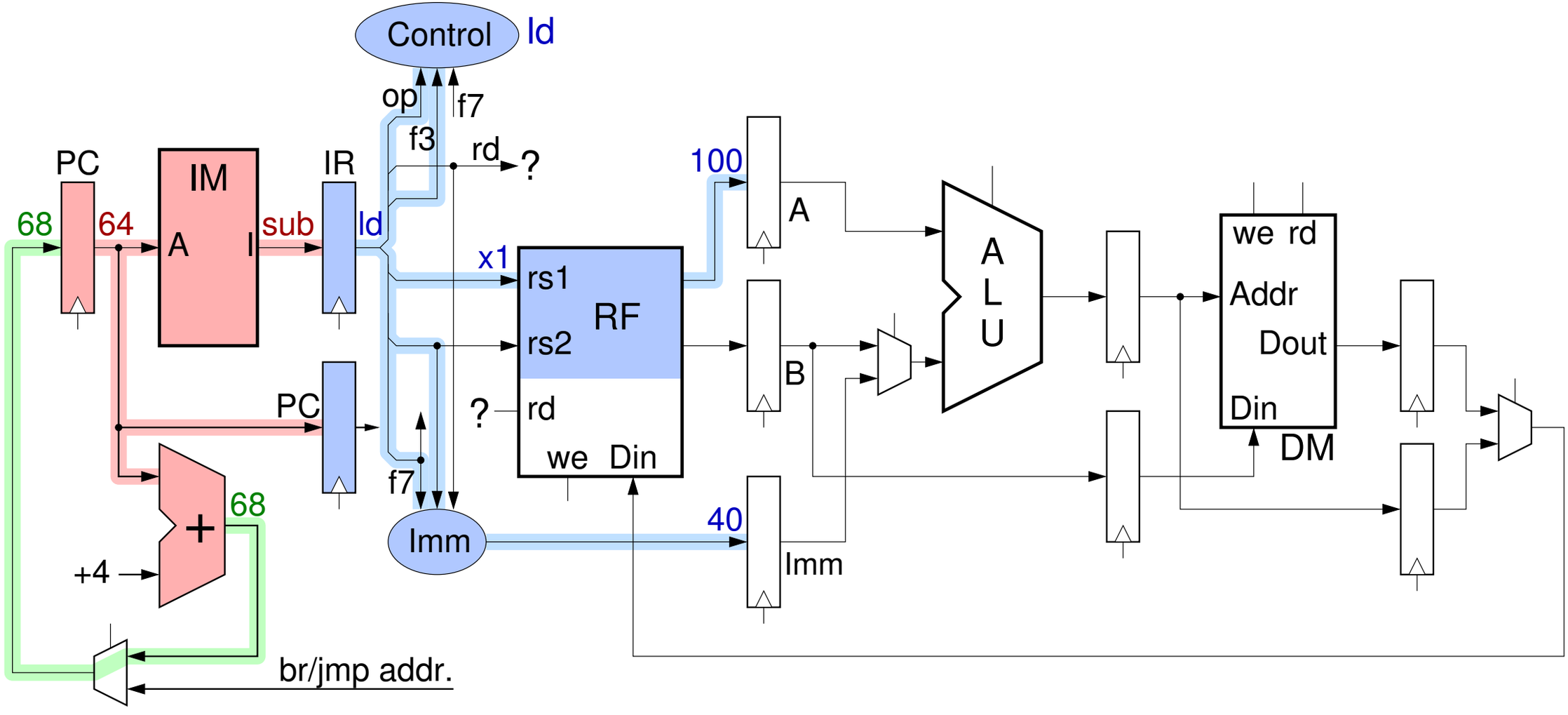
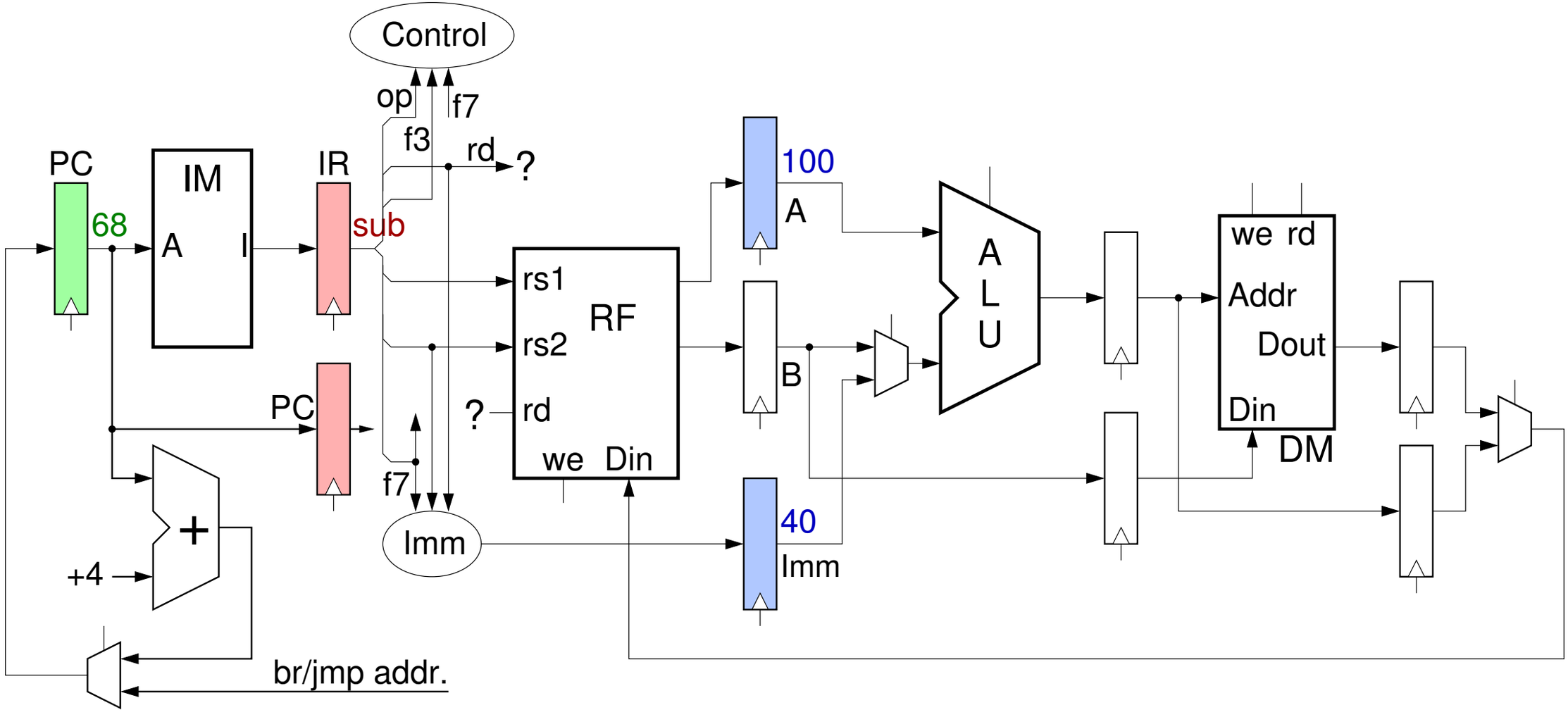


Start of Cycle 3

```
60:  ld   x10, 40(x1)
64:  sub  x11, x2, x3
68:  add  x12, x3, x4
72:  ld   x13, 48(x1)
76:  add  x14, x5, x6
```

x1	100
x2	200
x3	300
x4	400



End of Cycle 3

```
60:  ld   x10, 40(x1)
64:  sub  x11, x2, x3
68:  add  x12, x3, x4
72:  ld   x13, 48(x1)
76:  add  x14, x5, x6
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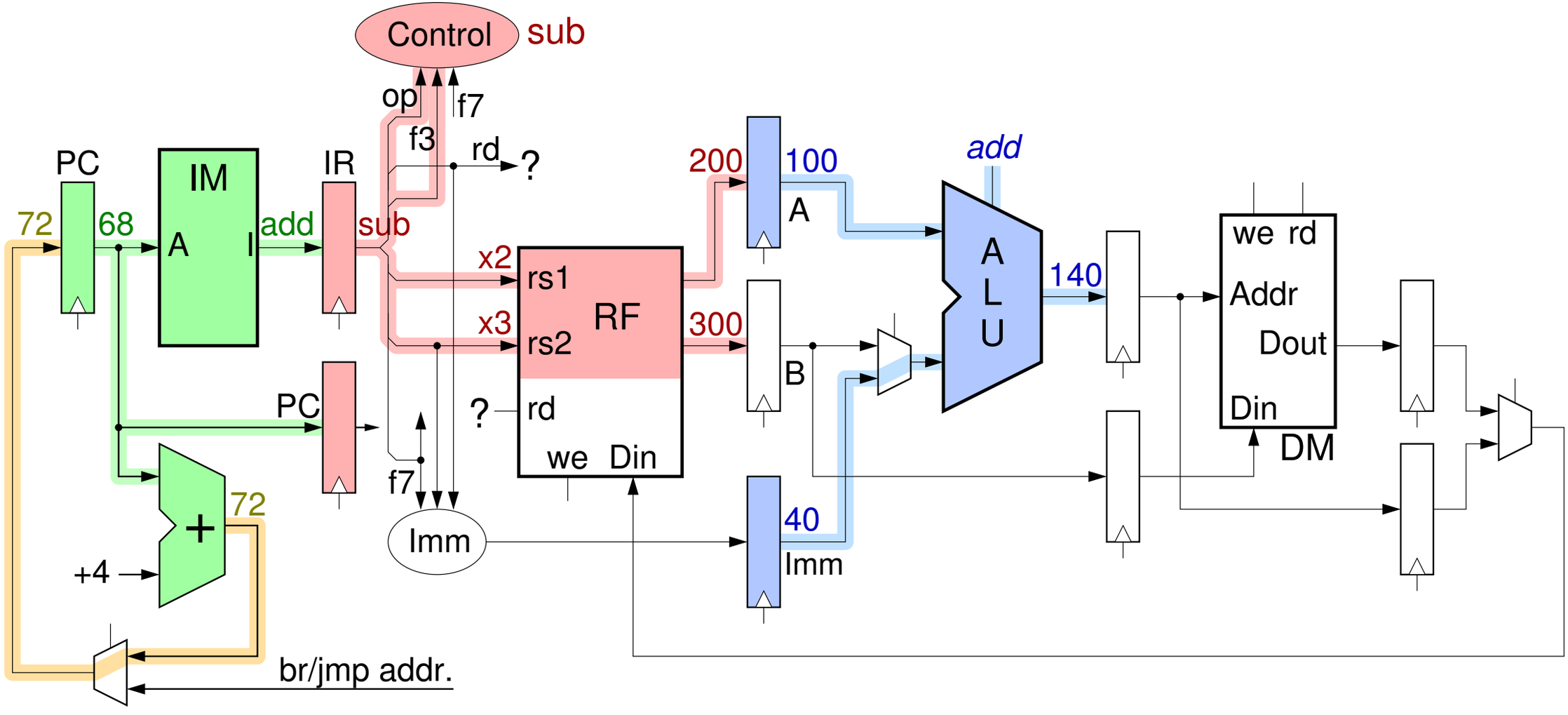
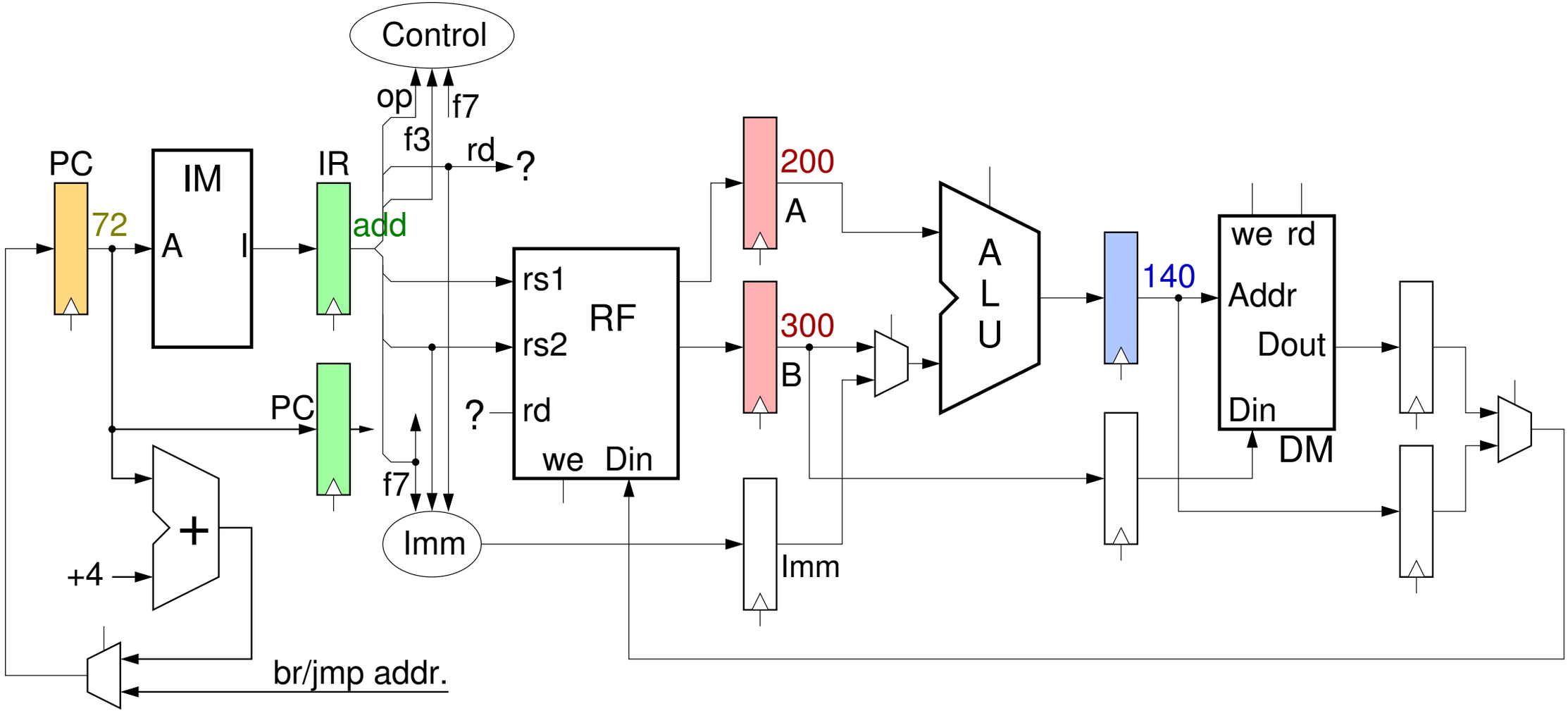


Start of Cycle 4

```
60:  ld   x10, 40(x1)
64:  sub  x11, x2, x3
68:  add  x12, x3, x4
72:  ld   x13, 48(x1)
76:  add  x14, x5, x6
```

x1	100
x2	200
x3	300
x4	400



End of Cycle 4

```
60:  ld   x10, 40(x1)
64:  sub  x11, x2, x3
68:  add  x12, x3, x4
72:  ld   x13, 48(x1)
76:  add  x14, x5, x6
```

x1	100
x2	200
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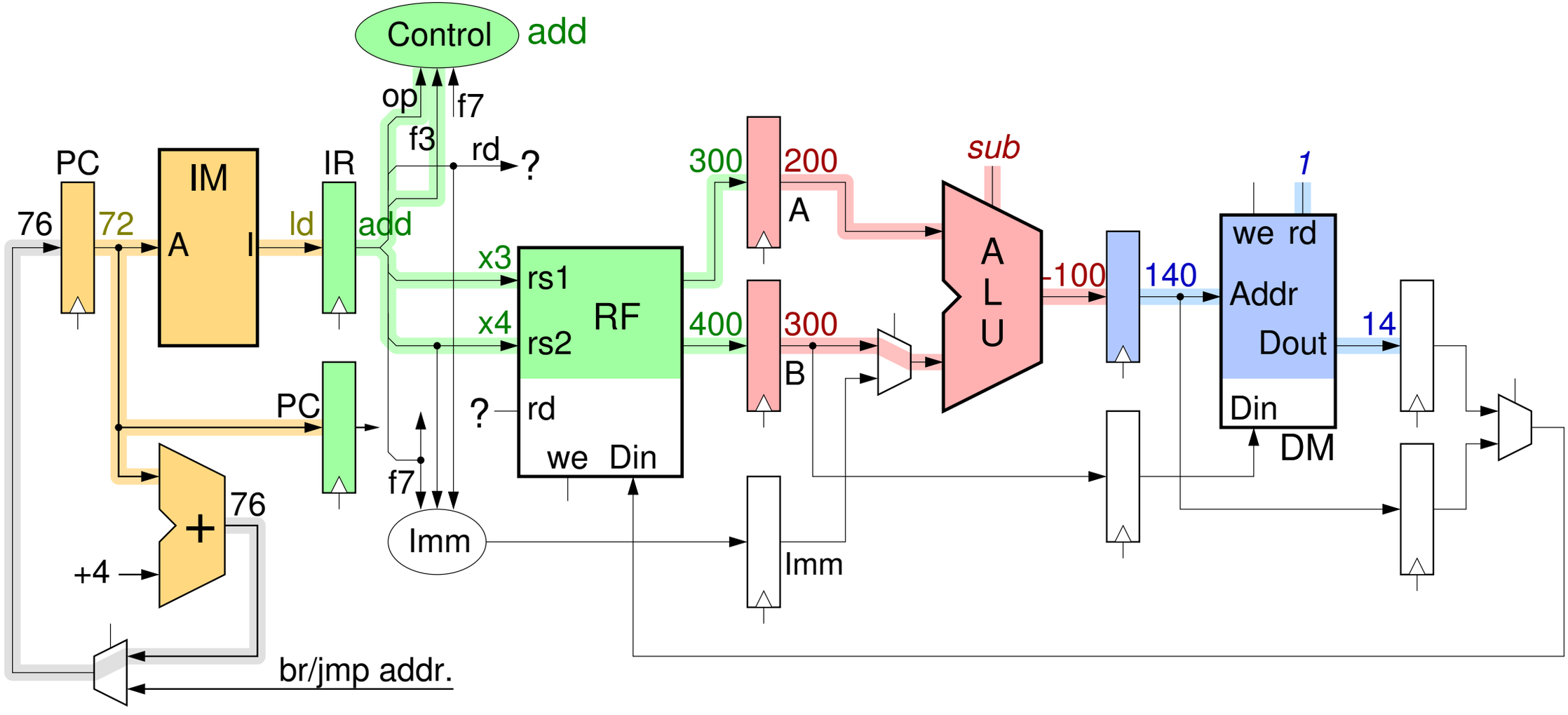
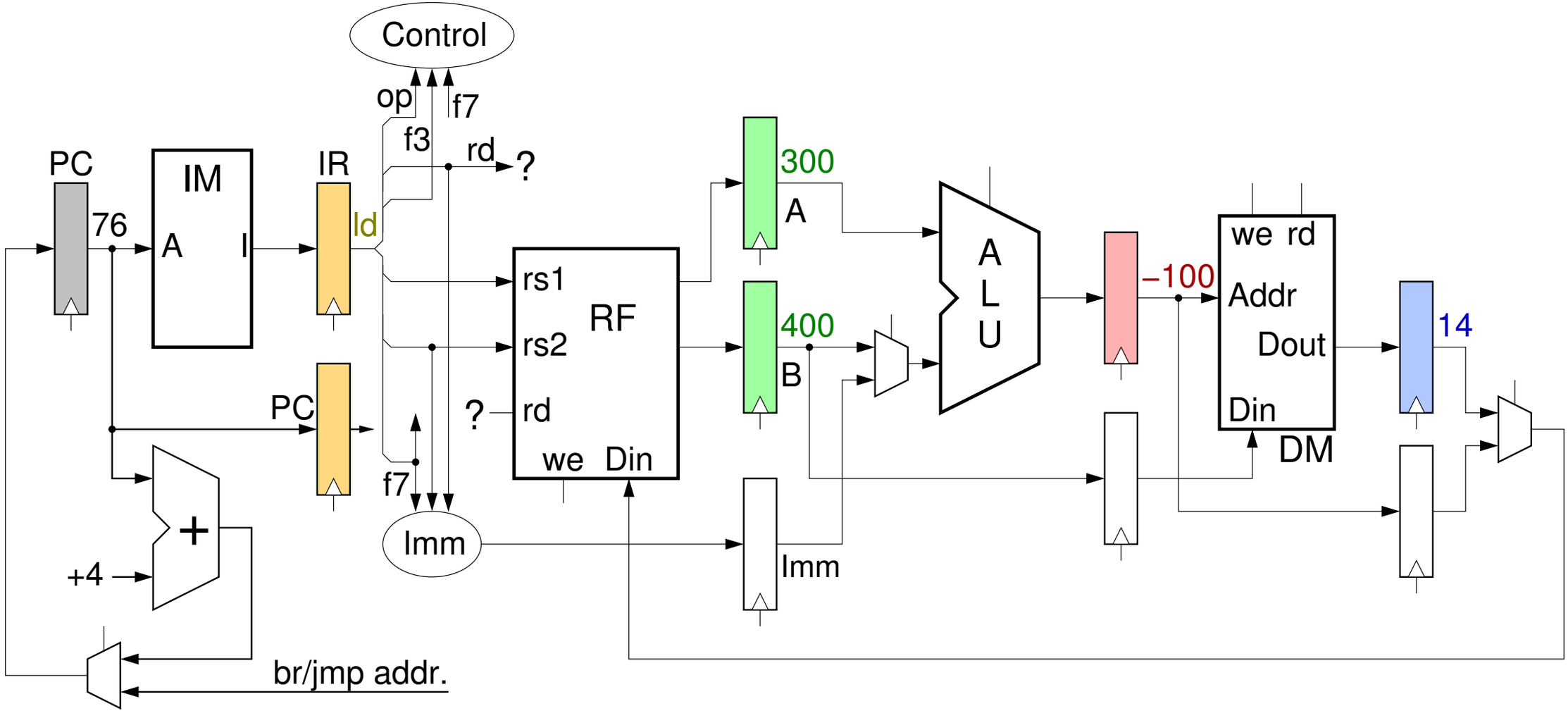


Start of Cycle 5

```
60:  ld   x10, 40(x1)
64:  sub  x11, x2, x3
68:  add  x12, x3, x4
72:  ld   x13, 48(x1)
76:  add  x14, x5, x6
```

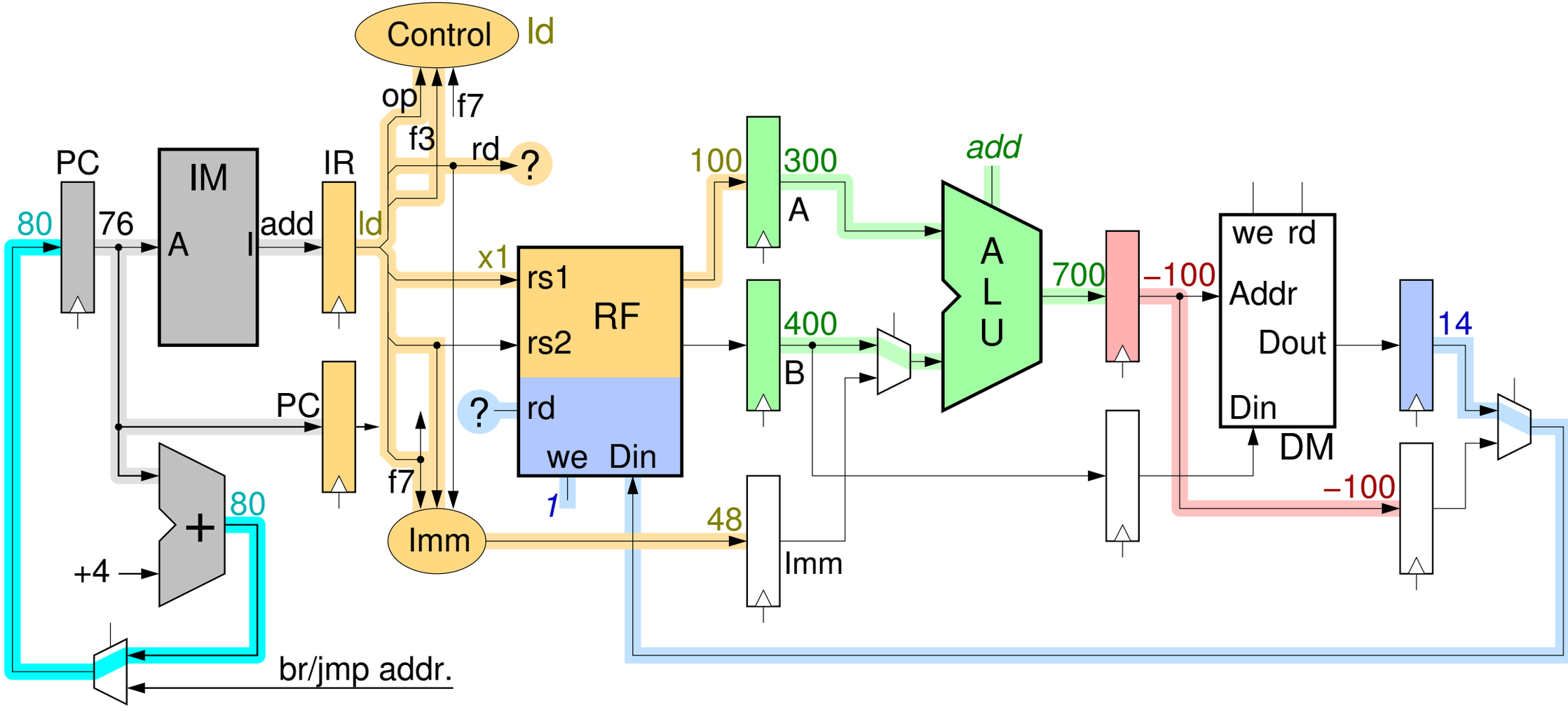
x1	100
x2	200
x3	300
x4	400



End of Cycle 5

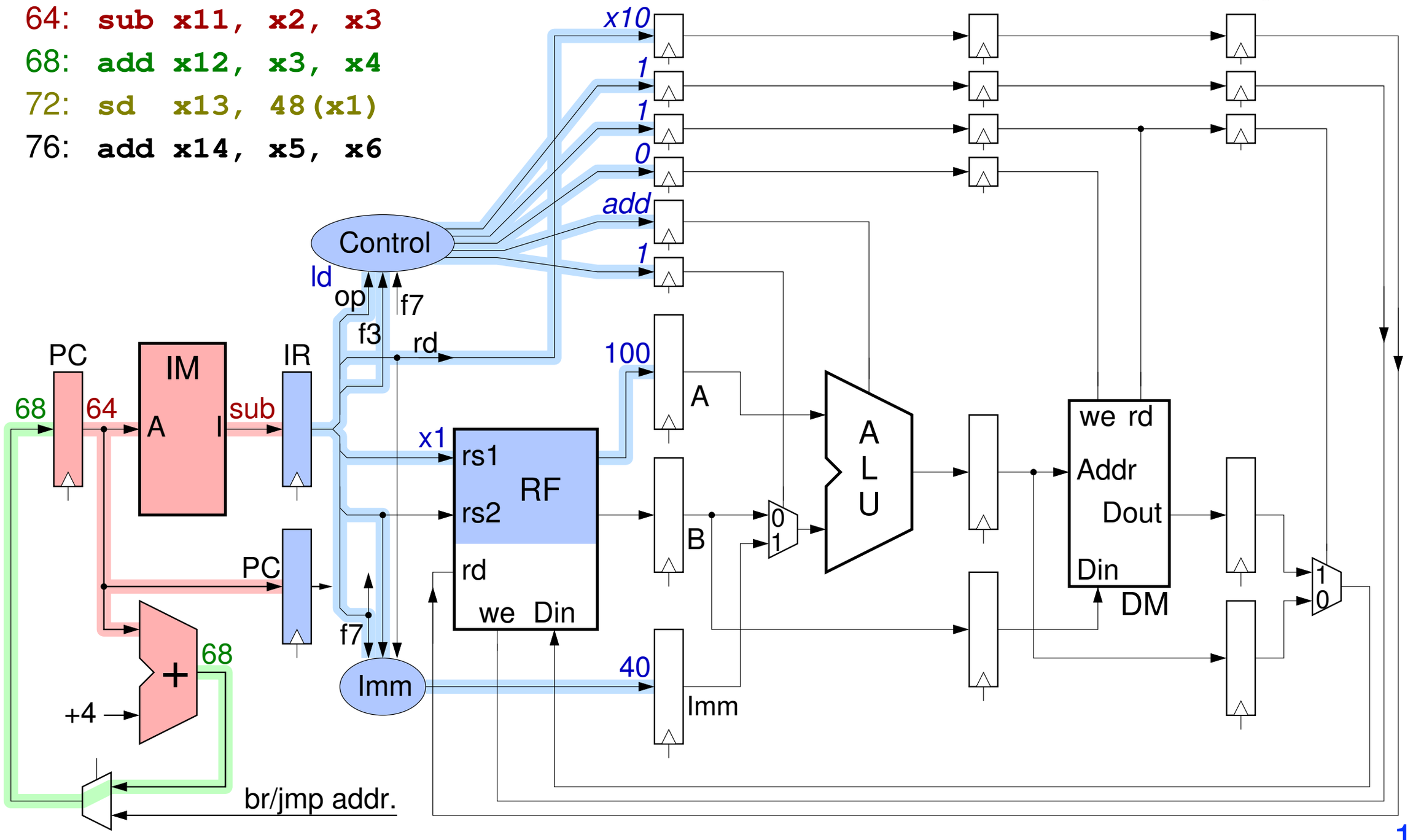
```
60:  ld   x10, 40(x1)
64:  sub  x11, x2, x3
68:  add  x12, x3, x4
72:  ld   x13, 48(x1)
76:  add  x14, x5, x6
```

x1	100
x2	200
x3	300
x4	400



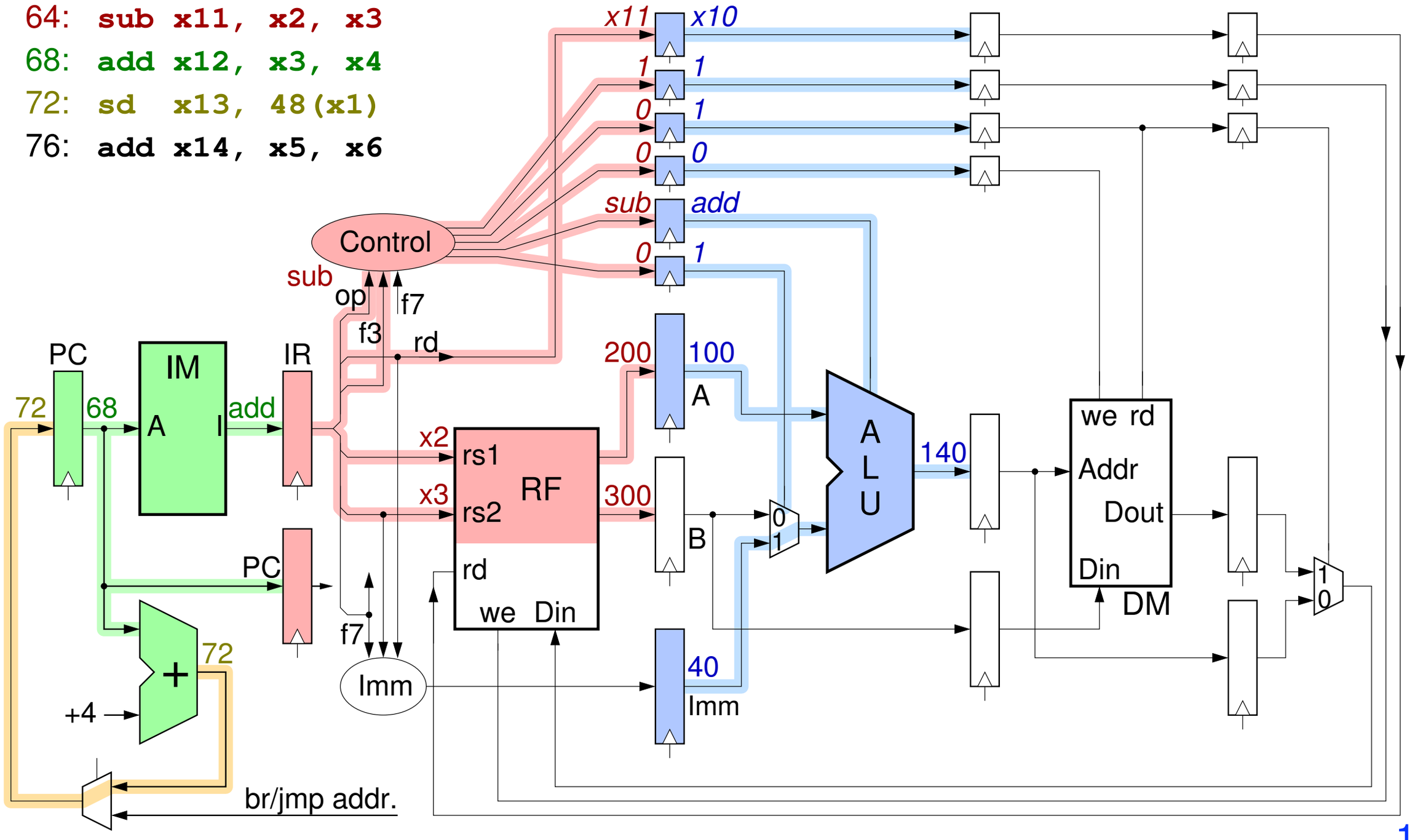
Cycle 2

```
60:  ld  x10, 40(x1)
64:  sub x11, x2, x3
68:  add x12, x3, x4
72:  sd  x13, 48(x1)
76:  add x14, x5, x6
```



Cycle 3

```
60:  ld  x10, 40(x1)
64:  sub x11, x2, x3
68:  add x12, x3, x4
72:  sd  x13, 48(x1)
76:  add x14, x5, x6
```



Cycle 4

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60: ld  x10, 40(x1)
64: sub x11, x2, x3
68: add x12, x3, x4
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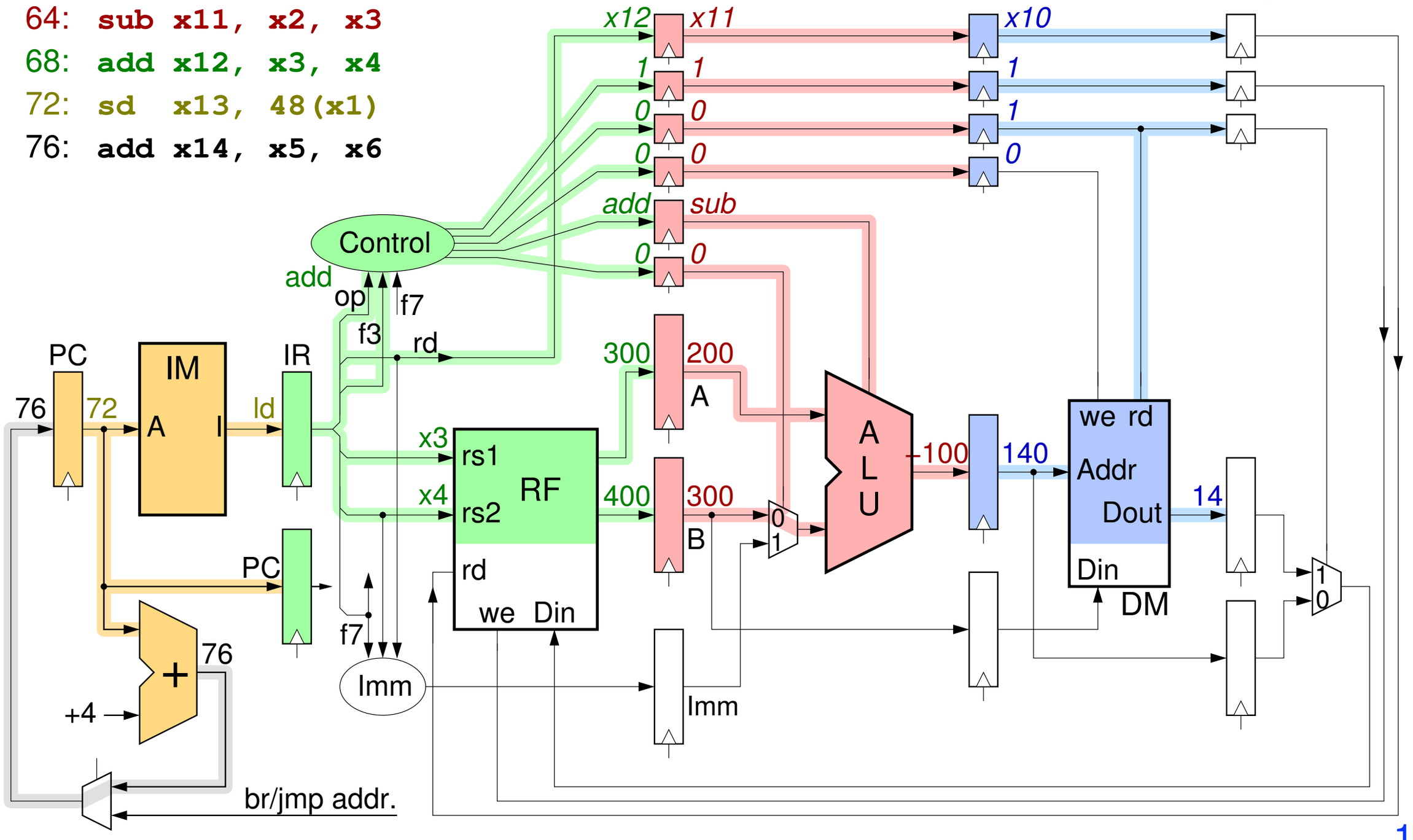

Cycle 5

```
60:  ld  x10, 40(x1)
64:  sub x11, x2, x3
68:  add x12, x3, x4
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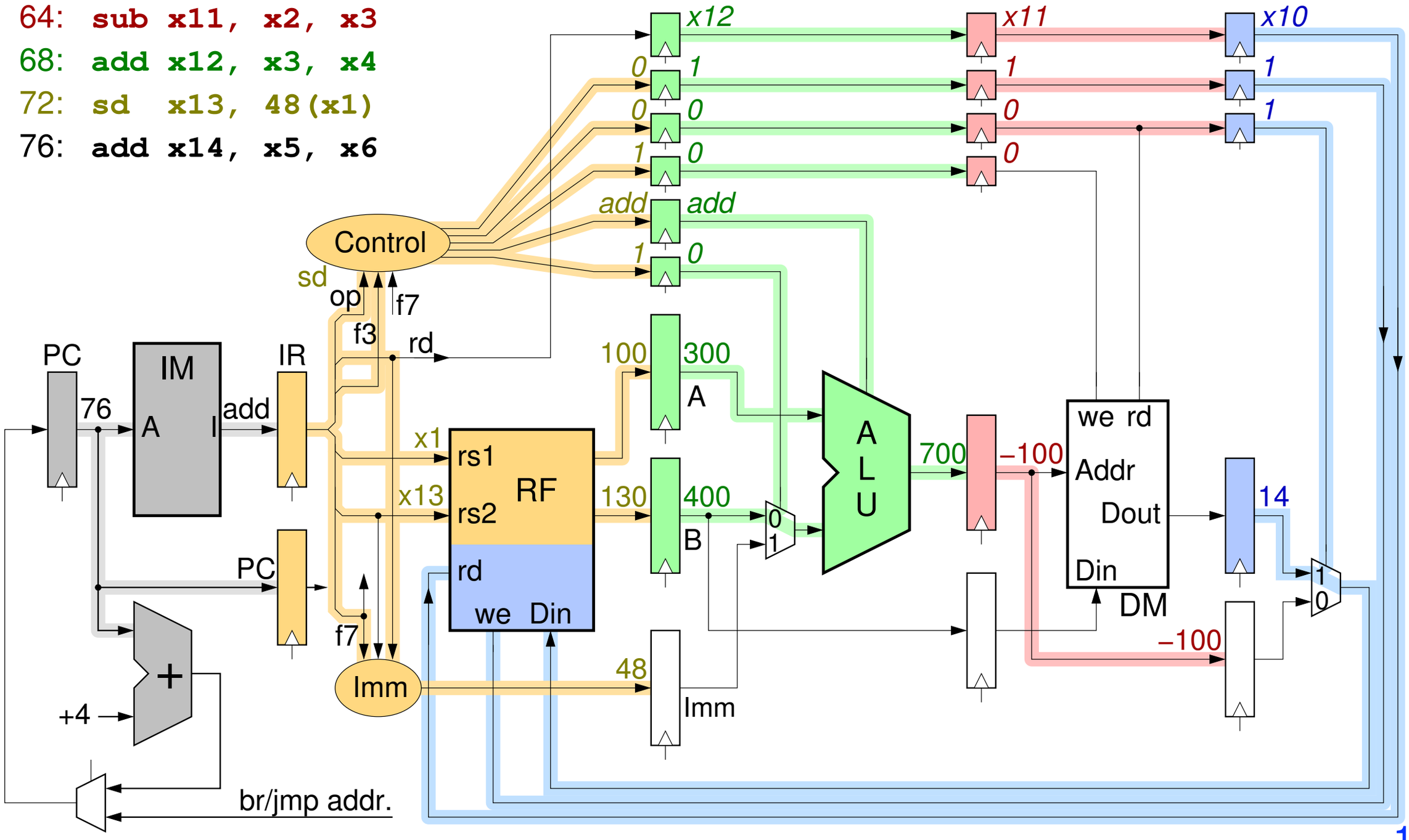
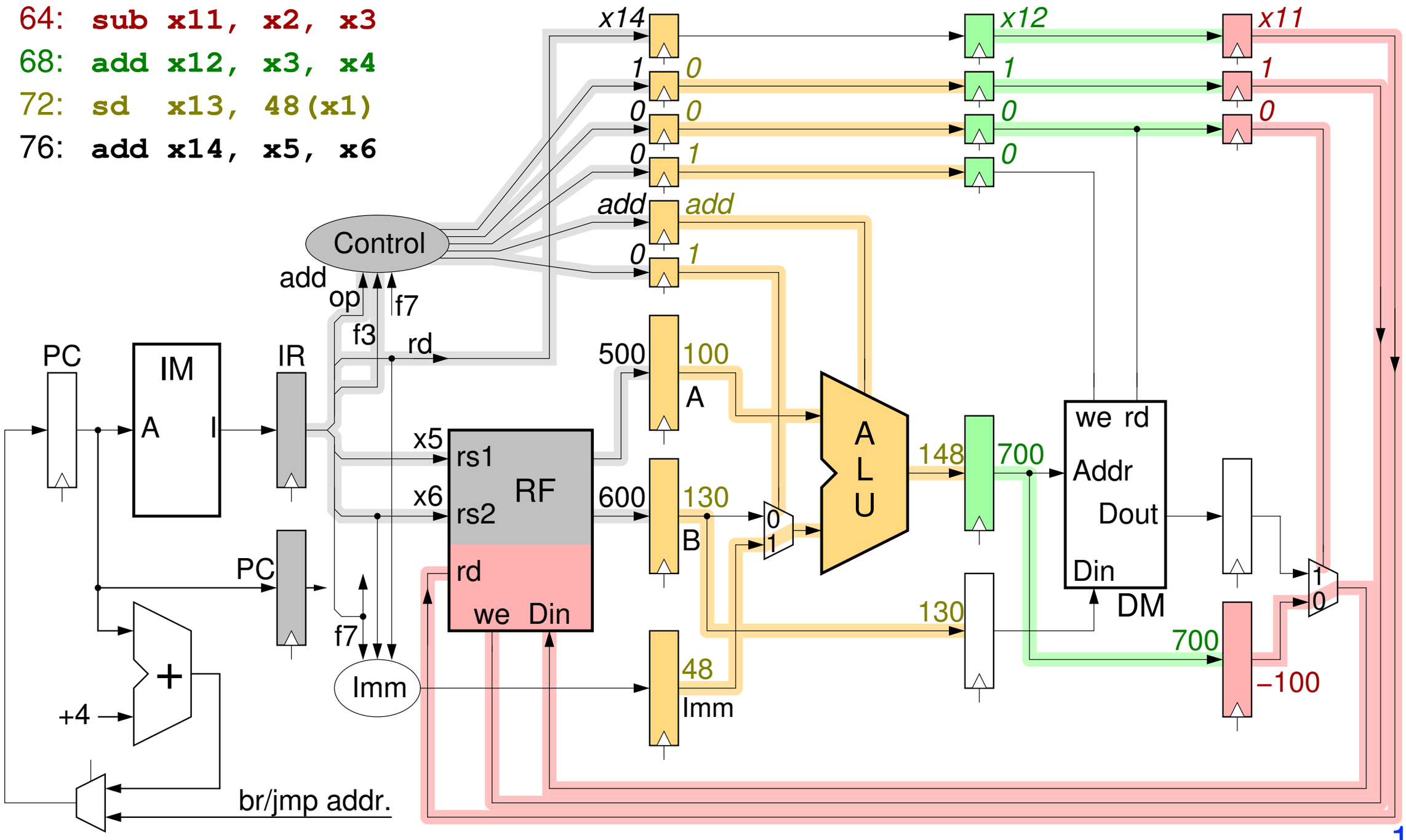
76:  add x14, x5, x6
```



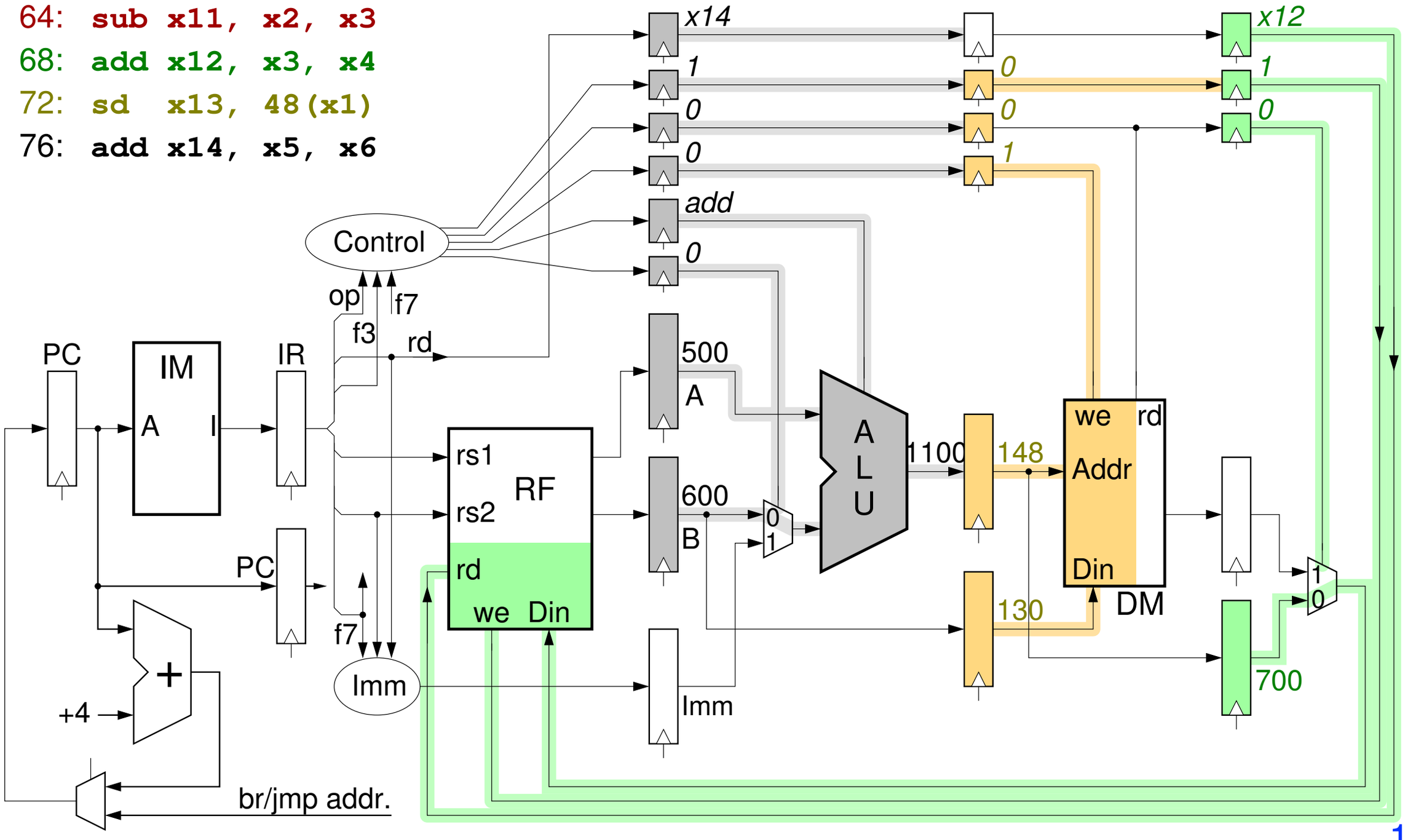
Cycle 6

```
60:  ld  x10, 40(x1)
64:  sub x11, x2, x3
68:  add x12, x3, x4
72:  sd  x13, 48(x1)
76:  add x14, x5, x6
```



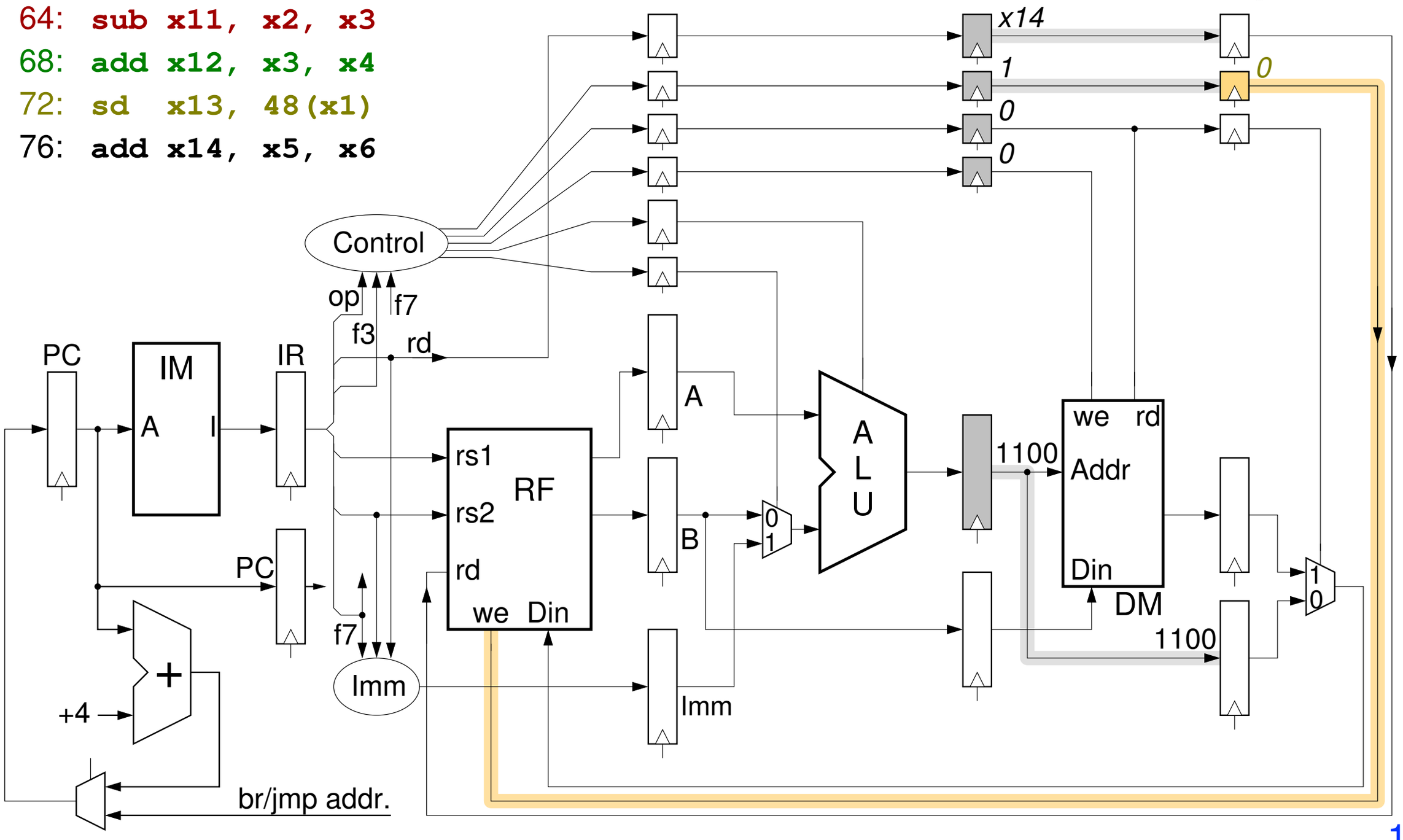
Cycle 7

```
60:  ld  x10, 40(x1)
64:  sub x11, x2, x3
68:  add x12, x3, x4
72:  sd  x13, 48(x1)
76:  add x14, x5, x6
```



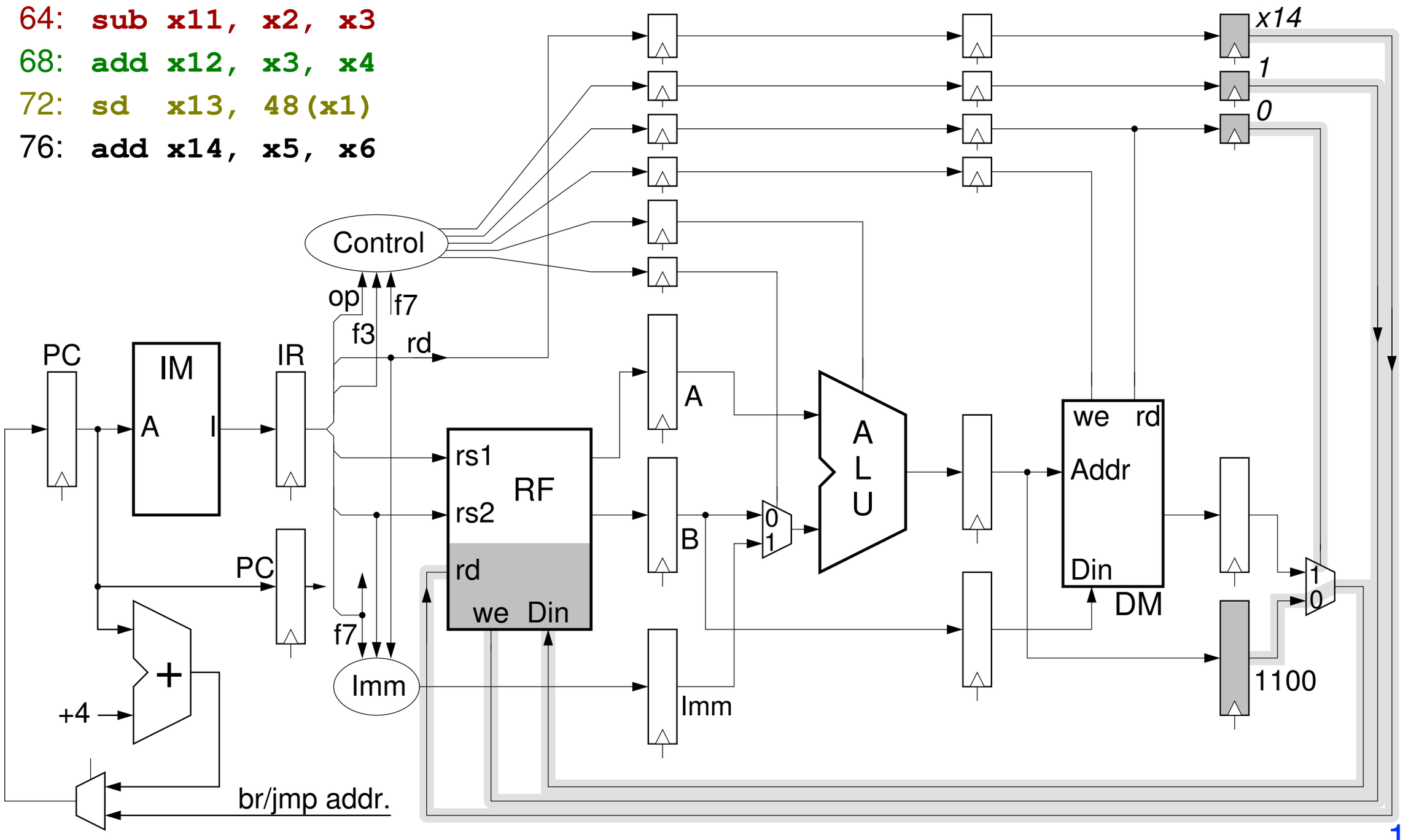
Cycle 8

```
60: ld  x10, 40(x1)
64: sub x11, x2, x3
68: add x12, x3, x4
72: sd  x13, 48(x1)
76: add x14, x5, x6
```



Cycle 9

```
60: ld  x10, 40(x1)
64: sub x11, x2, x3
68: add x12, x3, x4
72: sd  x13, 48(x1)
76: add x14, x5, x6
```



Cycle 1

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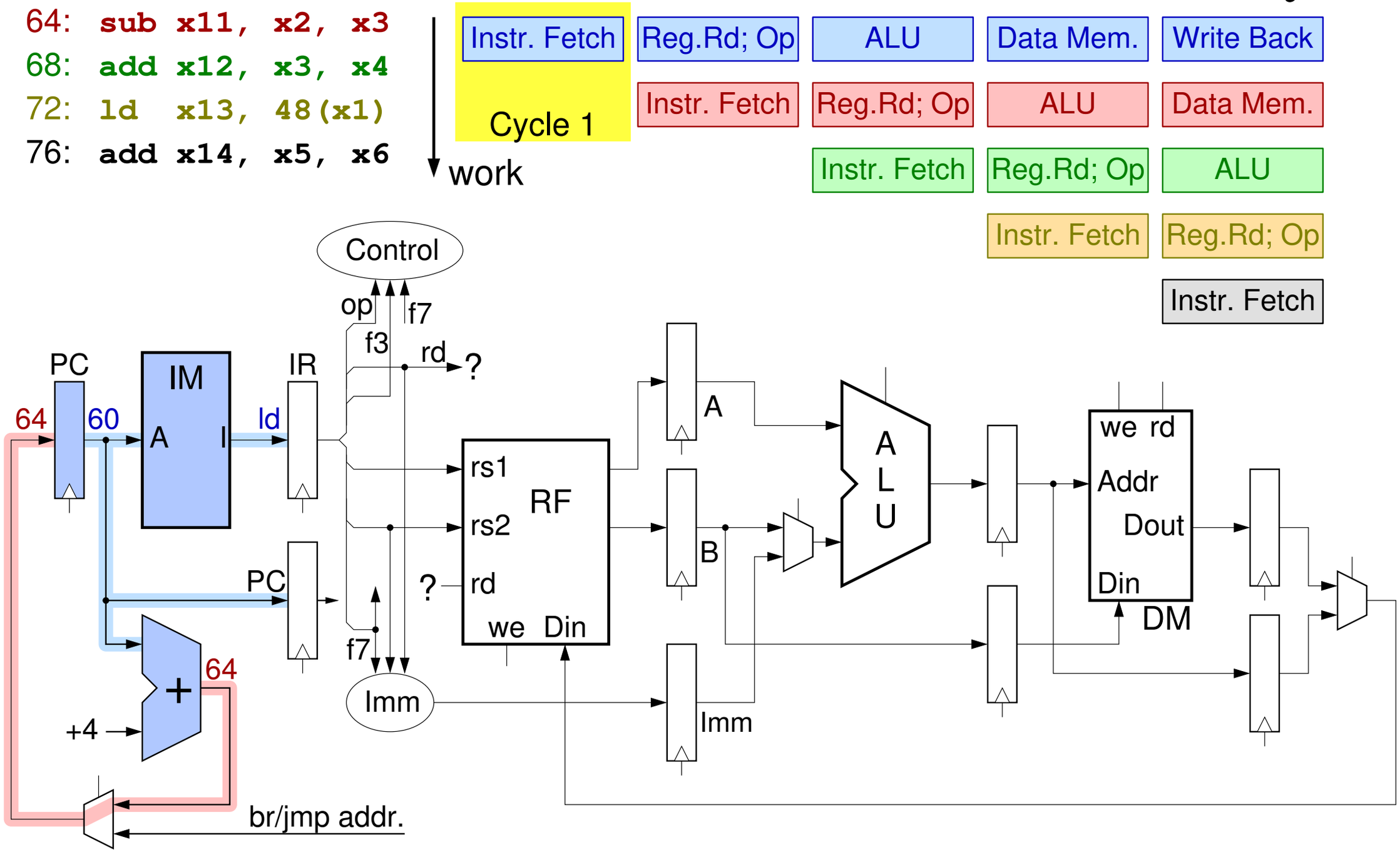

Cycle 2

```
60:  ld   x10, 40(x1)
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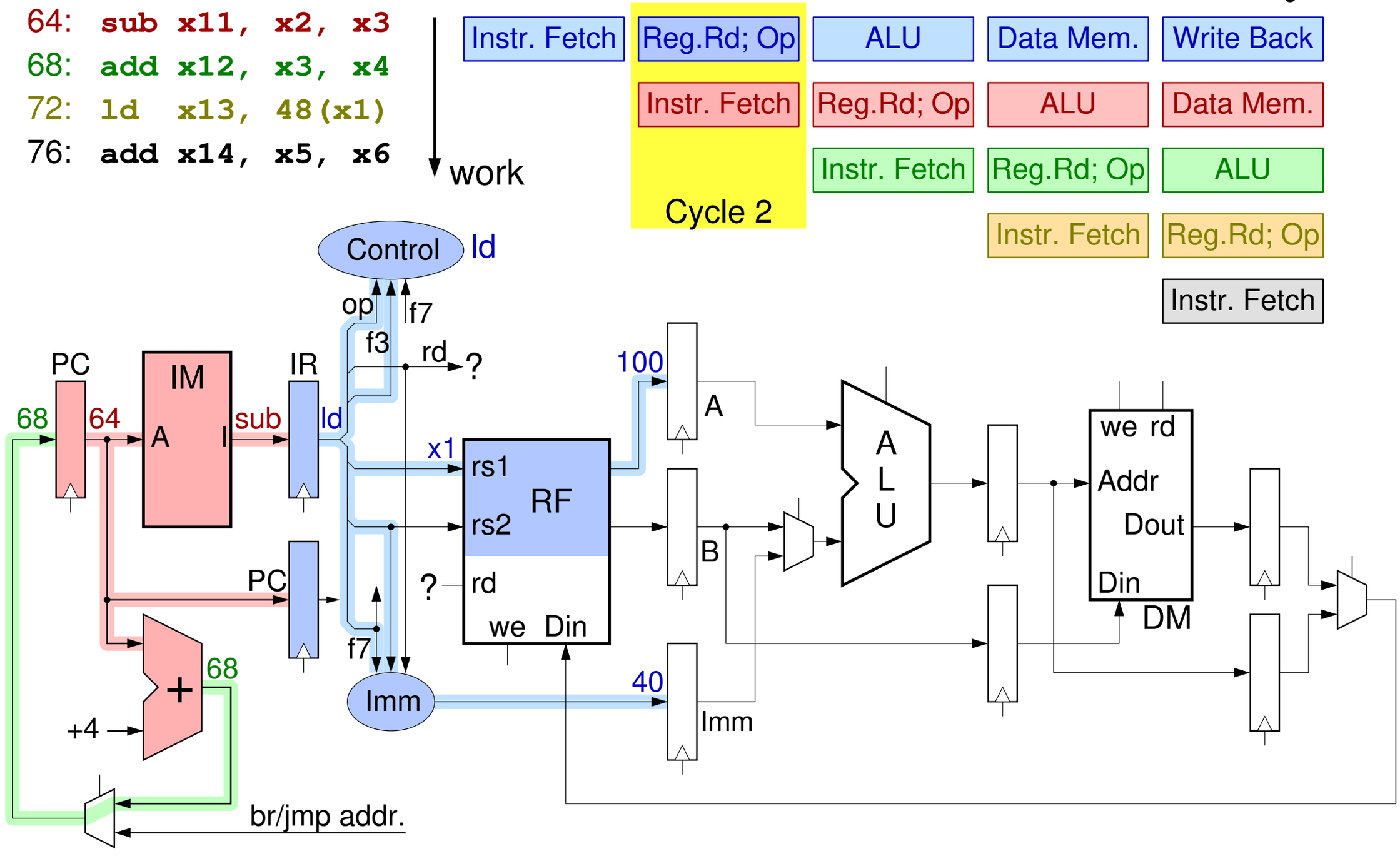

Cycle 3

```
60:  ld   x10, 40(x1)
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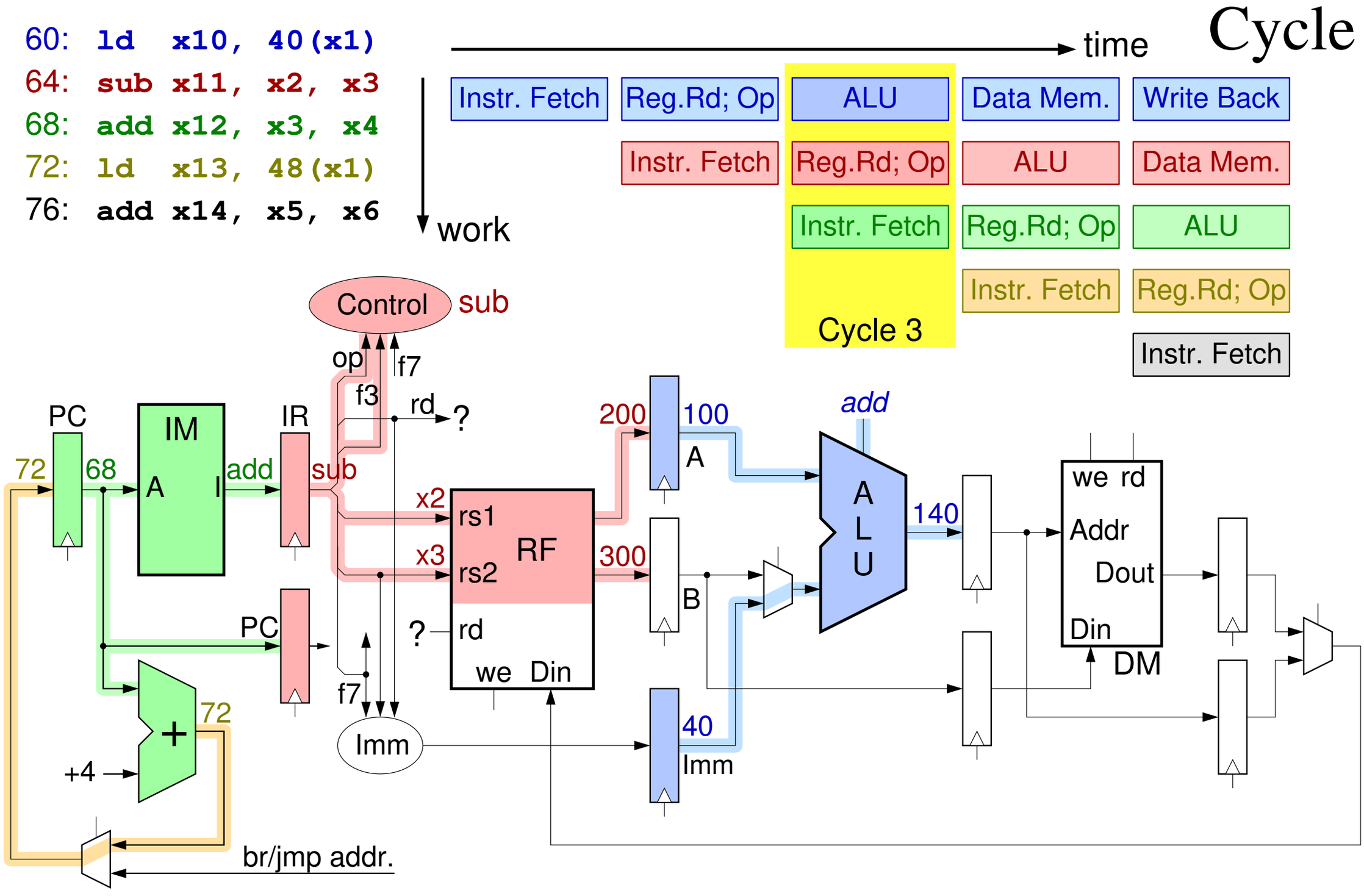

Cycle 4

```
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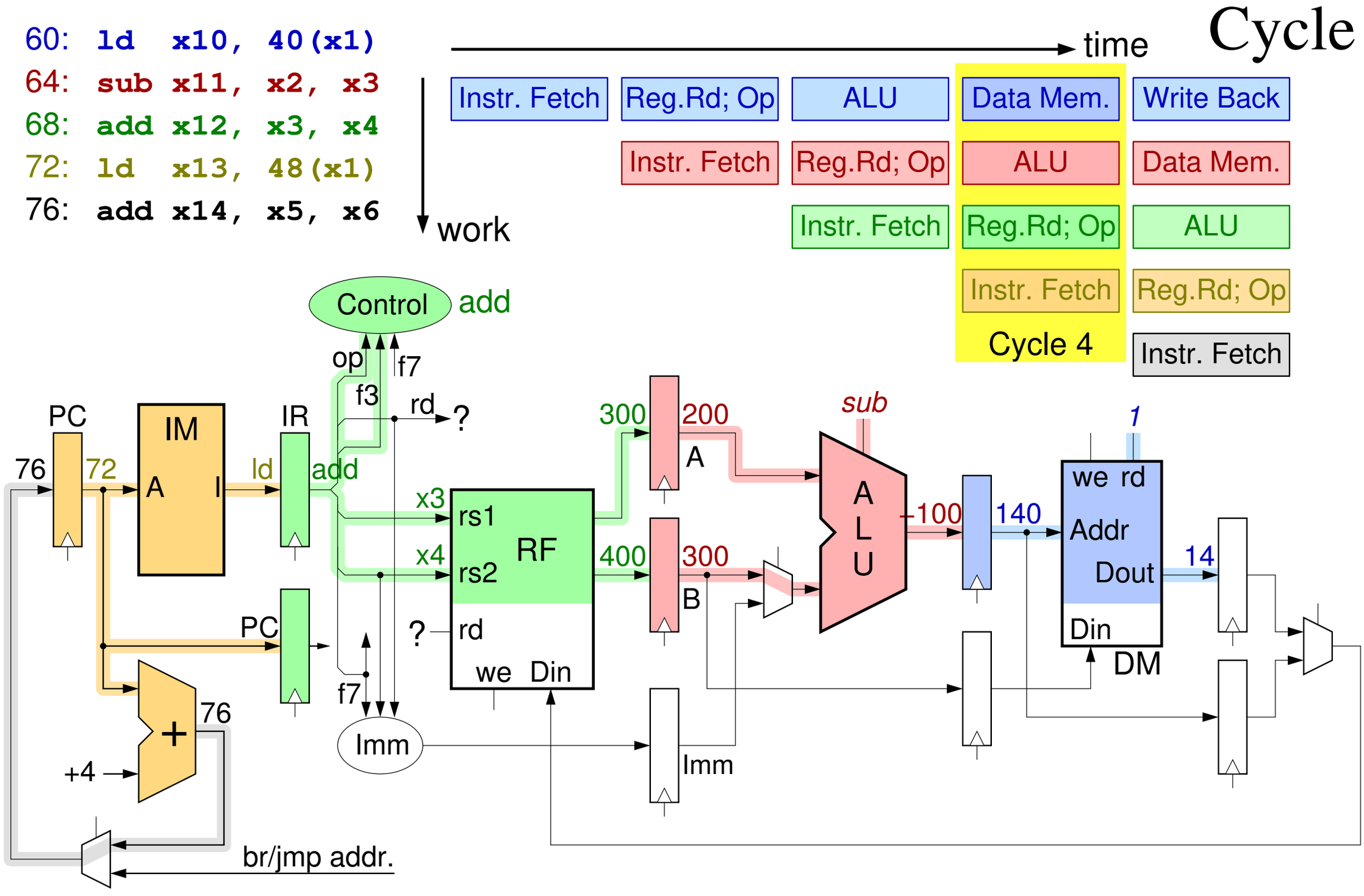

Cycle 5

```
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```