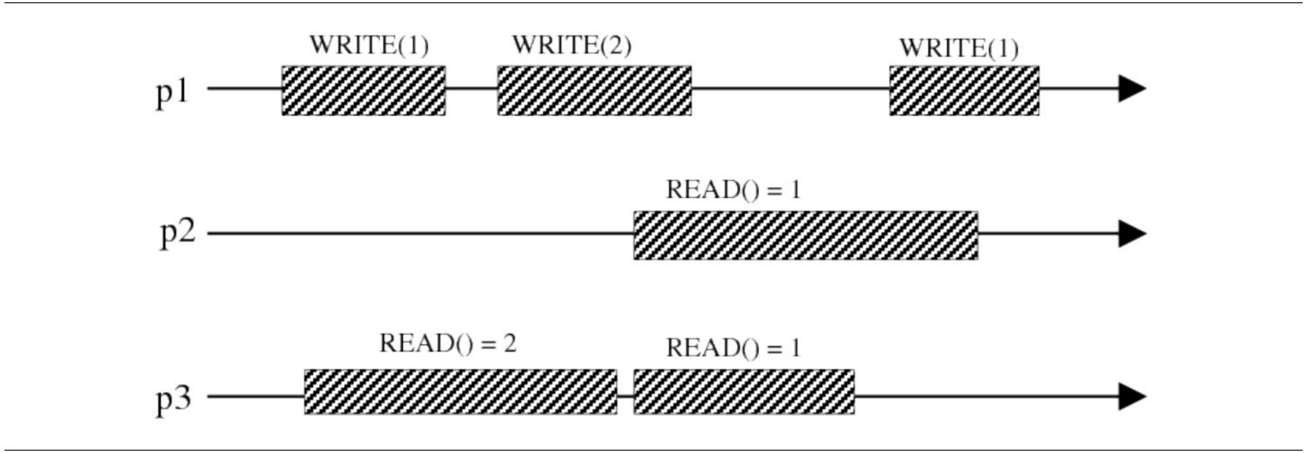
Exercise 1

04 Oct. 2016

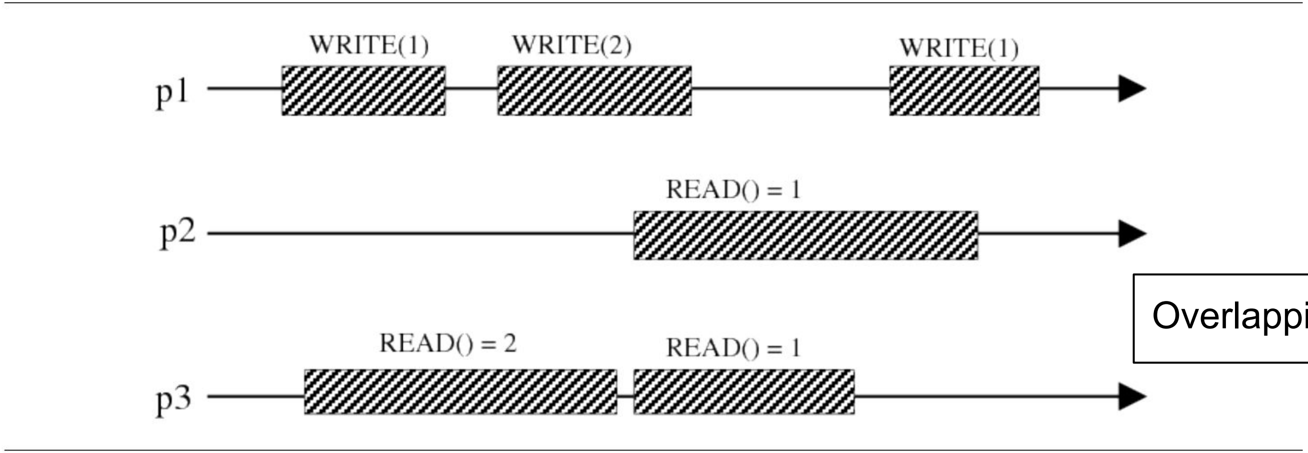
Problem 1.a

Safe: any READ that does not overlap a WRITE returns the most recently written value.



Problem 1.a

Regular: any READ that overlaps a WRITE returns the value written by the last preceding WRITE, or any of the values written by overlapping WRITEs.

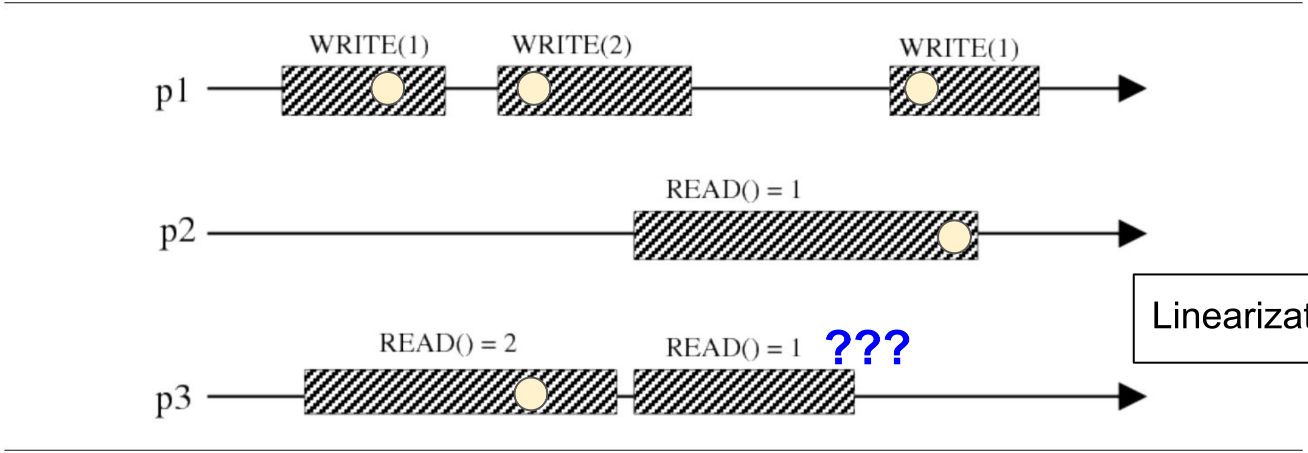


Overlapping WRITEs

Problem 1.a

Atomic: READs and WRITEs have a linearization order.

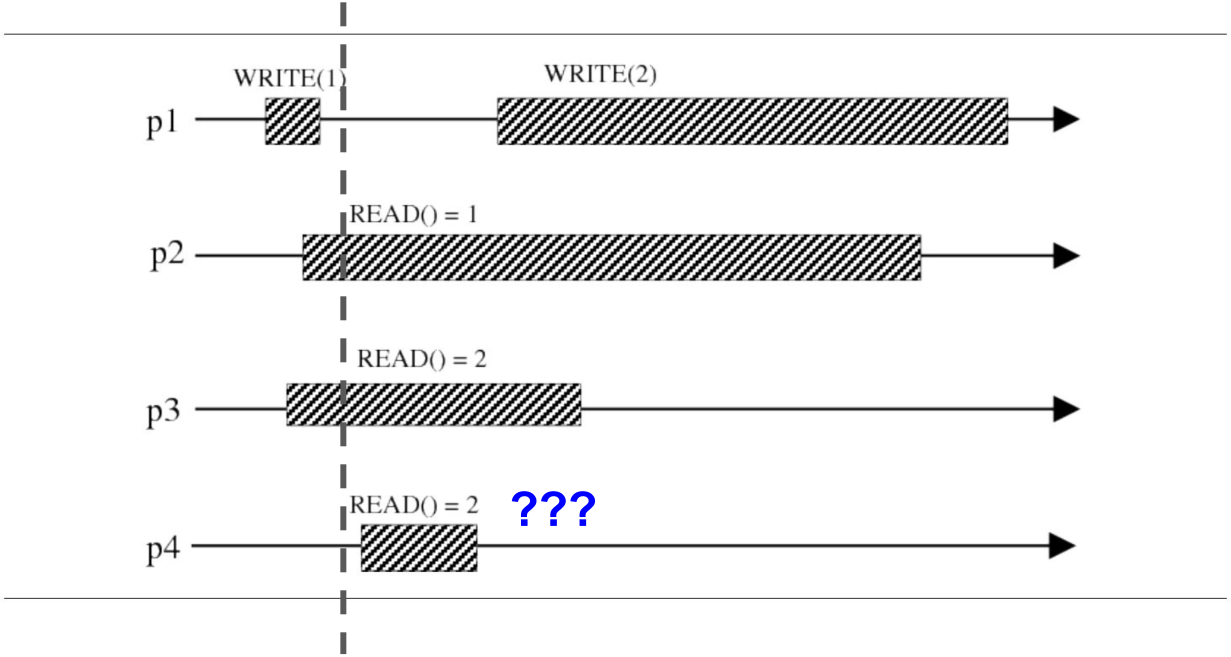
=> NOT atomic !



Linearization points?

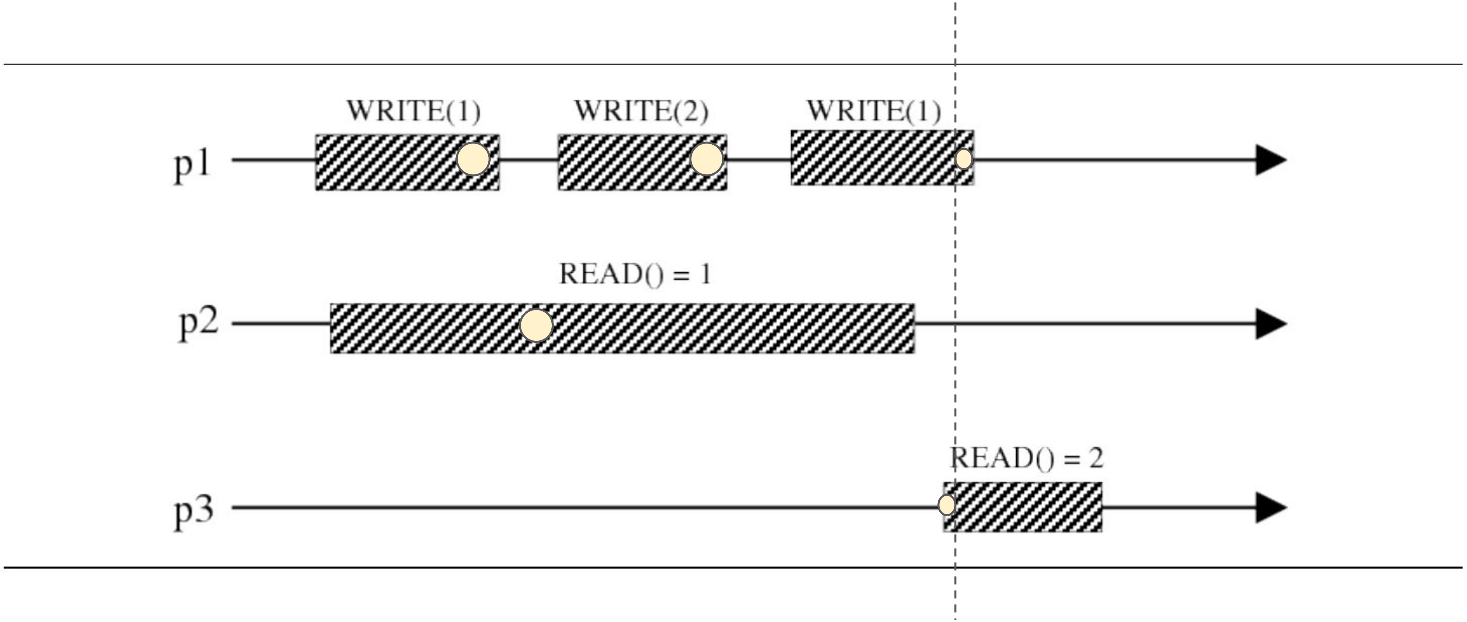
Problem 1.b

None of the above (not safe).



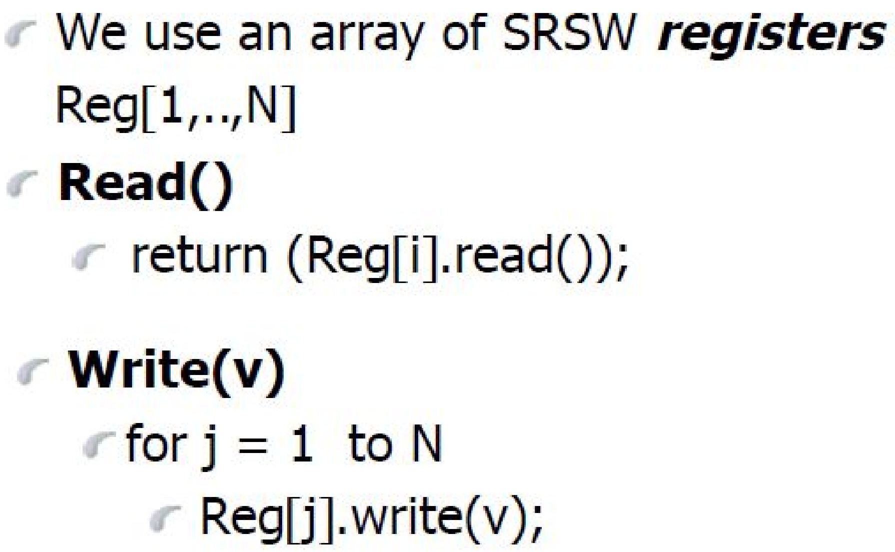
Problem 1.c

Atomic



Problem 2.a

The transformation works for multi-valued registers and regular registers.

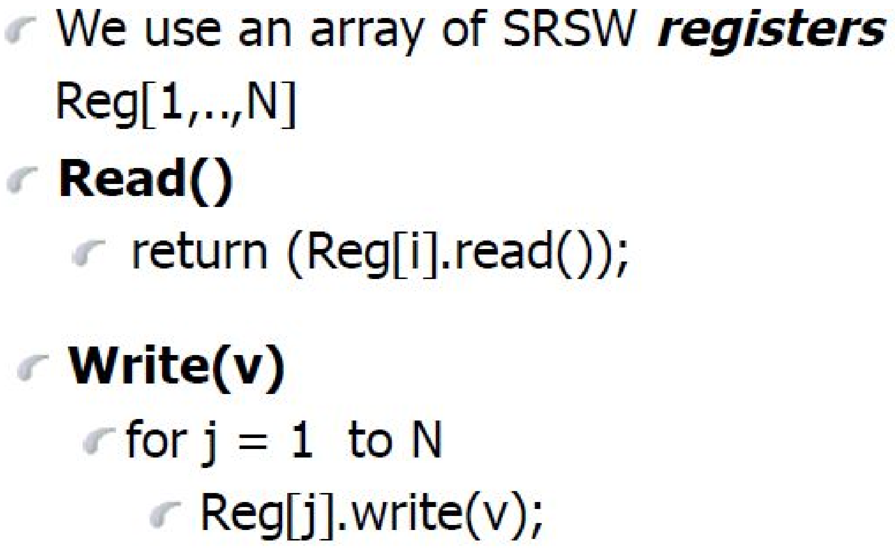


- We use an array of SRSW ***registers*** Reg[1,..,N]
- **Read()**
  - return (Reg[i].read());
- **Write(v)**
  - for j = 1 to N
    - Reg[j].write(v);

- Use an array of SRSW multi-valued registers
- Use an array of SRSW regular registers

Problem 2.a

For regular registers:



- We use an array of SRSW ***registers*** Reg[1,..,N]
- **Read()**
  - return (Reg[i].read());
- **Write(v)**
  - for j = 1 to N
    - Reg[j].write(v);

If Pi.Read is concurrent with some Write

- Either Reg[i].read is concurrent with Reg[i].write
- Or Reg[i].read is not concurrent with Reg[i].write

If concurrent

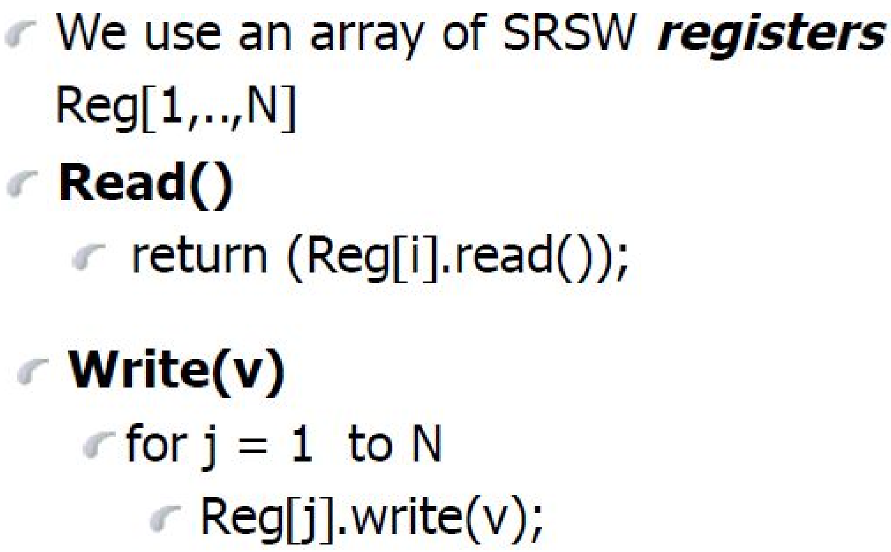
- Reg[i].read returns as a regular register

If not

- Either Reg[i] has been written by WRITE
- Or not
- ...

Problem 2.b

The transformation does **NOT** work for atomic registers.

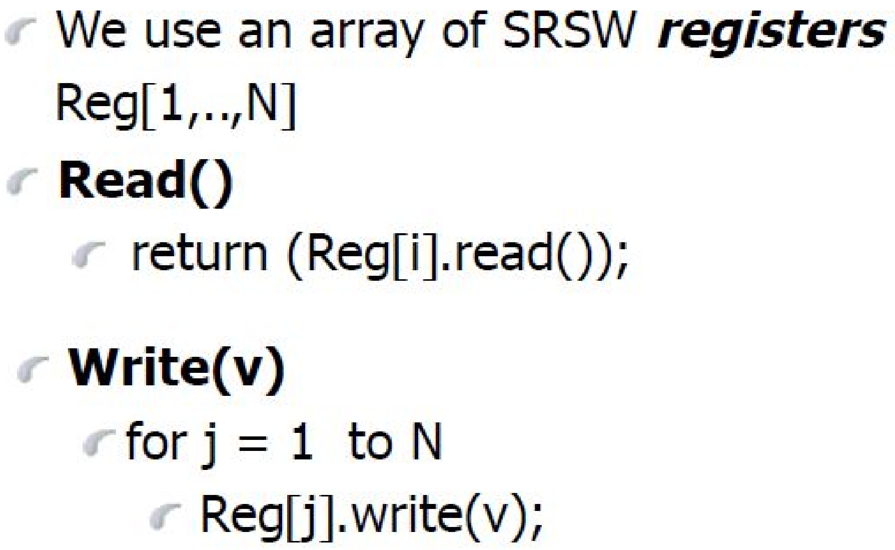


- We use an array of SRSW ***registers*** Reg[1,..,N]
- **Read()**
  - return (Reg[i].read());
- **Write(v)**
  - for j = 1 to N
    - Reg[j].write(v);

- Use an array of SRSW atomic registers

Problem 2.b

For atomic registers:



- We use an array of SRSW ***registers*** Reg[1,..,N]
- **Read()**
  - return (Reg[i].read());
- **Write(v)**
  - for j = 1 to N
    - Reg[j].write(v);

If Pi.Read is concurrent with some Write

- Either Reg[i].read is concurrent with Reg[i].write
- Or Reg[i].read is not concurrent with Reg[i].write

If concurrent

- Reg[i].read returns as a regular register

If not

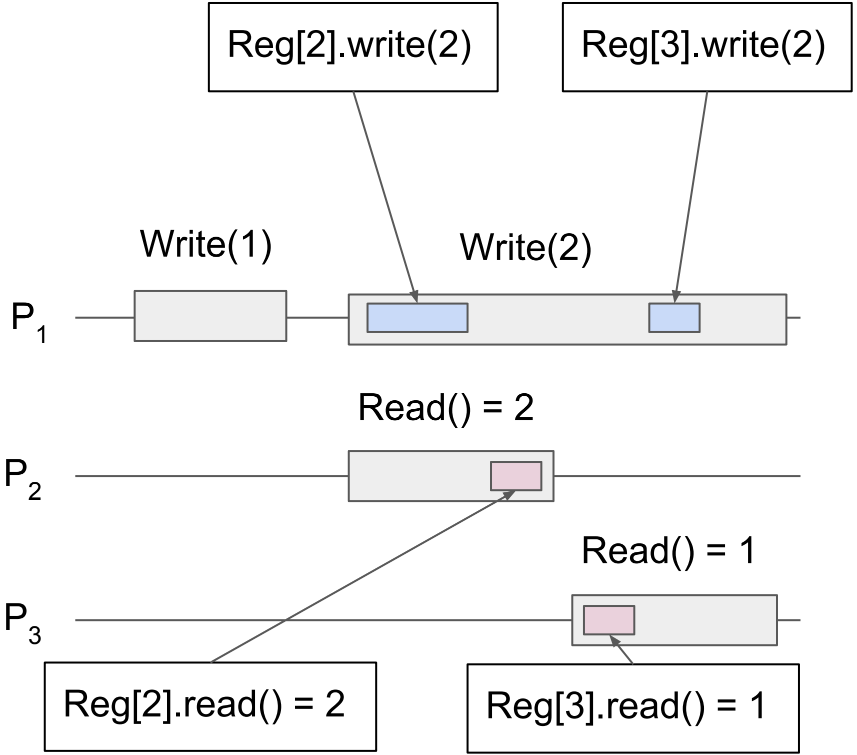
- Either Reg[i] has been written by WRITE
- Or not
- ...

???

Problem 2.b

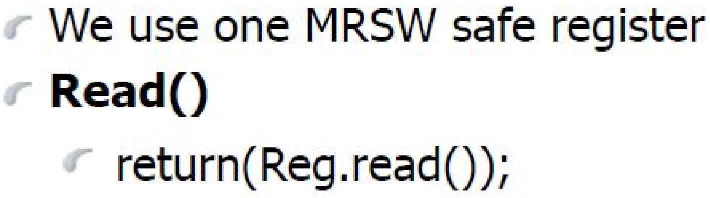
The transformation does **NOT** work for atomic registers.

- We use an array of SRSW ***registers*** Reg[1,..,N]
- **Read()**
    - return (Reg[i].read());
- **Write(v)**
    - for j = 1 to N
        - Reg[j].write(v);

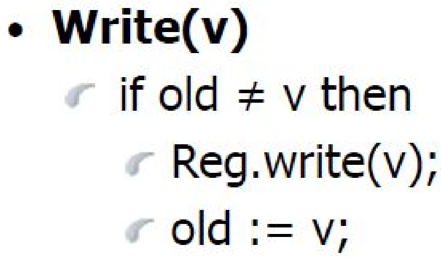


Problem 3.a

The transformation does **NOT** work for multi-valued registers.



- We use one MRSW safe register
- **Read()**
  - return(Reg.read());



- **Write(v)**
  - if old ≠ v then
    - Reg.write(v);
    - old := v;

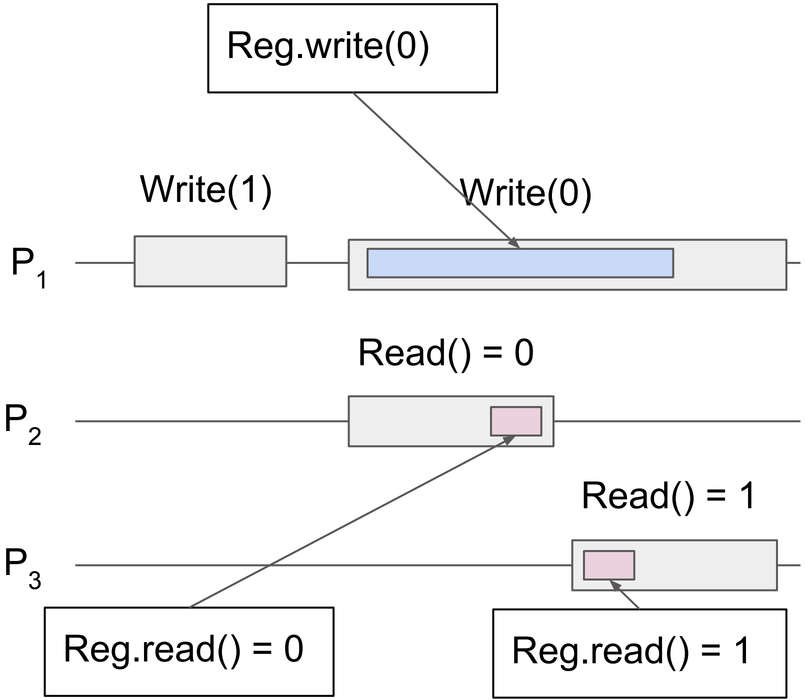
- Use one MRSW safe multi-valued register
- Reg.read may return arbitrarily when being concurrent with Reg.write

Problem 3.b

The resulting register is **NOT** (binary MRSW) atomic.

- We use one MRSW safe register
- **Read()**
  - return(Reg.read());

- **Write(v)**
  - if old ≠ v then
    - Reg.write(v);
    - old := v;


Reg.write(0)
Write(1)
Write(0)
P1
Read() = 0
P2
Read() = 1
P3
Reg.read() = 0
Reg.read() = 1