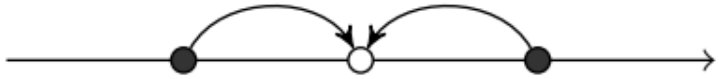

Stand Up Indulgent Rendezvous

Quentin Bramas, Anissa Lamani, Sébastien Tixeuil

Slides available at https://bramas.fr

Model

Model

- Two Robots

Model

- Two Robots
- No Communication

Model

- Two Robots
- No Communication
- No Memory

Model

- Two Robots
- No Communication
- No Memory
- Disoriented

Model

- Two Robots
- No Communication
- No Memory
- Disoriented
- No Common Unit-Distance

Model

Model

- What they do?

  Look (where is the other robot?)
  Compute (where am I going next?)
  Move (who am I?)

Model

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  Look (where is the other robot?)
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  - Fully-Synchronous:

    Robot 1: LCM LCM LCM LCM LCM LCM …
    Robot 2: LCM LCM LCM LCM LCM LCM …

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  Look (where is the other robot?)
  Compute (where am I going next?)
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- When?
  - Fully-Synchronous:

    Robot 1: LCM LCM LCM LCM LCM LCM …
    Robot 2: LCM LCM LCM LCM LCM LCM …
  - Semi-Synchronous:

    Robot 1: LCM LCM LCM LCM LCM …
    Robot 2: LCM LCM LCM LCM …

The Rendezvous Problem

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- What we want:

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- What we want:
  - Starting from an arbitrary configuration

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- What we want:
  - Starting from an arbitrary configuration
  - After a finite number of rounds

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- What we want:
  - Starting from an arbitrary configuration
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  - End up (and remain) at the same position

Related Work

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- Suzuki-Yamashita (99)

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  - Solvable in FSYNC

Related Work

- Suzuki-Yamashita (99)
  - Solvable in FSYNC
  - Solvable in SSYNC with common coordinate system.

Related Work

- Suzuki-Yamashita (99)
  - Solvable in FSYNC
  - Solvable in SSYNC with common coordinate system.
  - **Not** solvable in SSYNC **without** common coordinate system.

What if robots may crash

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- Two Possibilities:

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- Two Possibilities:
  - Ignore crashed robots (weak gathering)

What if robots may crash

- Two Possibilities:
  - Ignore crashed robots (weak gathering)
  - Gather at the position of the crashed robot (strong gathering)

Related Work

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- Strong gathering:

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  - Not possible when $f > 1$

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Related Work

- Strong gathering:
  - Not possible when $f > 1$
  - Possible if robots move one at a time (round-robin SSYNC)
- Weak gathering (n-robots) tolerating crash faults:
  - possible for any f in SSYNC with multiplicity detection

The Stand Up Indulgent Rendezvous Problem

- What we want:
  - Starting from an arbitrary configuration
  - After a finite number of rounds
  - End up (and remain) at the same position
  - Even if one robot crashes (strong gathering)

Summary

	Rendezvous	SUIR
SSYNC oblivious, disoriented	Impossible [SY99]	
SSYNC oblivious, common x-axis		
SSYNC oblivious, common x-y-axis	Possible [SY99]	
SSYNC luminous, common x-y-axis	Possible	
FSYNC oblivious, disoriented	Possible [SY99]	

Summary

	Rendezvous	SUIR
SSYNC oblivious, disoriented	Impossible [SY99]	Impossible (our paper)
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Let A be an algorithm that solves the SUIR problem with lights
(infinite memory and communication capabilities)

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Let A be an algorithm that solves the SUIR problem with lights
(infinite memory and communication capabilities)

Lemma: in an execution, if only one robot r is activated, then there is a round when r is dictated to move to the other robot.

Proof: Indeed, if the other robot is crashed, we know that in finite number of rounds r moves to the other robot.

Impossibility Result

Theorem: SUIR is not Solvable in SSYNC (even with lights and common coordinate system)

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Let r and r' be the two robots.

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After each round the robots are not gathered.

Solving The SUIR in FSYNC

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How to define an algorithm:

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A rule defines the target for a set of views

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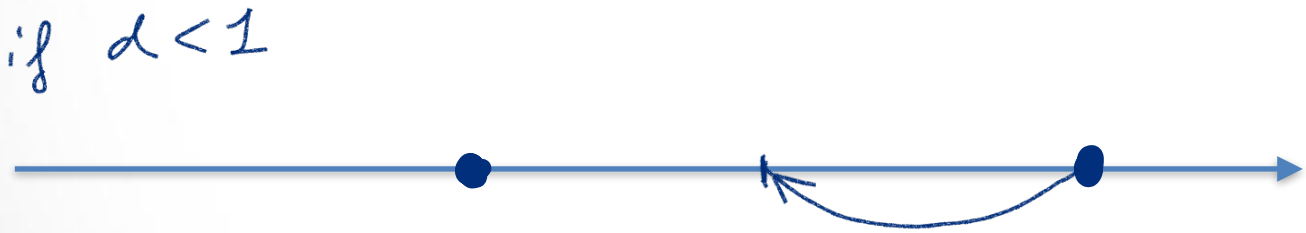

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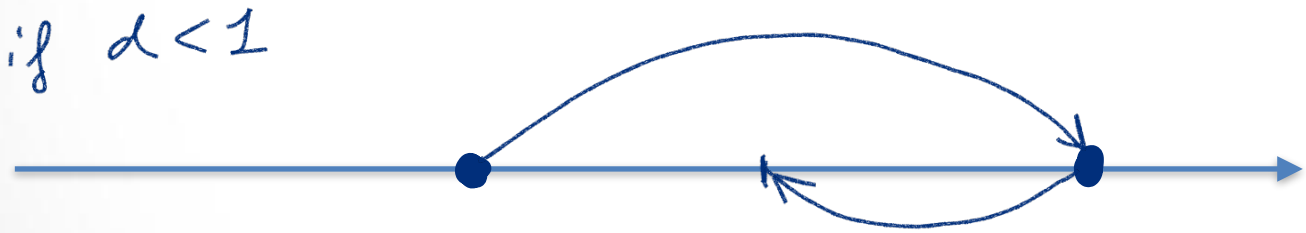
Examples:



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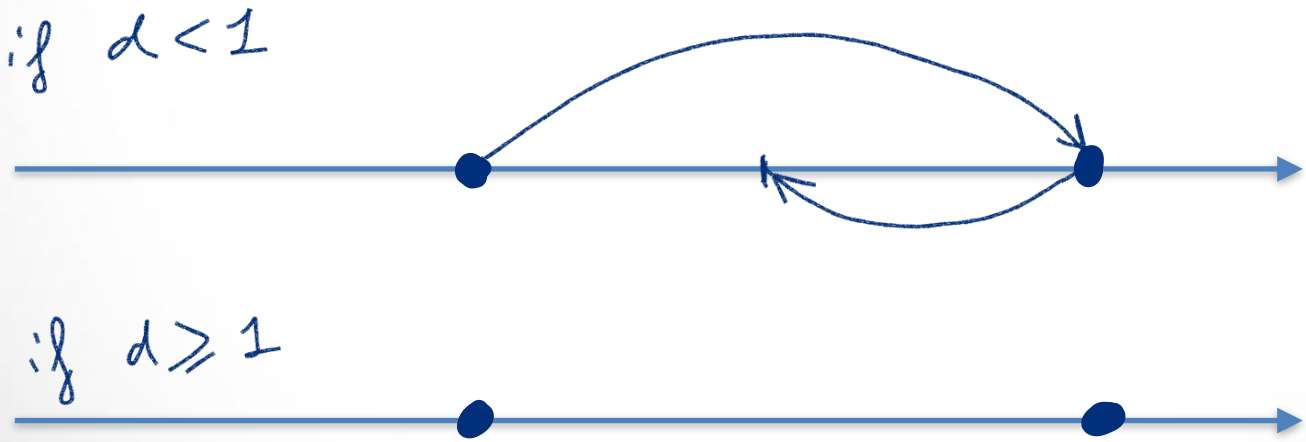

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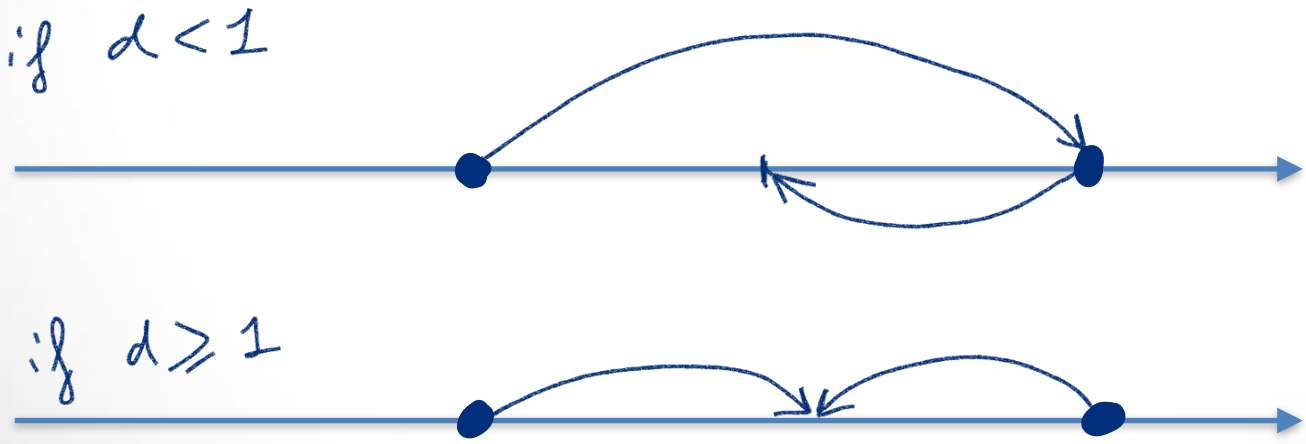

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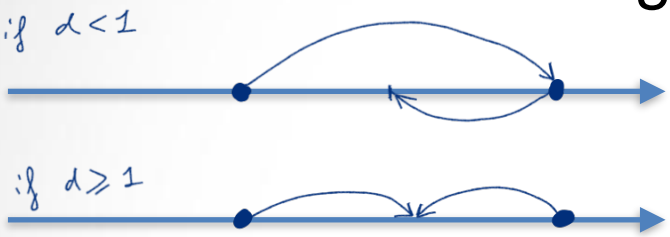
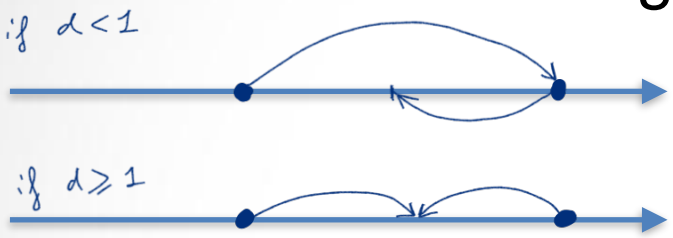


Example execution:

Solving The SUIR in FSYNC



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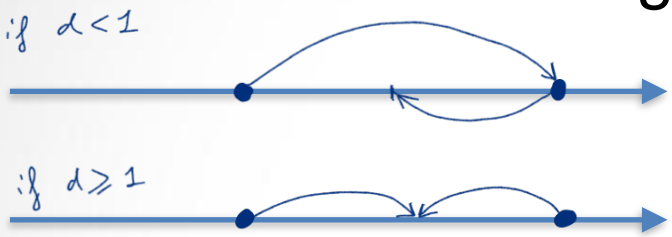

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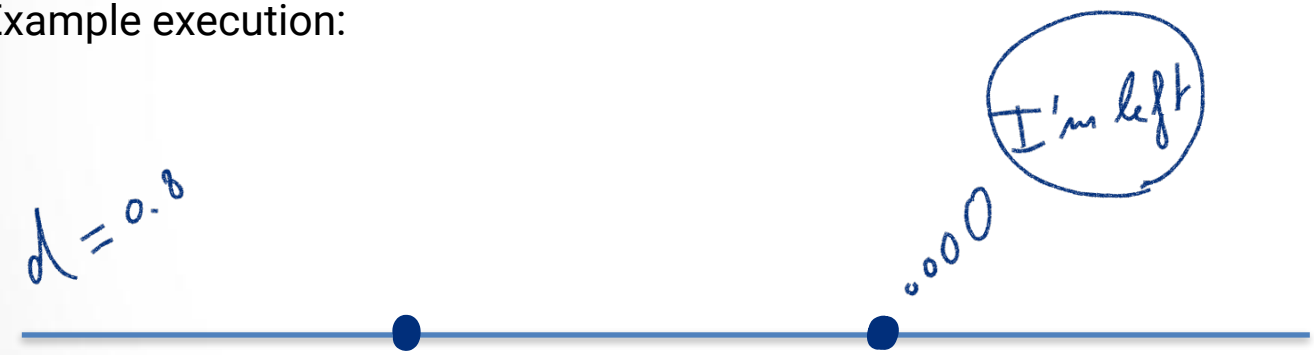

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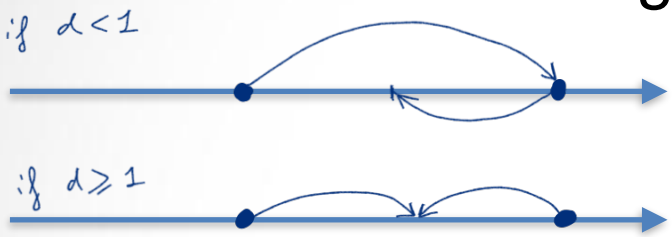

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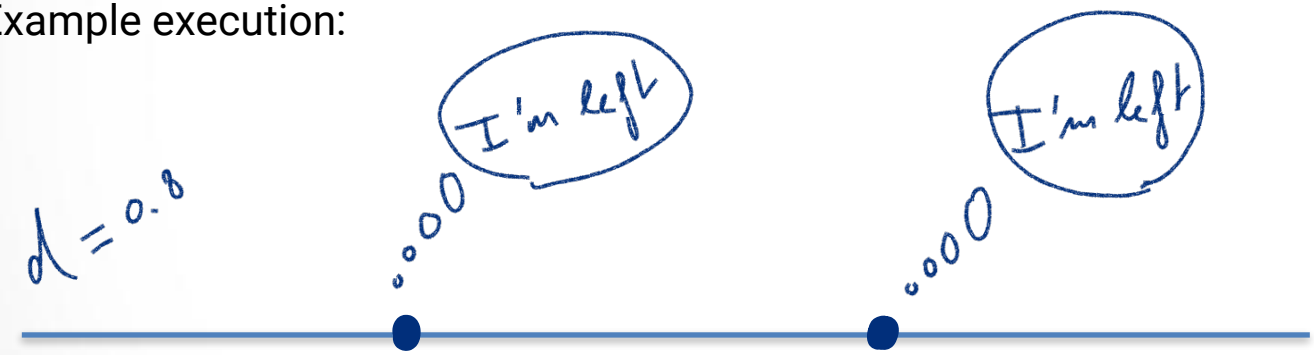

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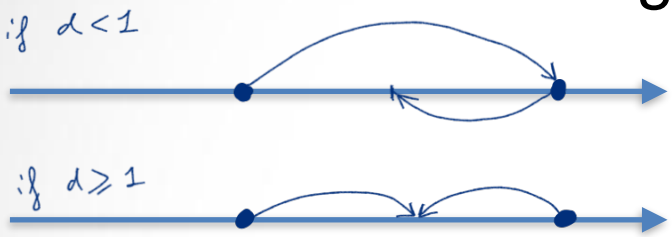

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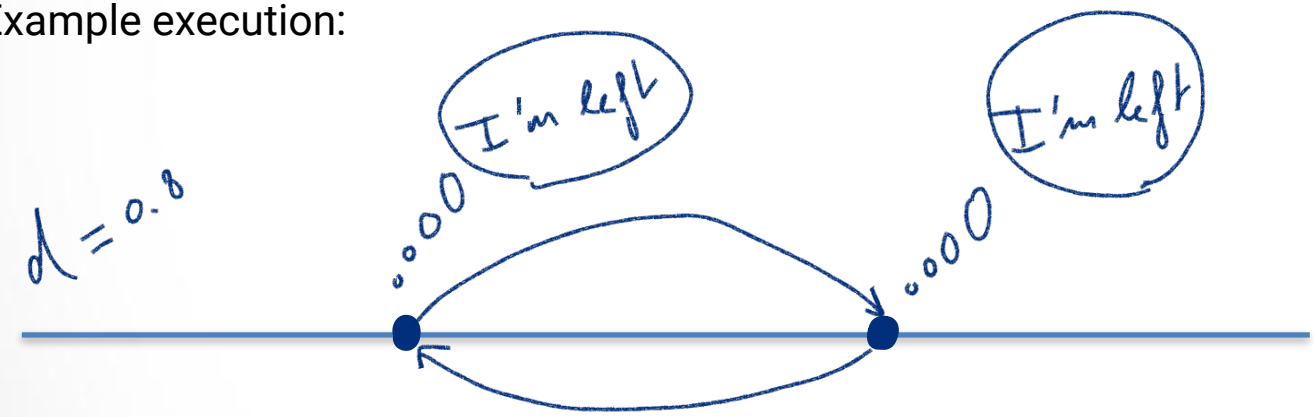

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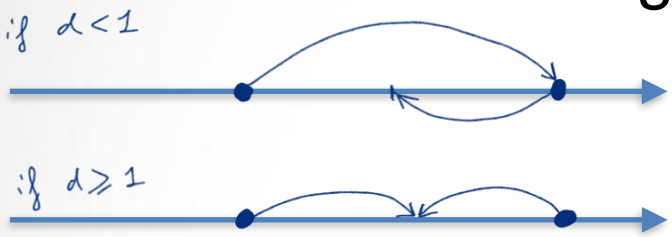

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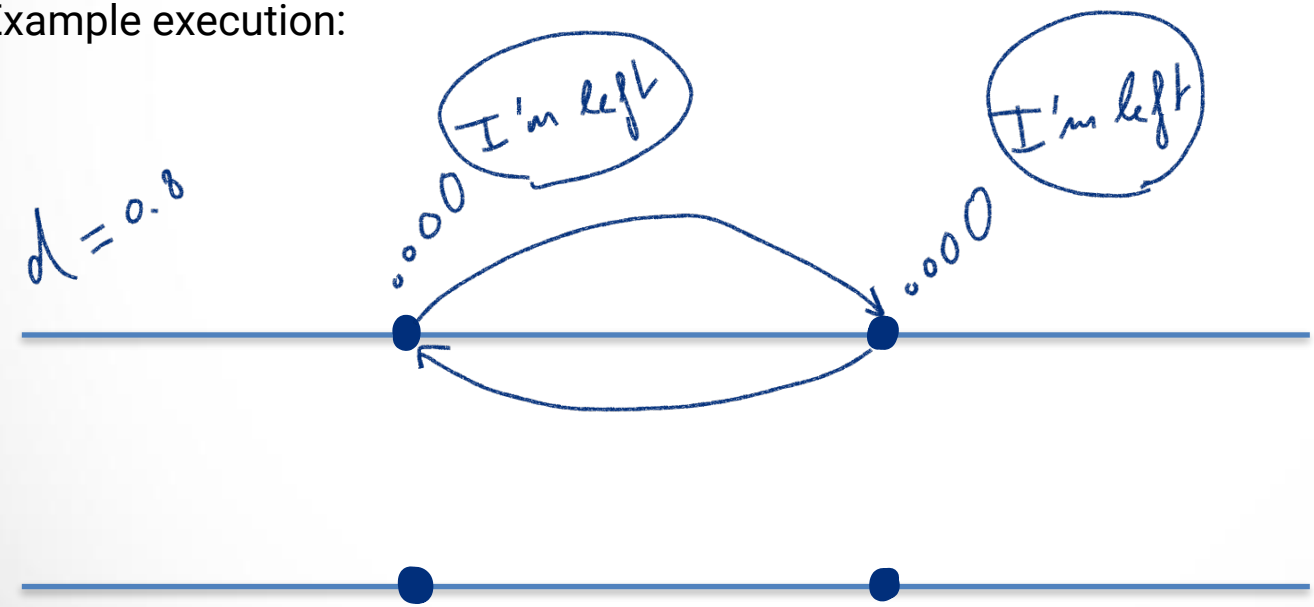

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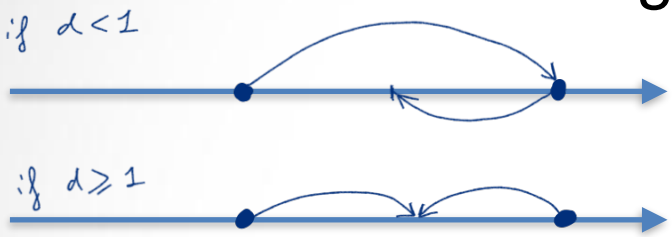

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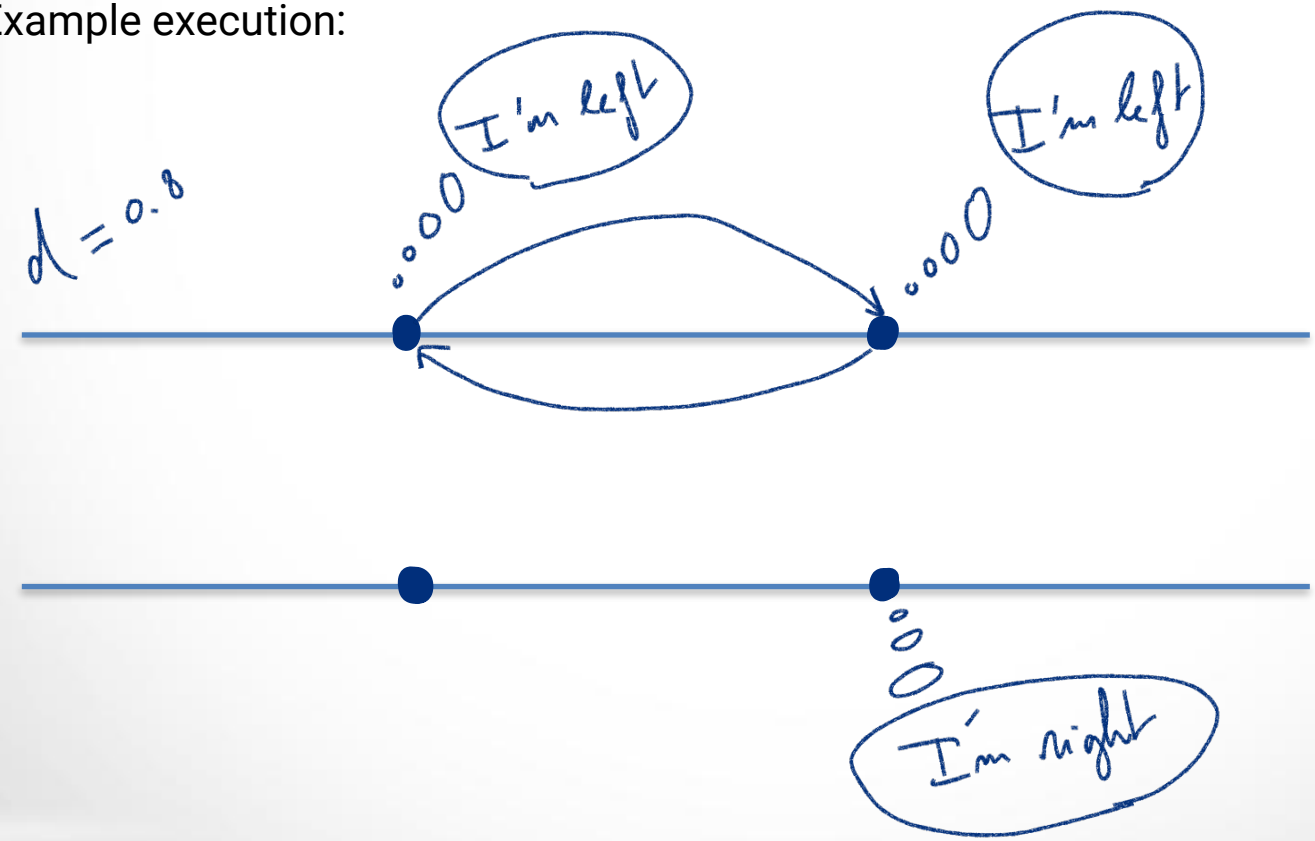

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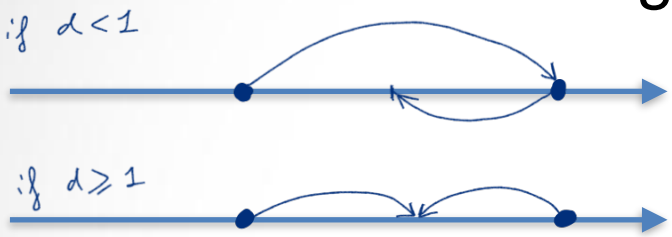

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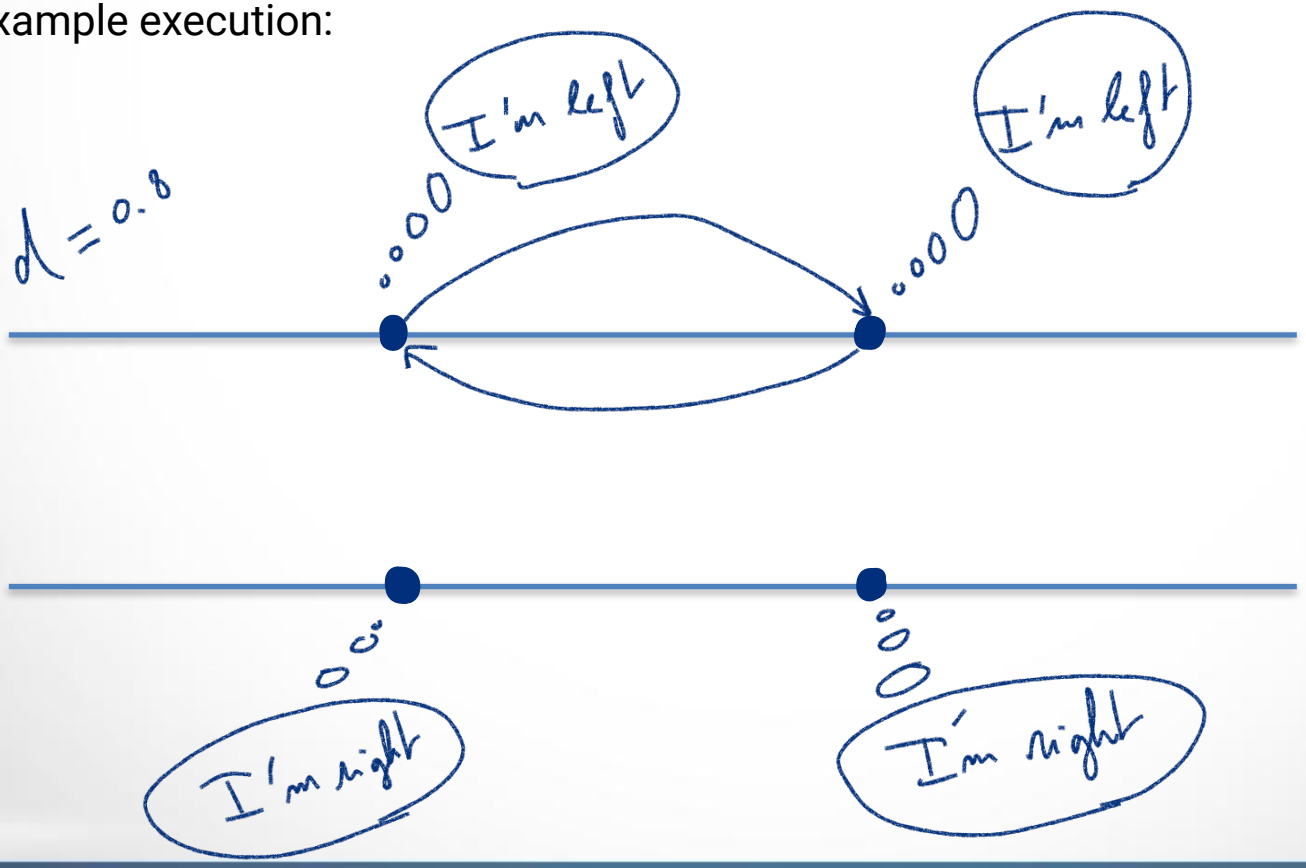

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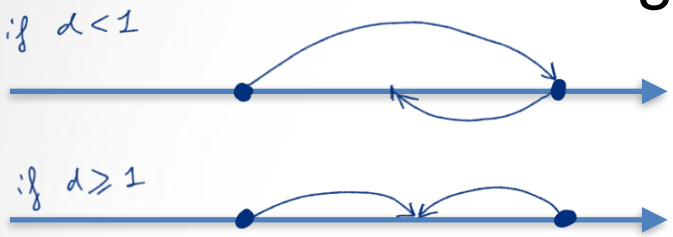

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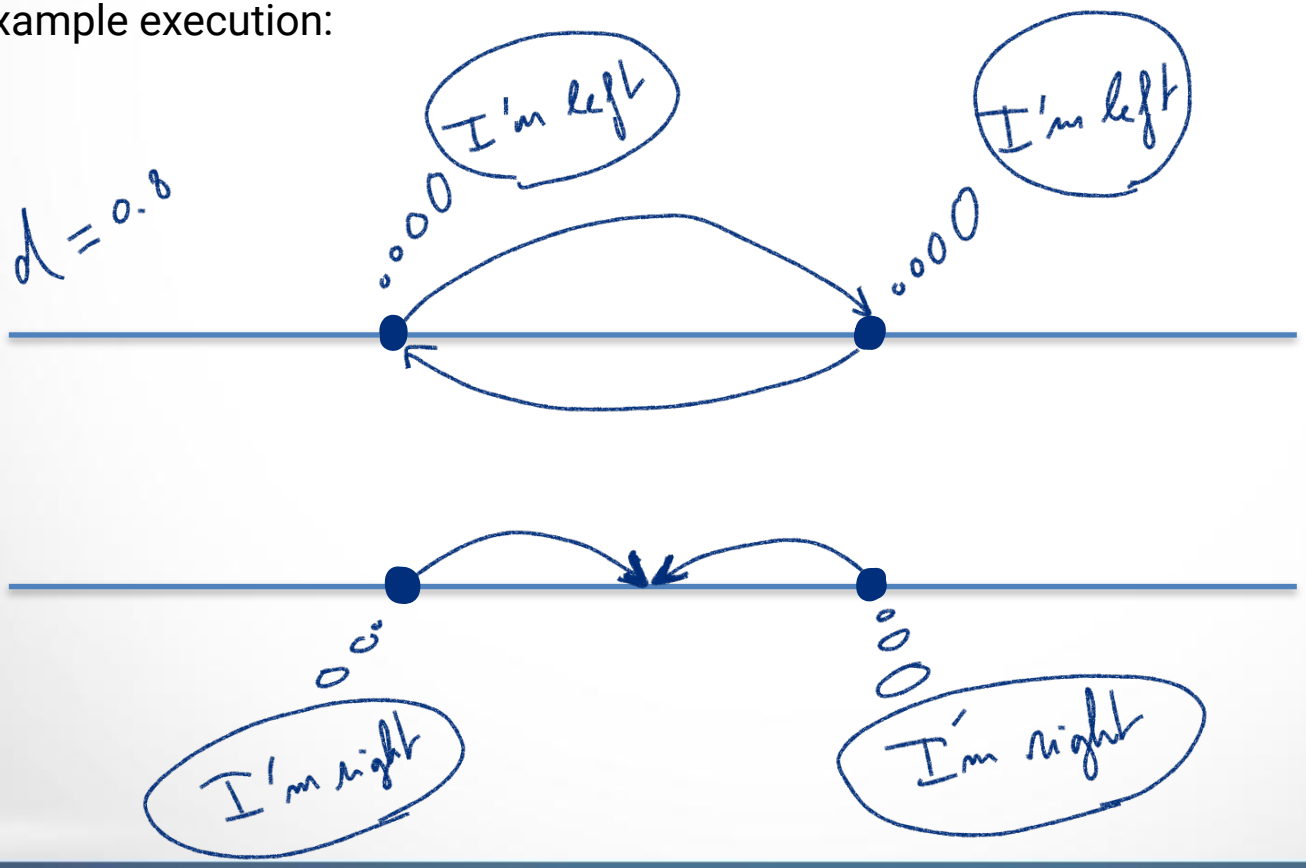

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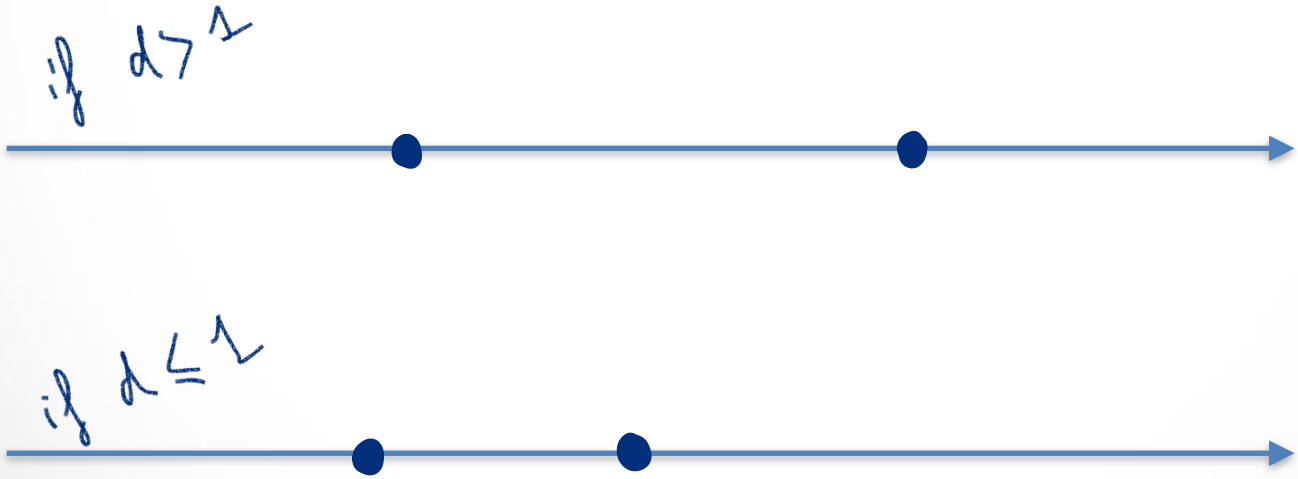
- Are on an oriented line
- Have a common unit distance
- Have rigid movements



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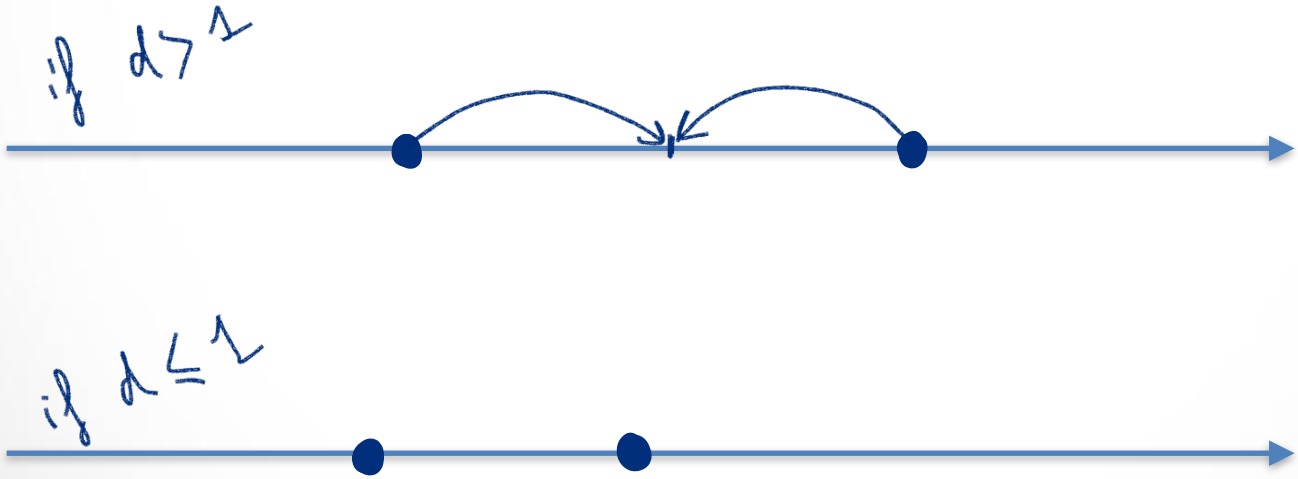

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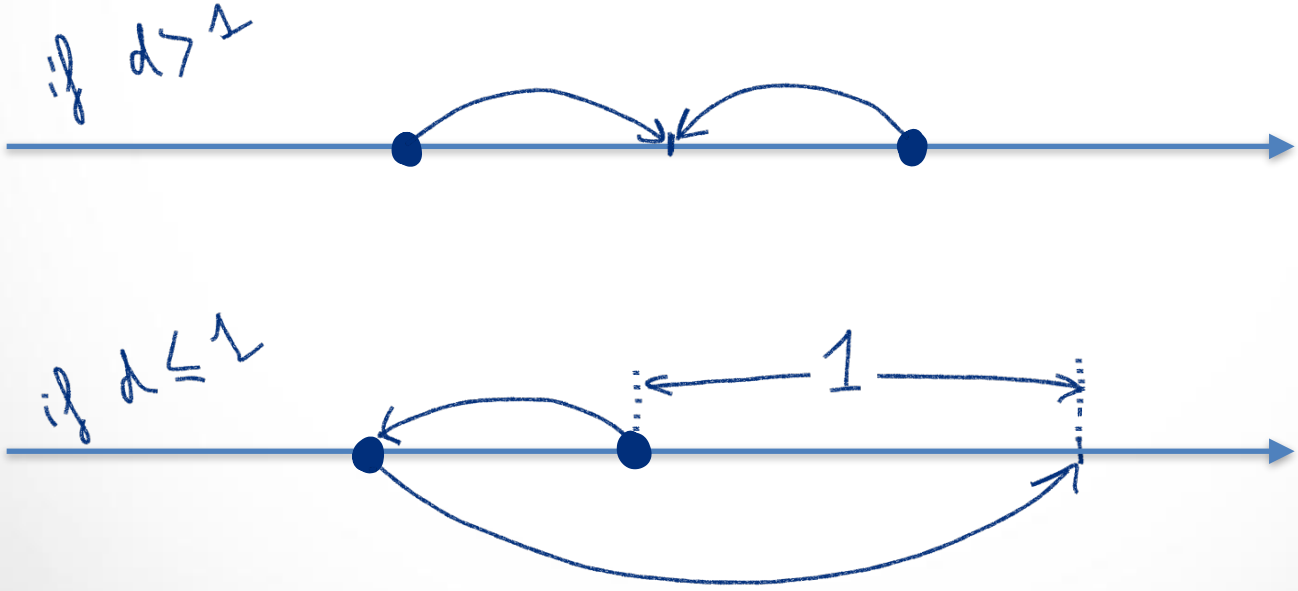

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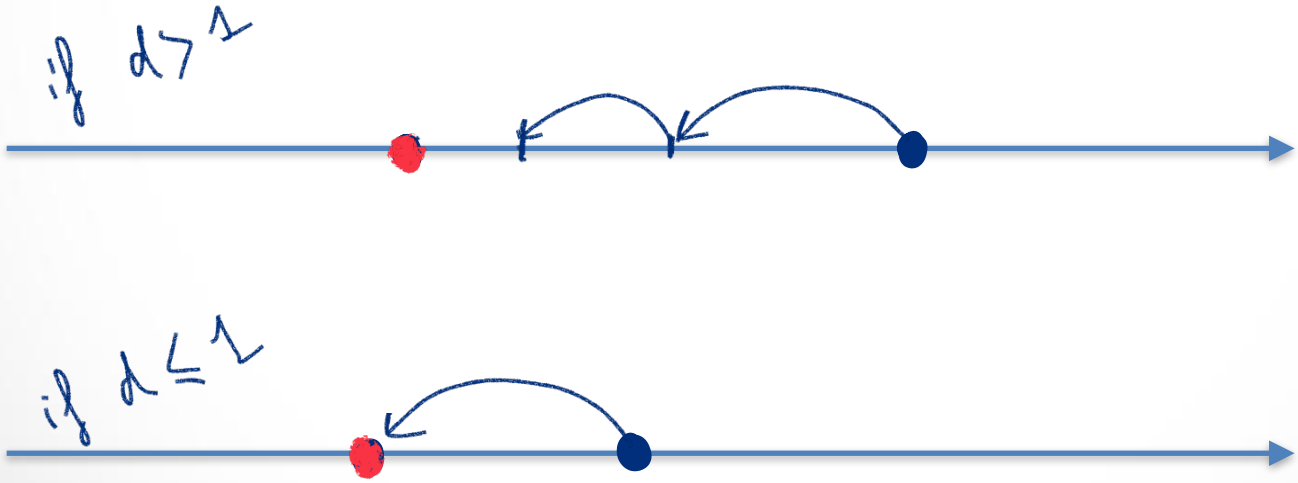

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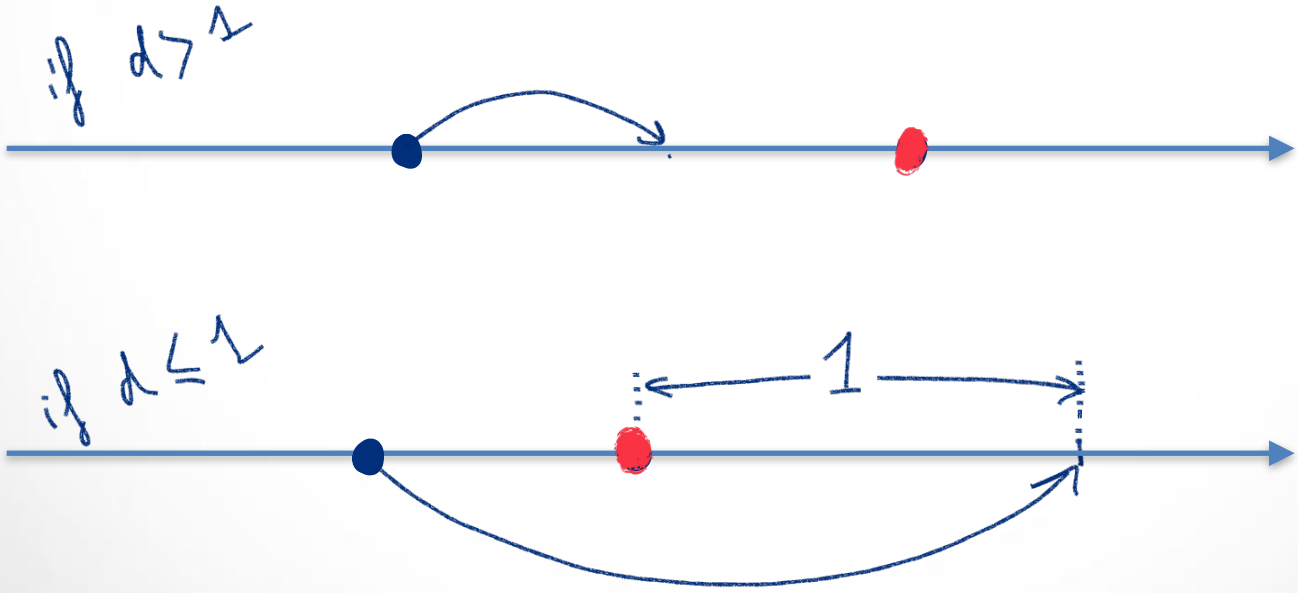

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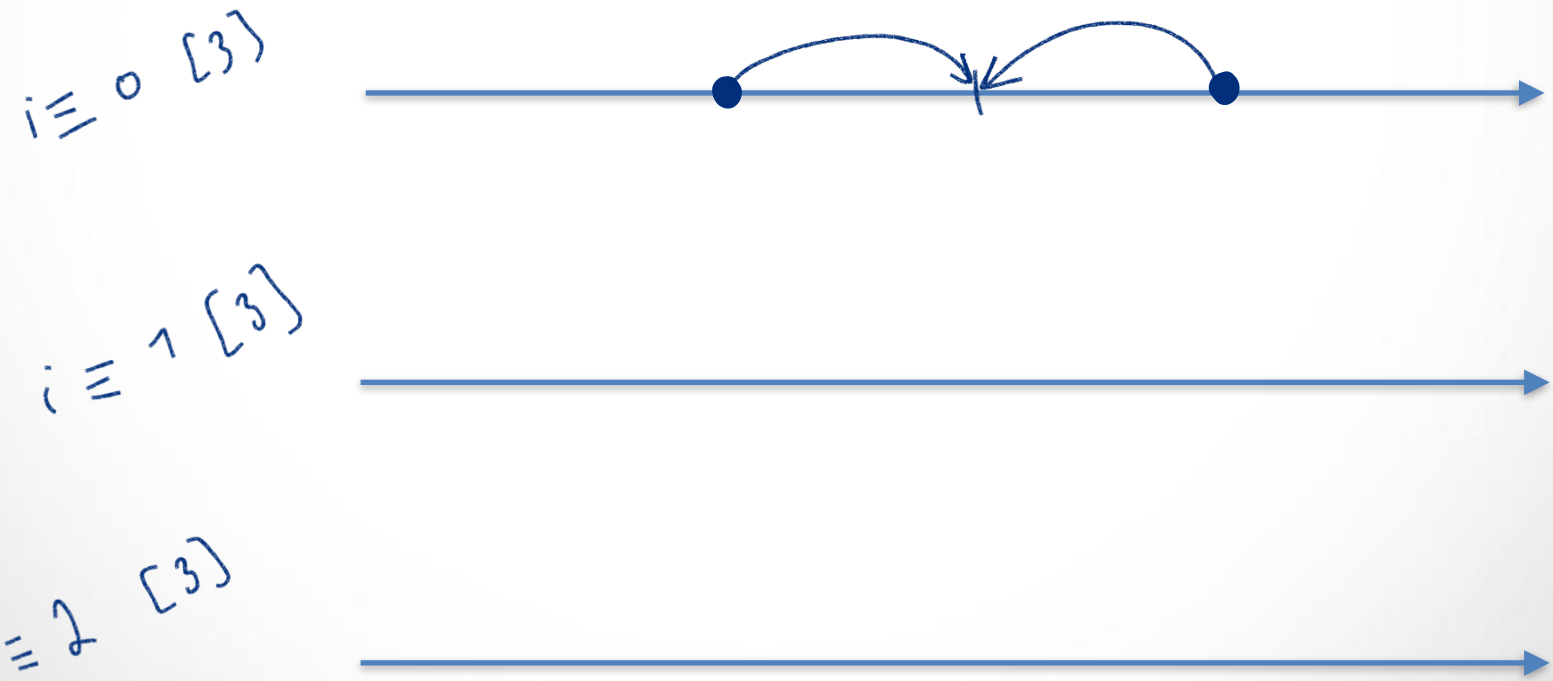

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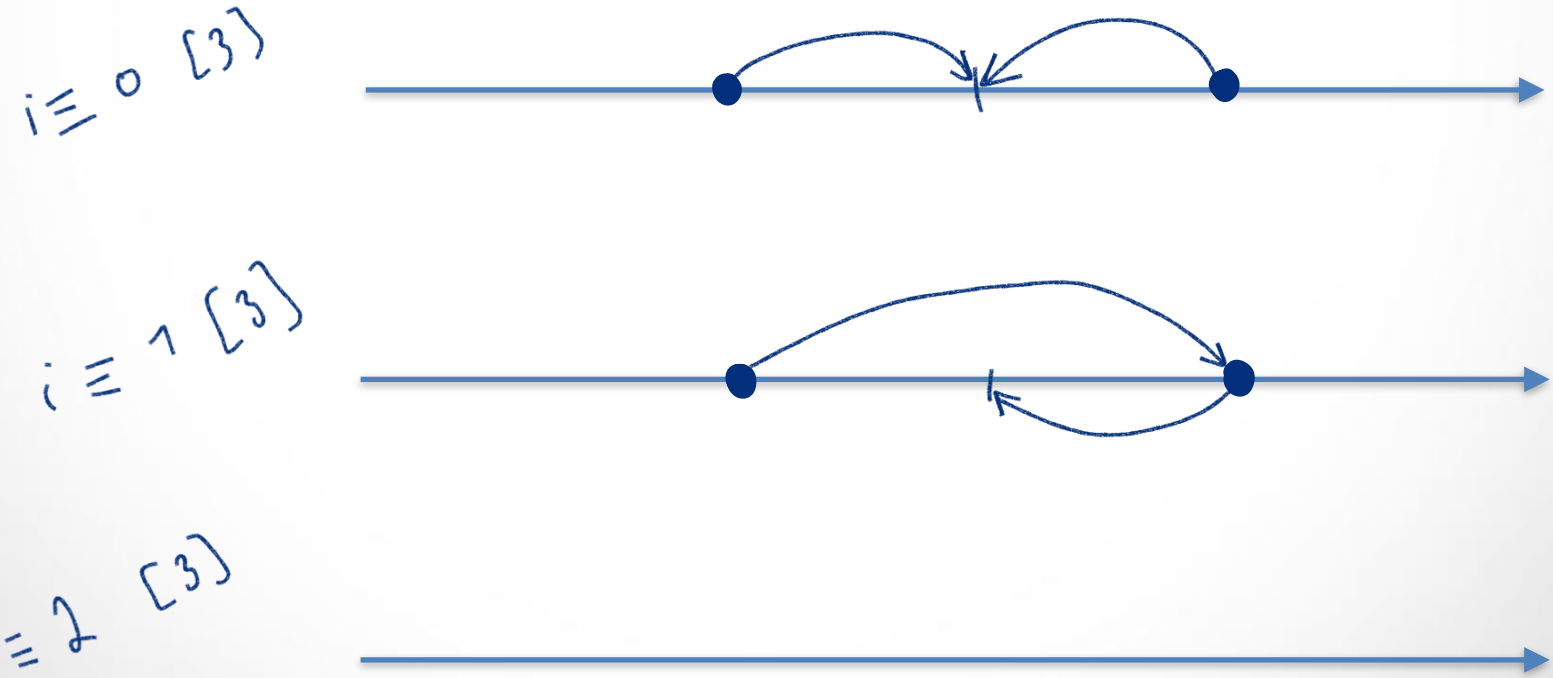

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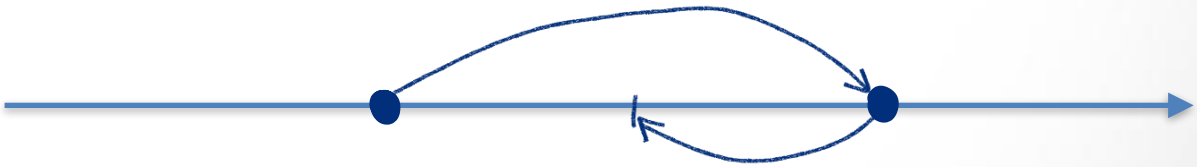

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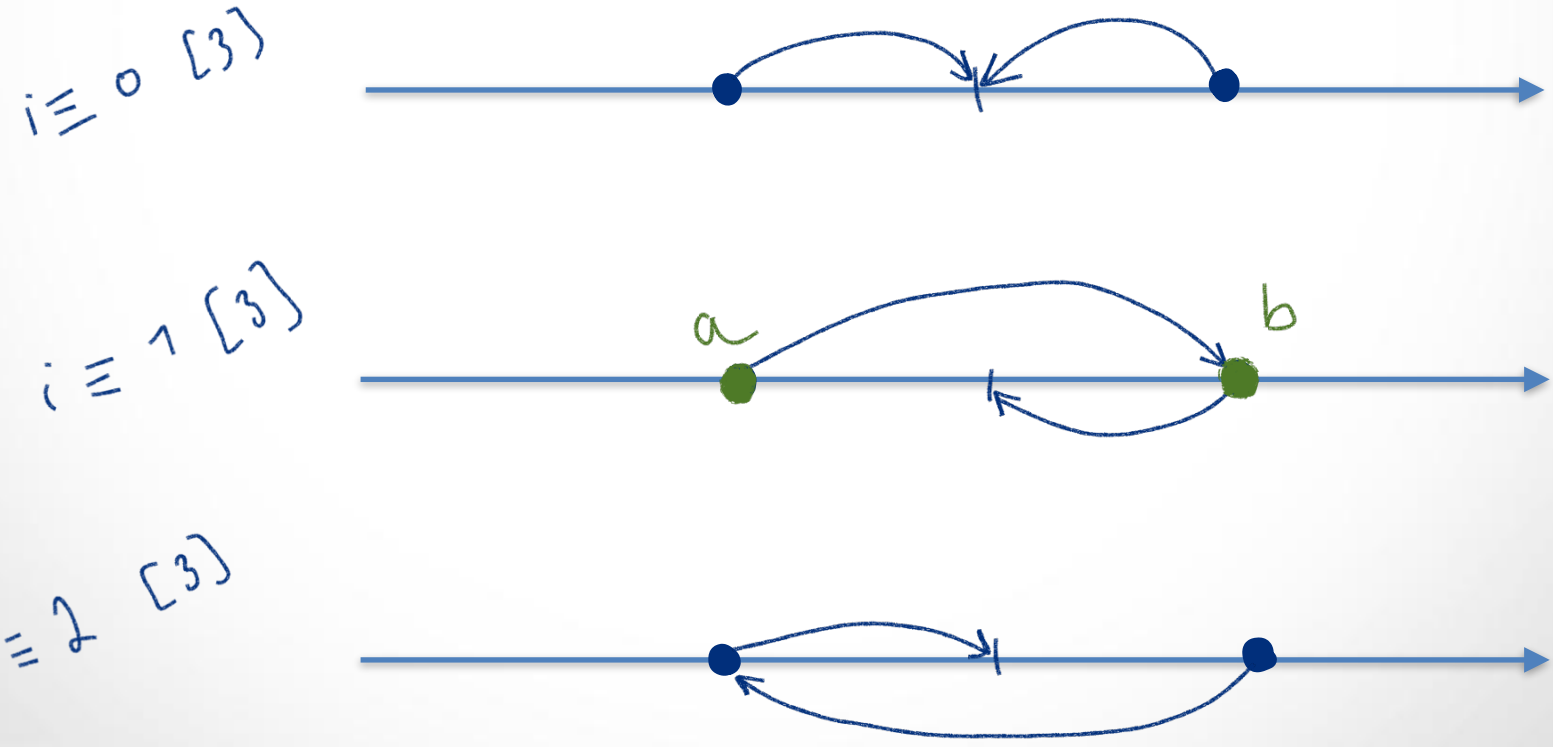

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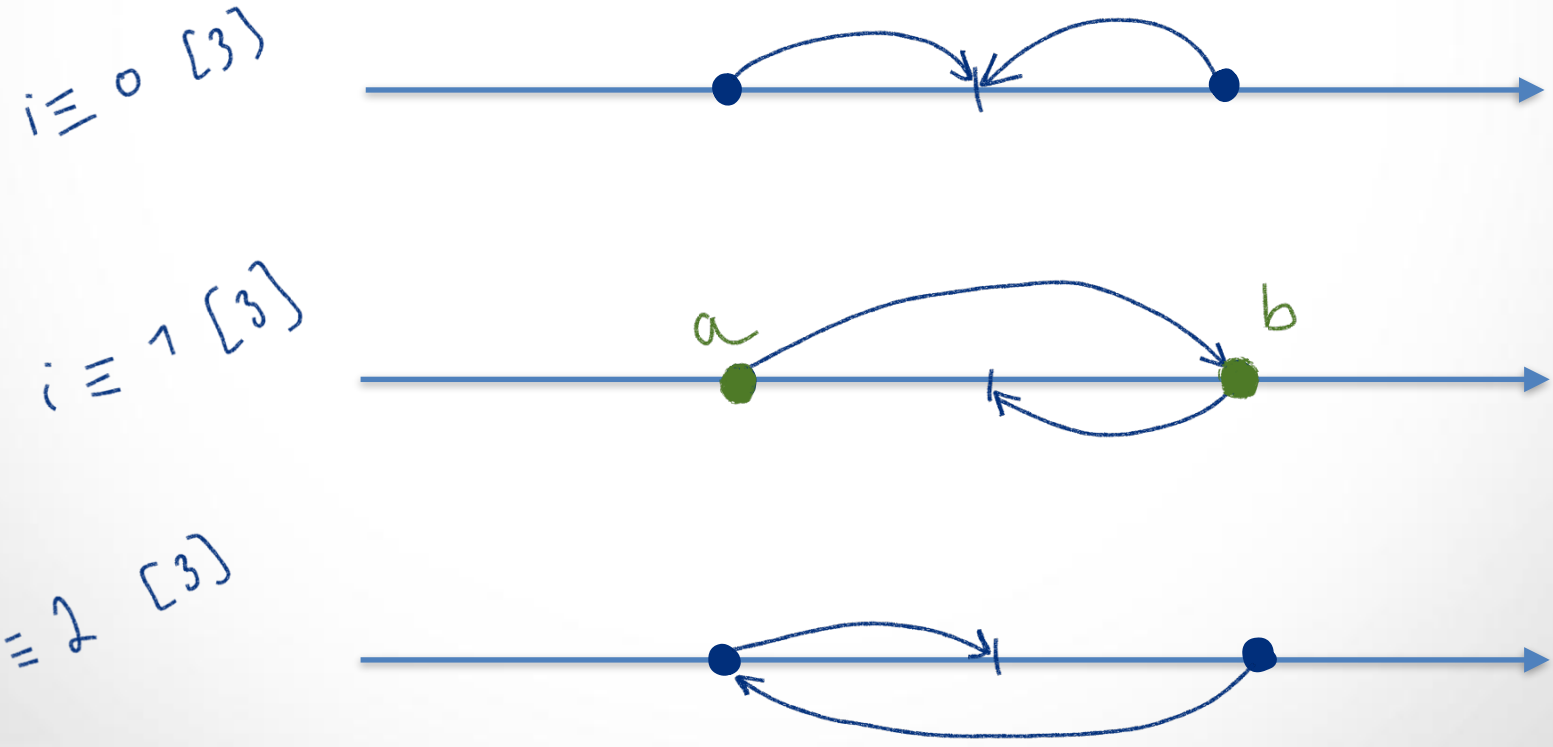

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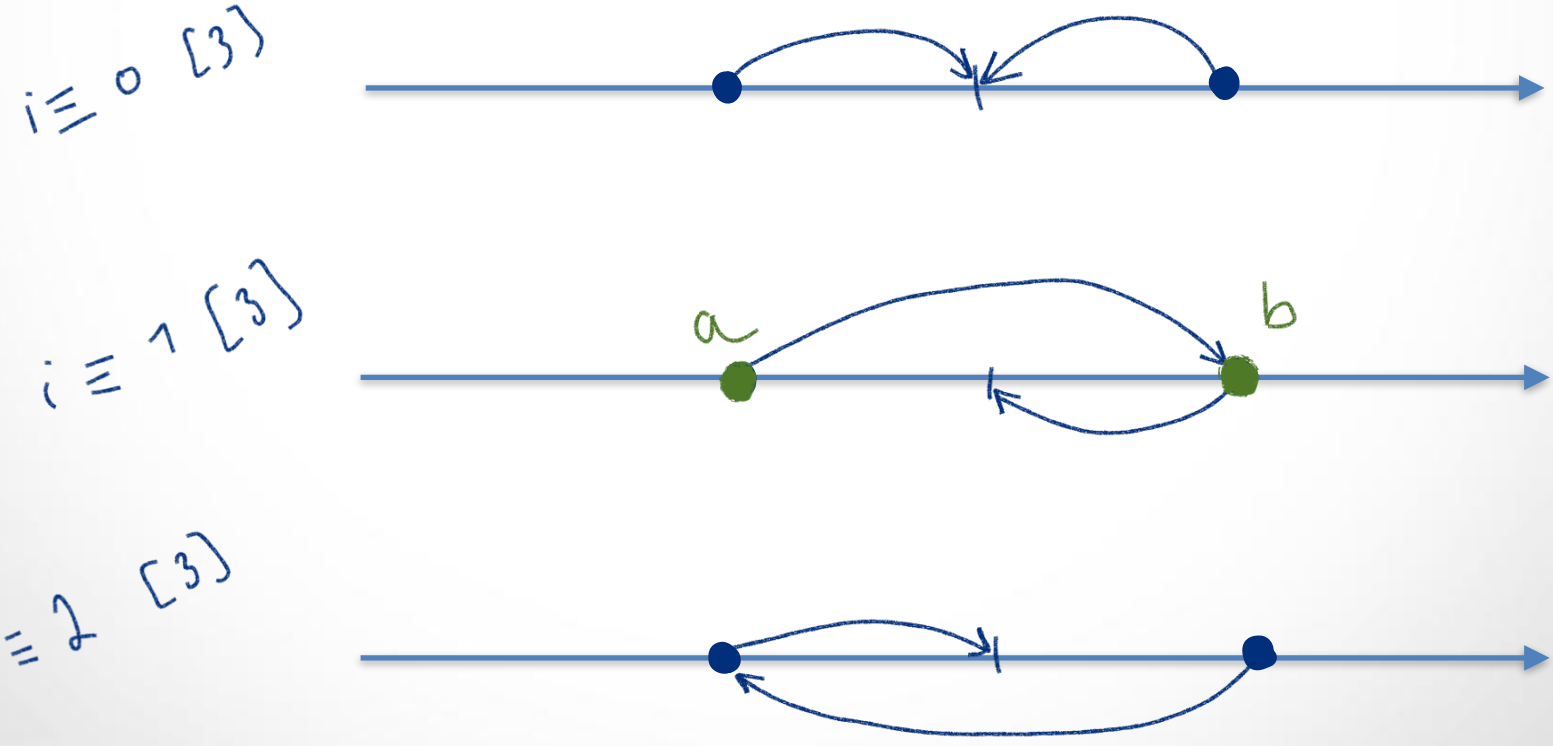

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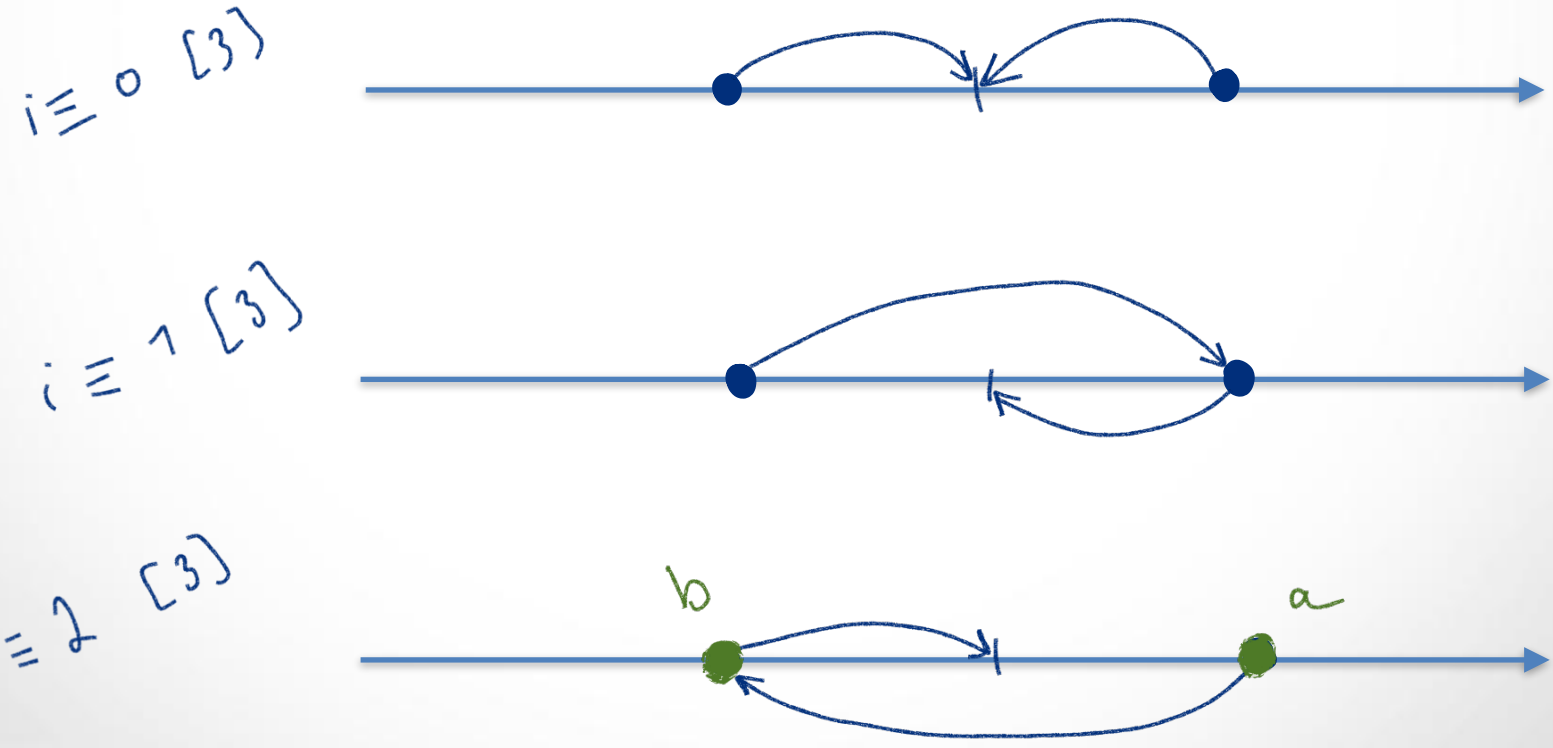

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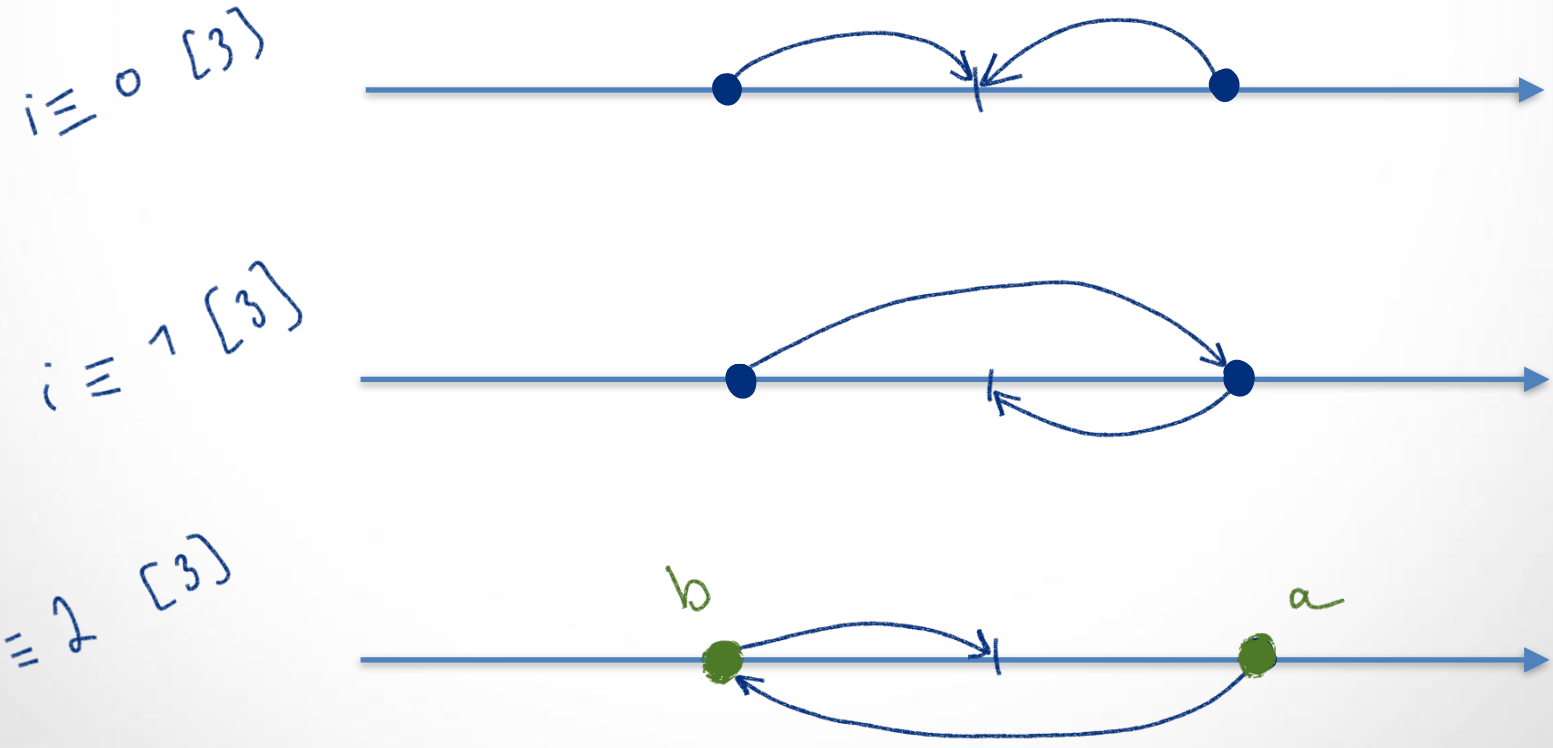

Solving The SUIR in FSYNC

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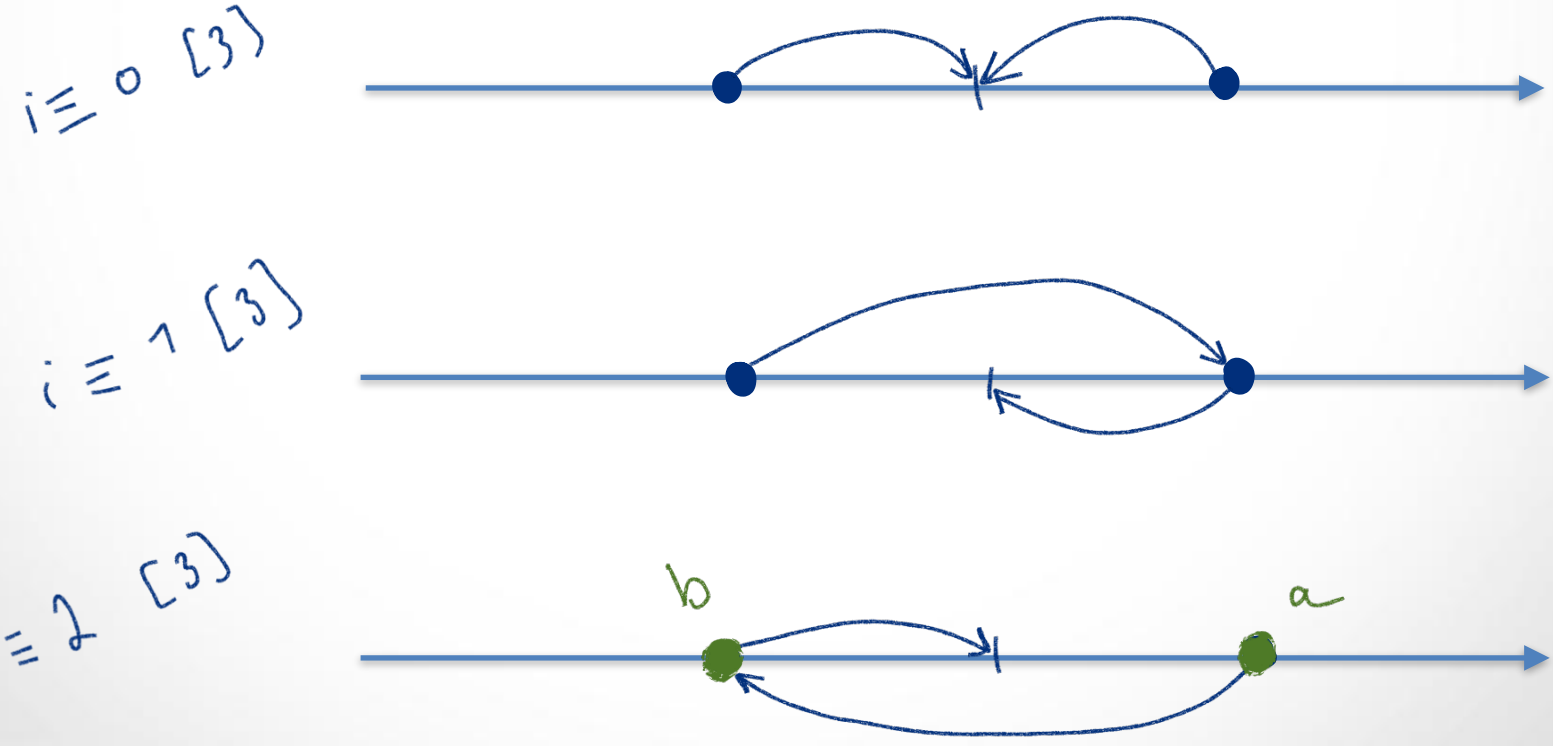

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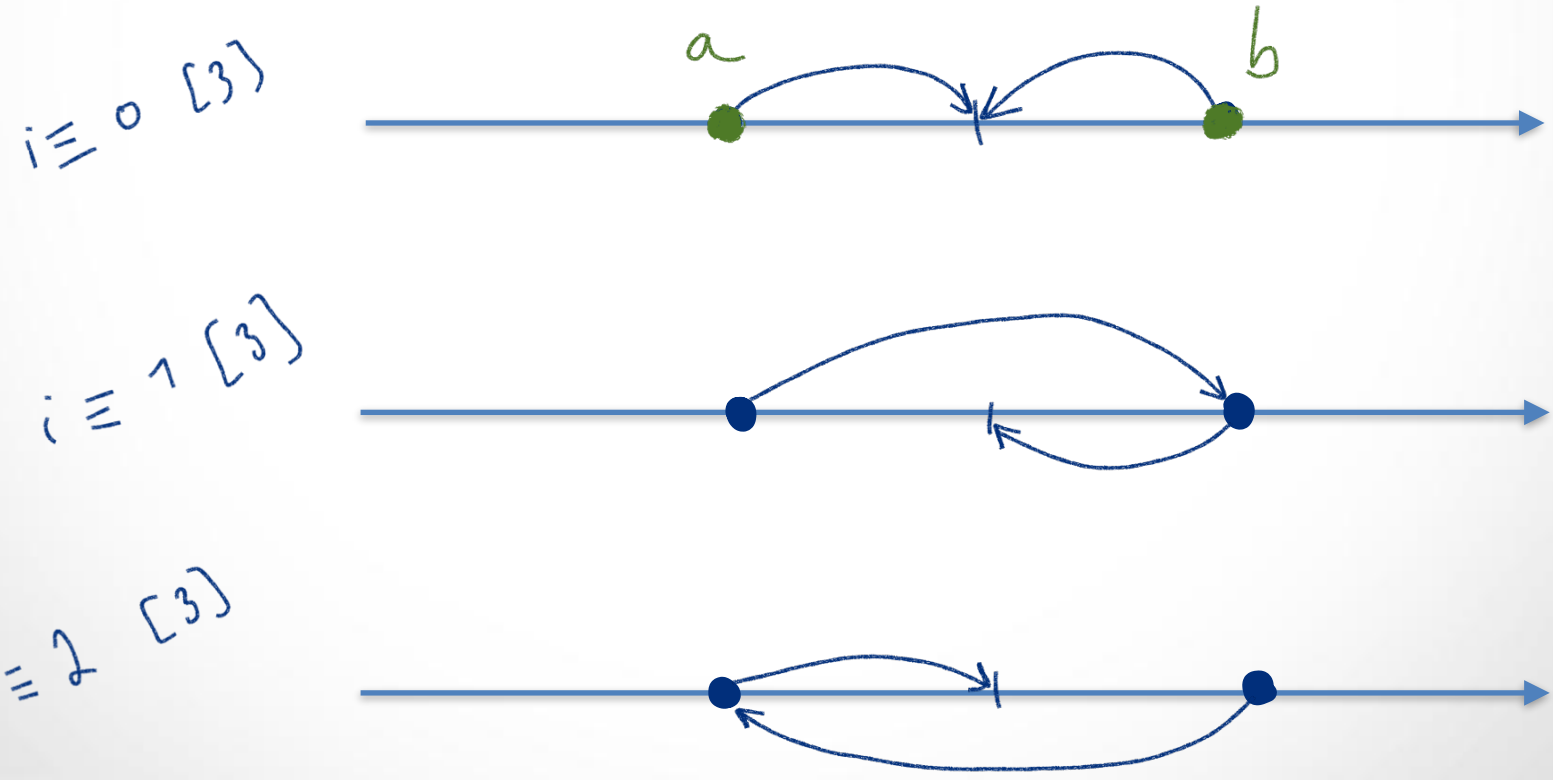

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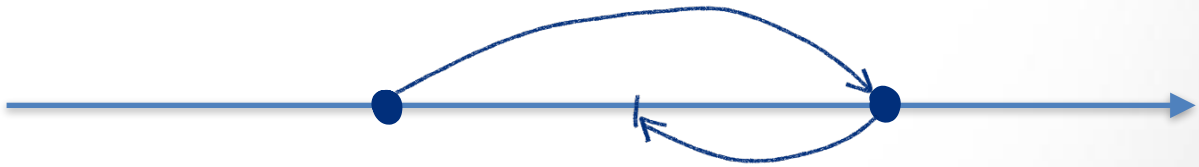

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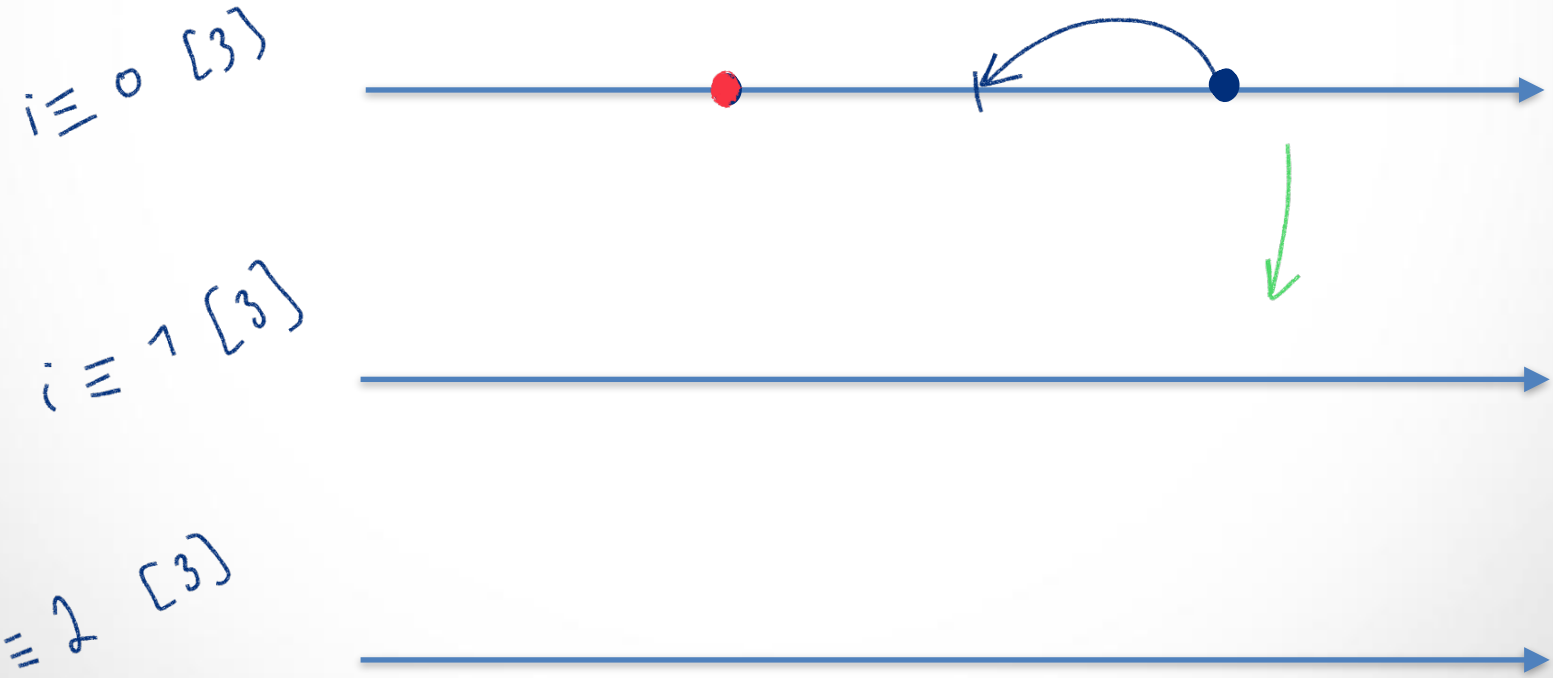

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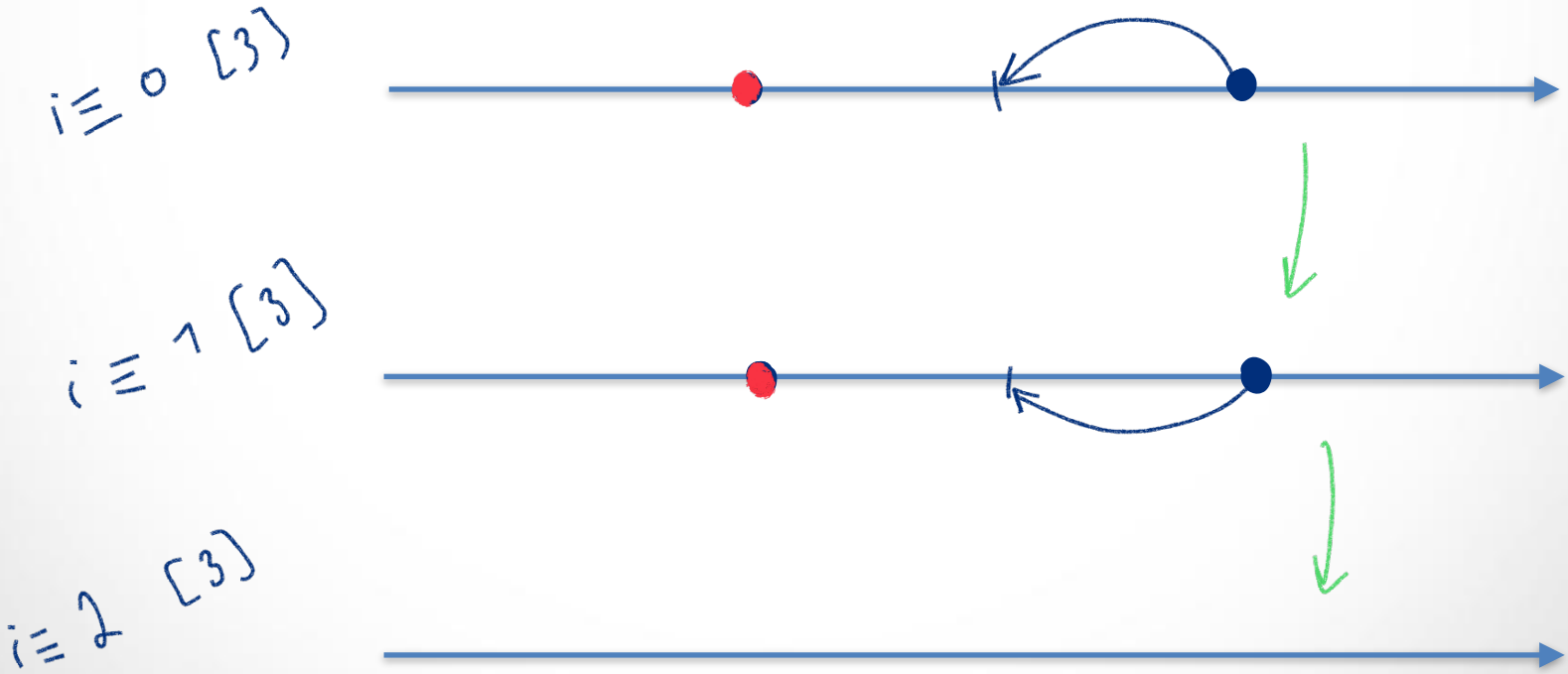

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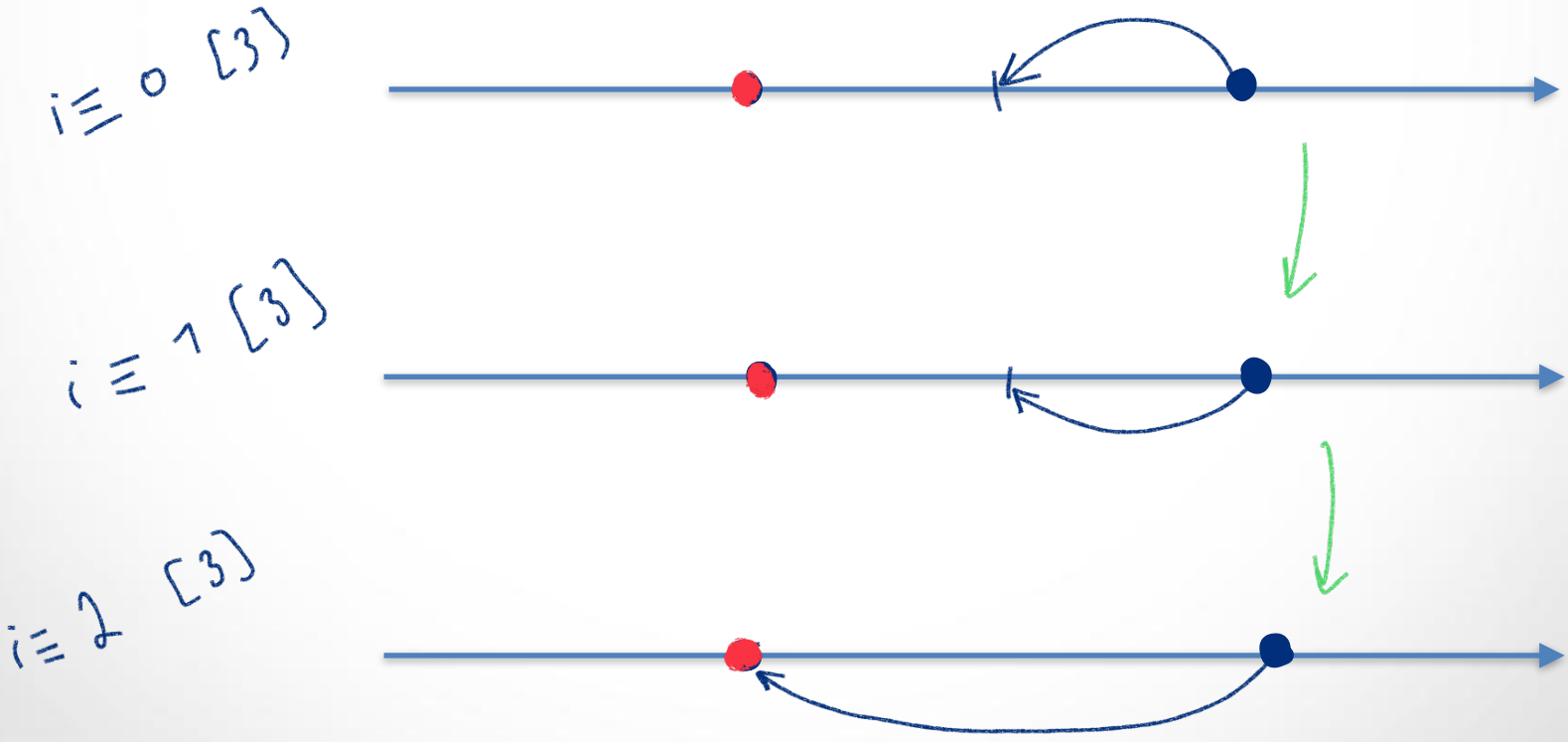

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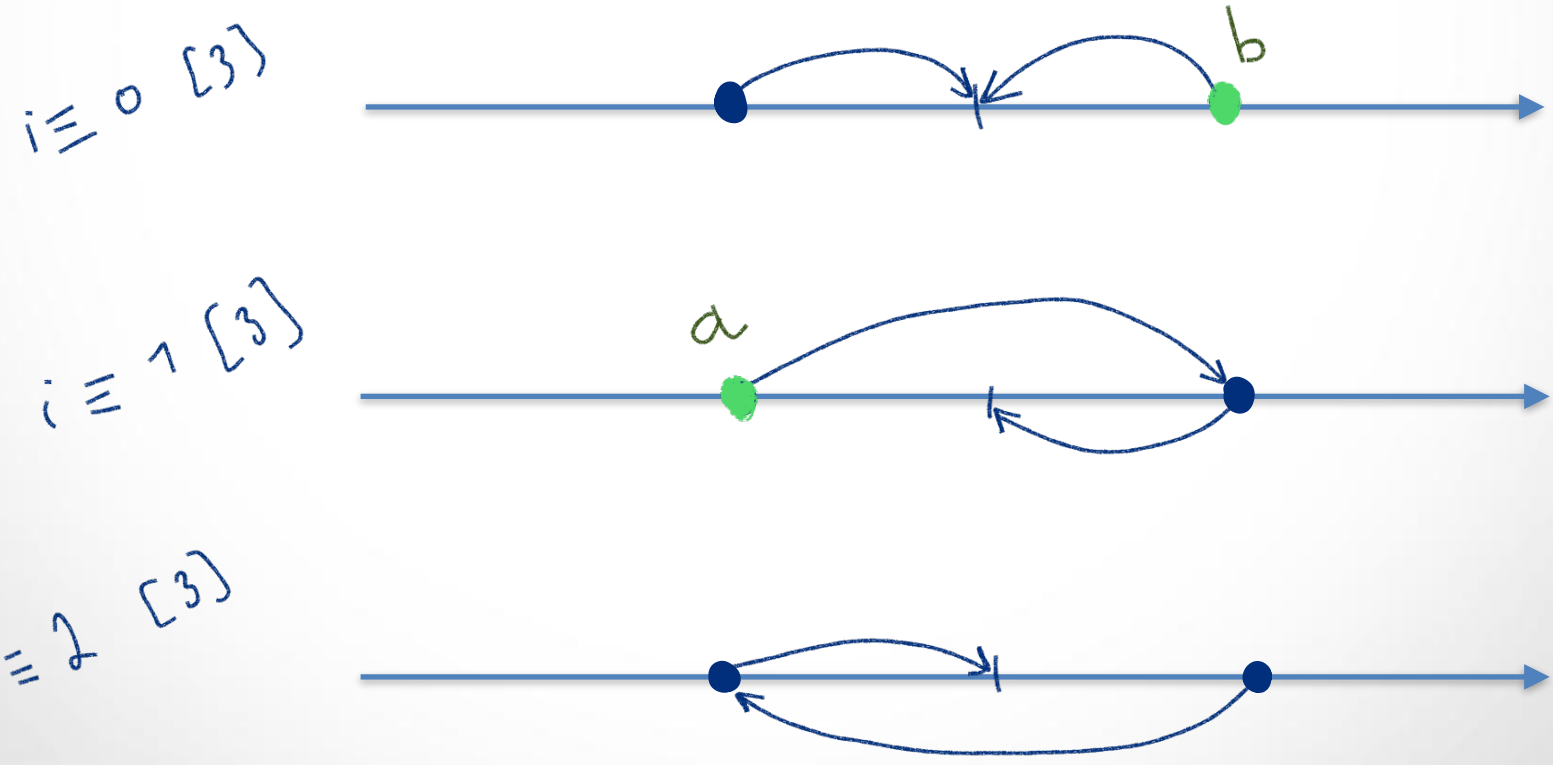

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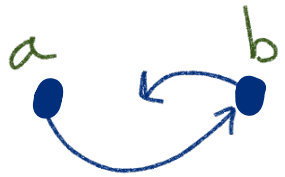

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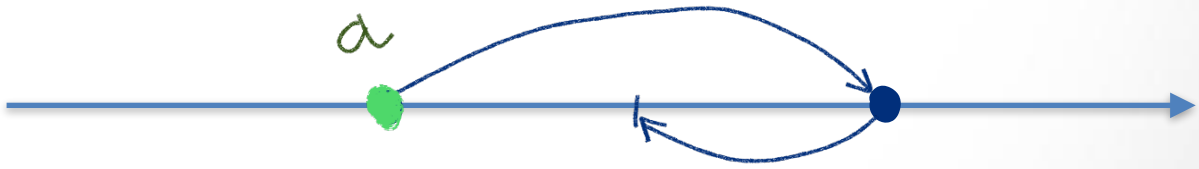

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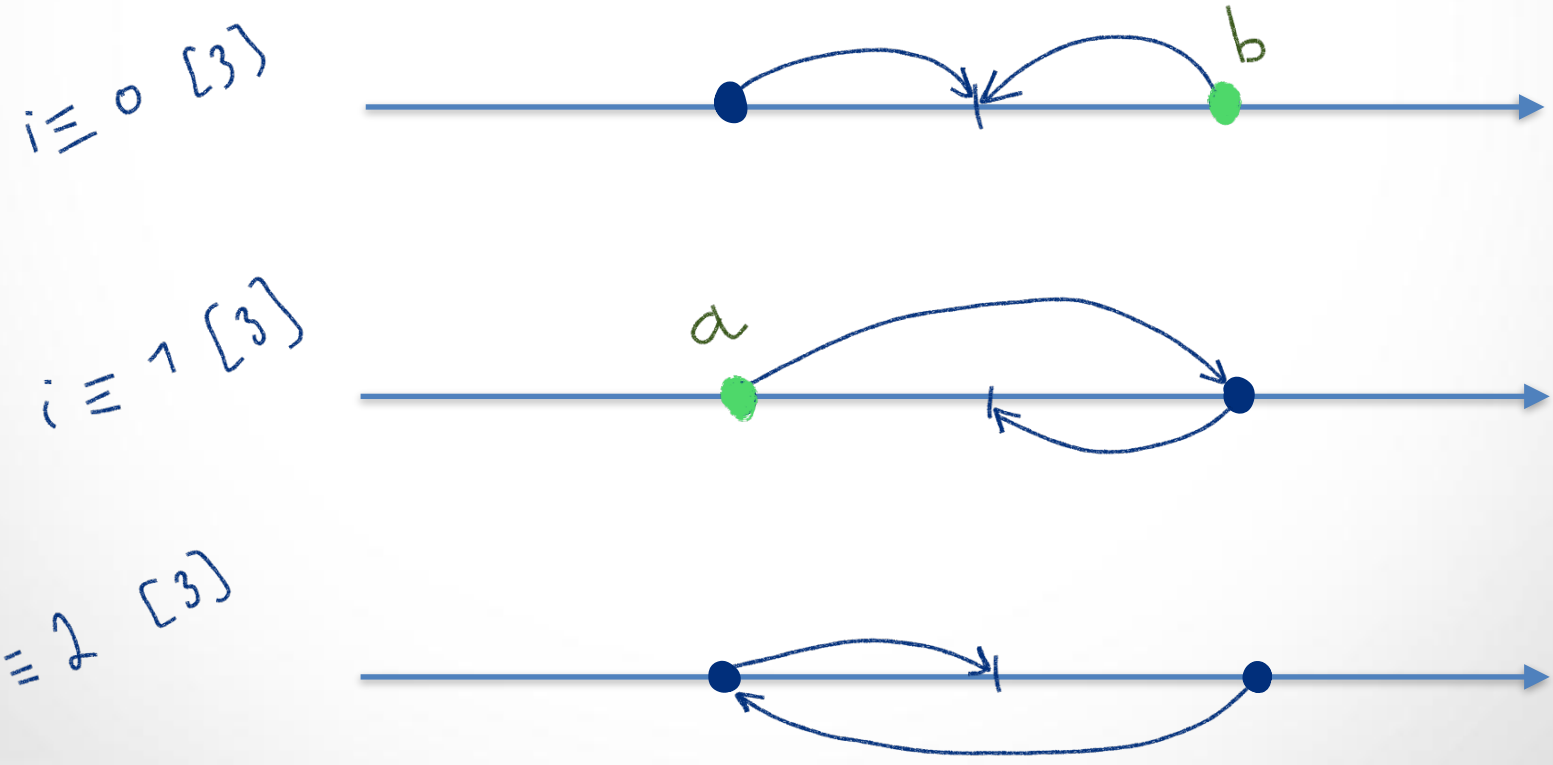

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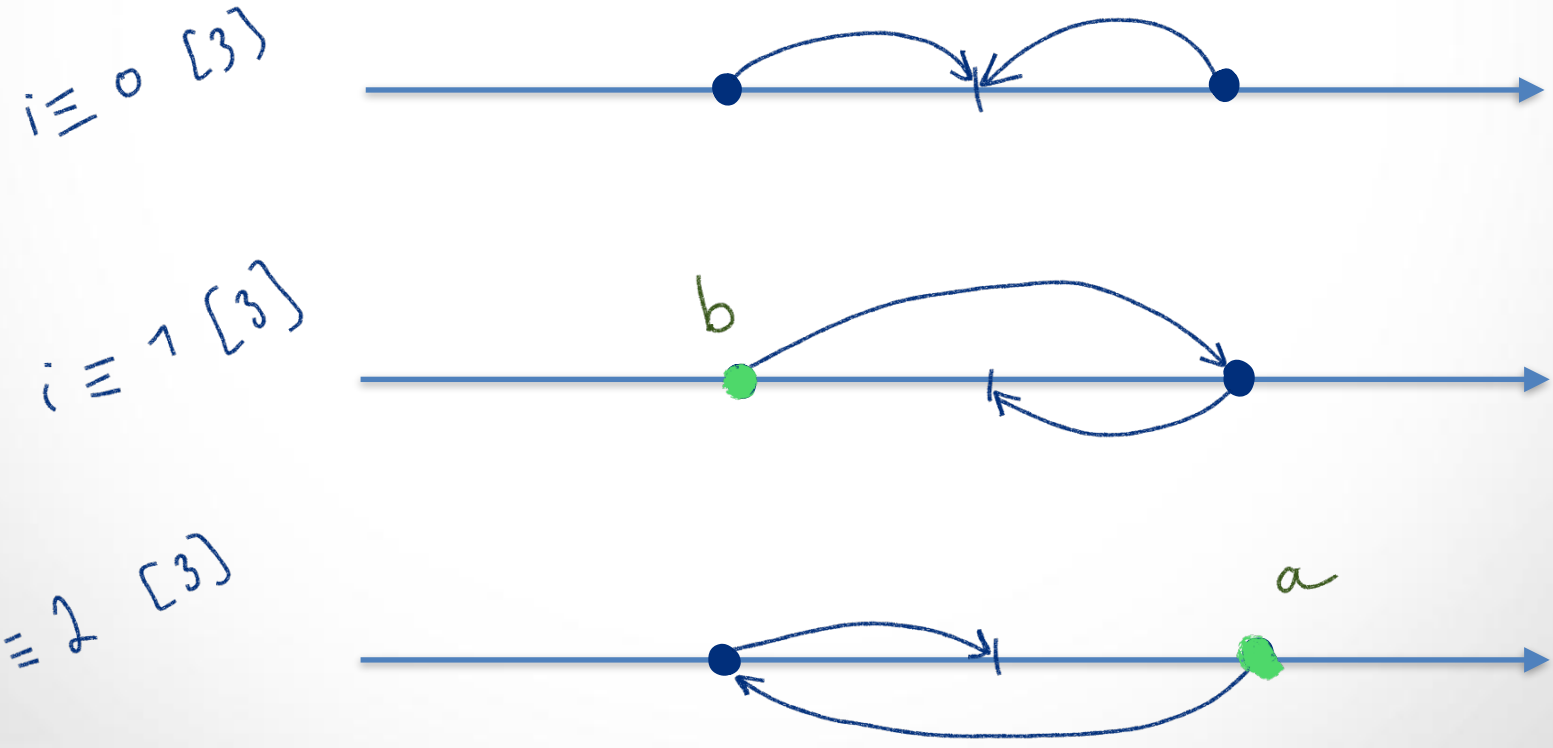

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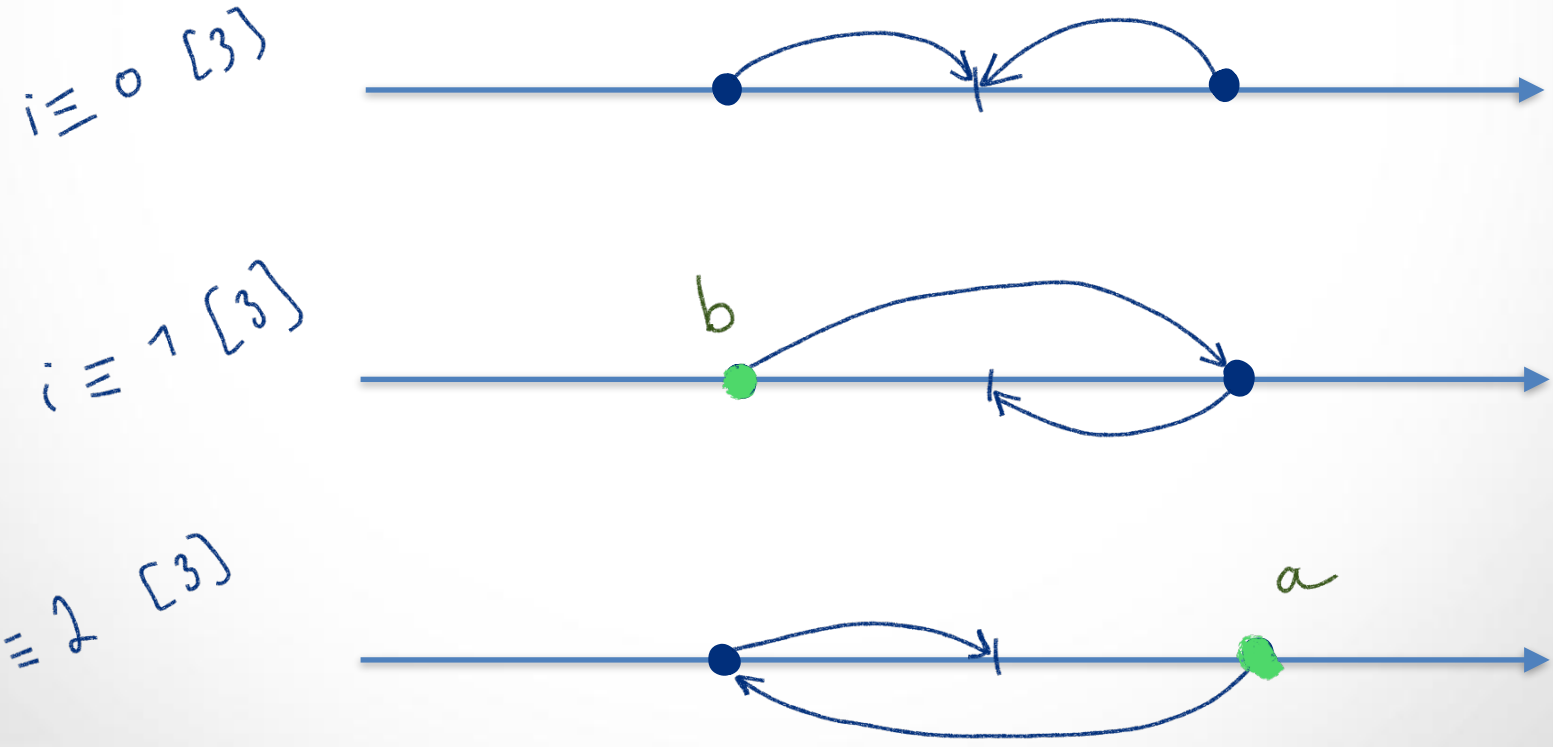

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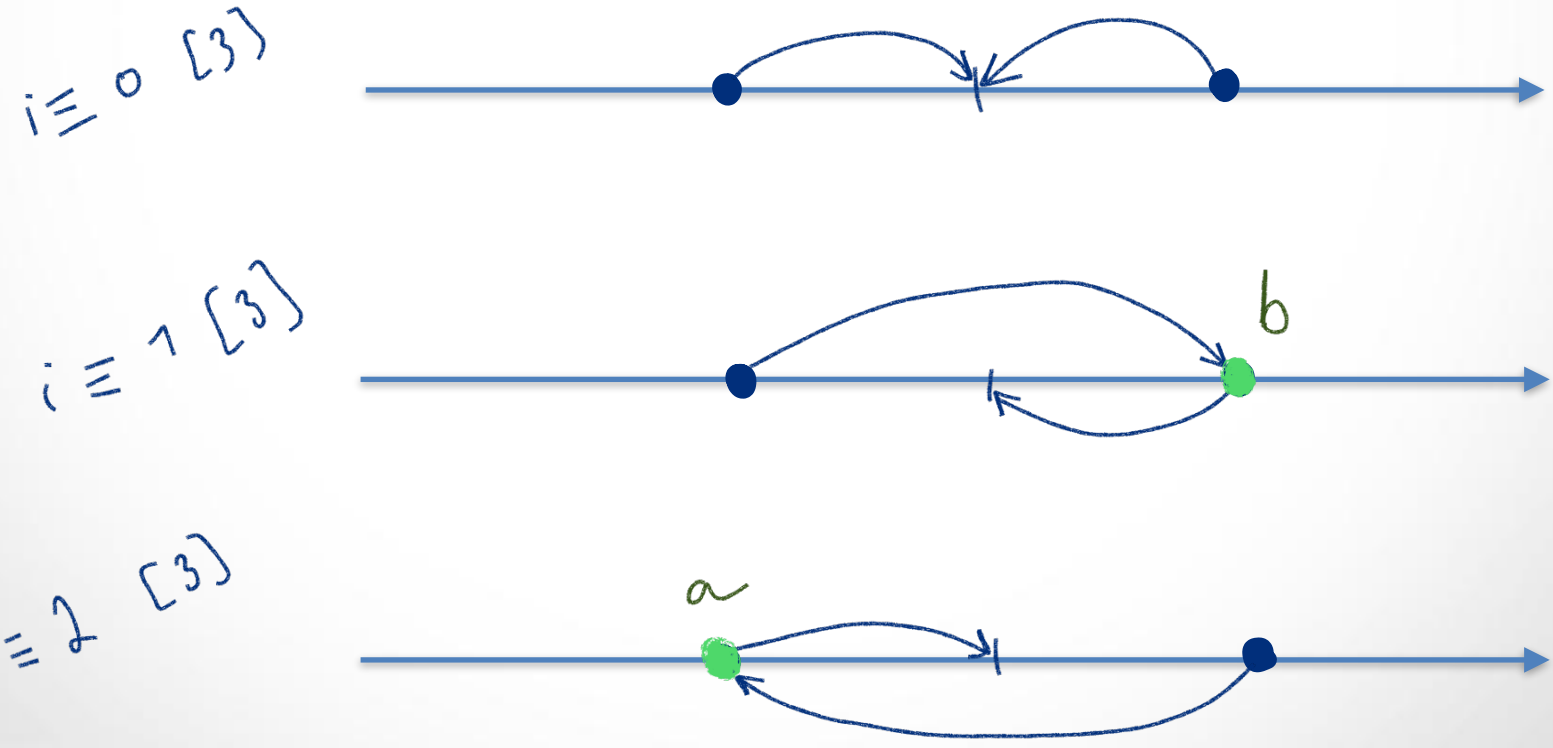

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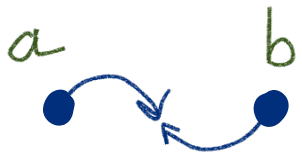

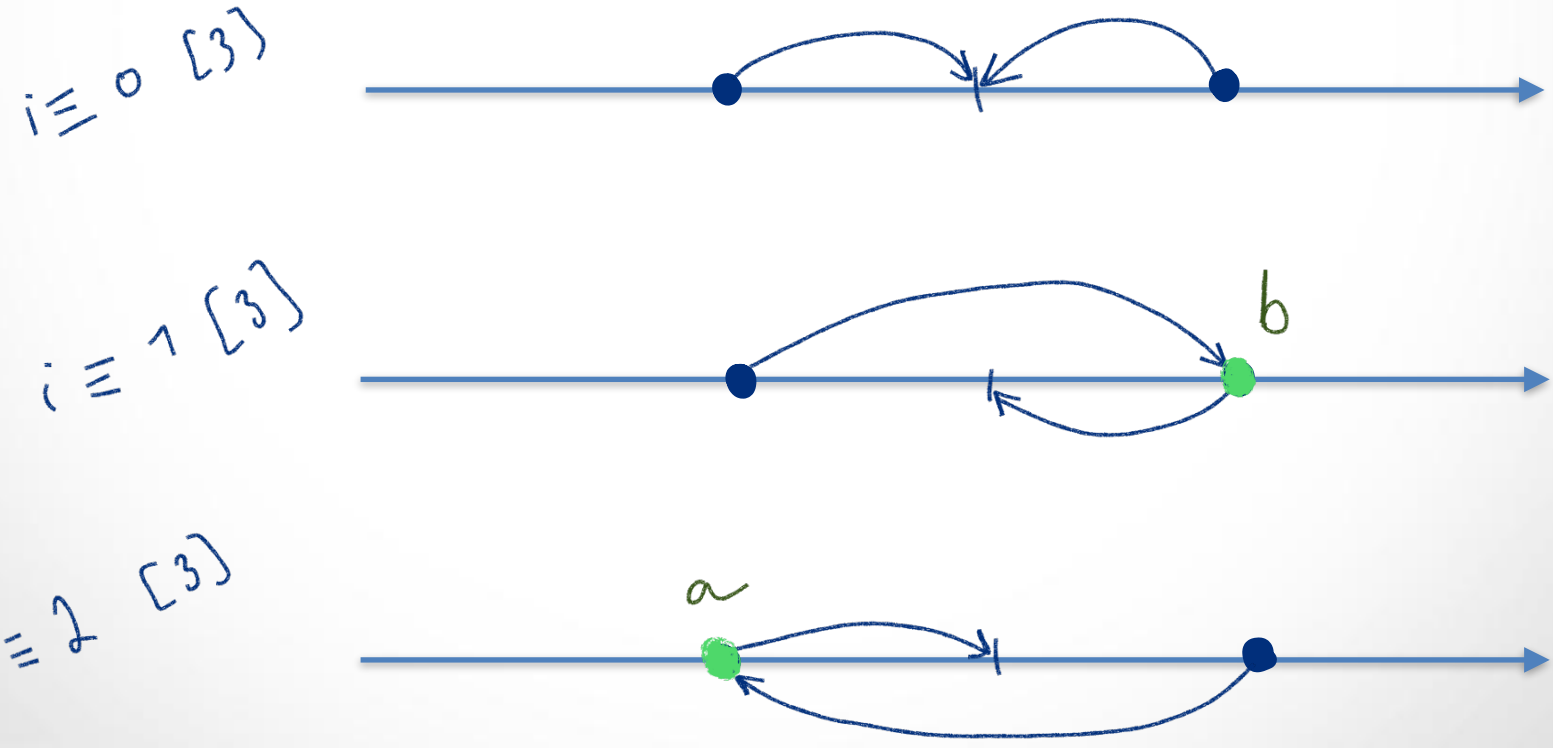

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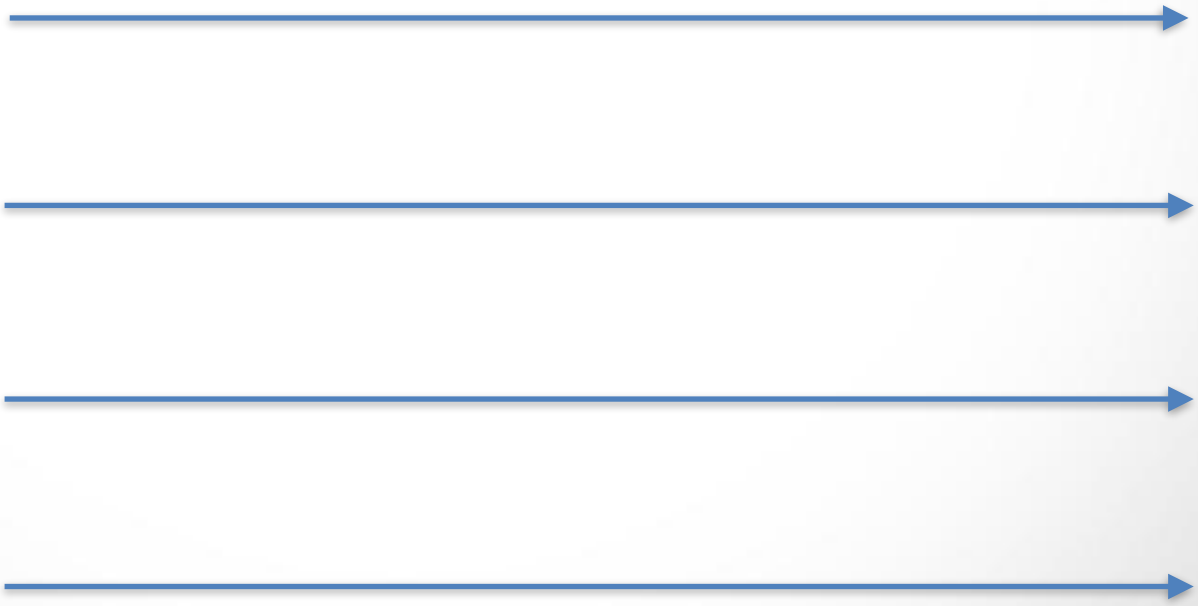

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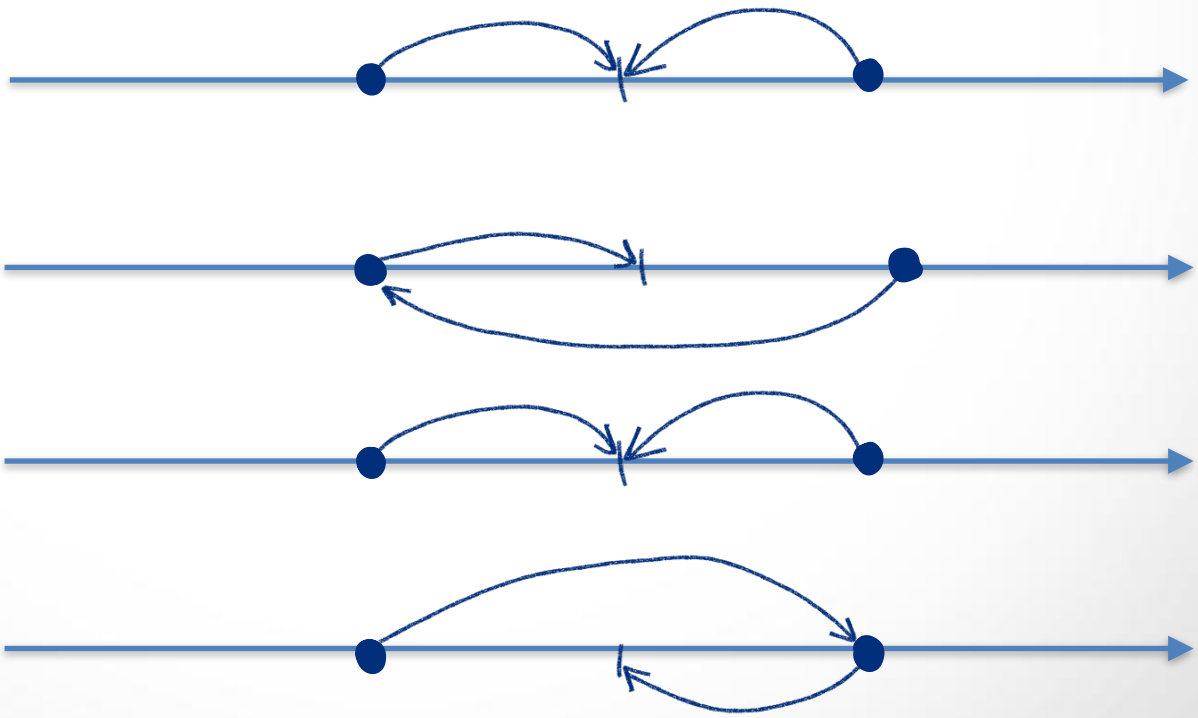

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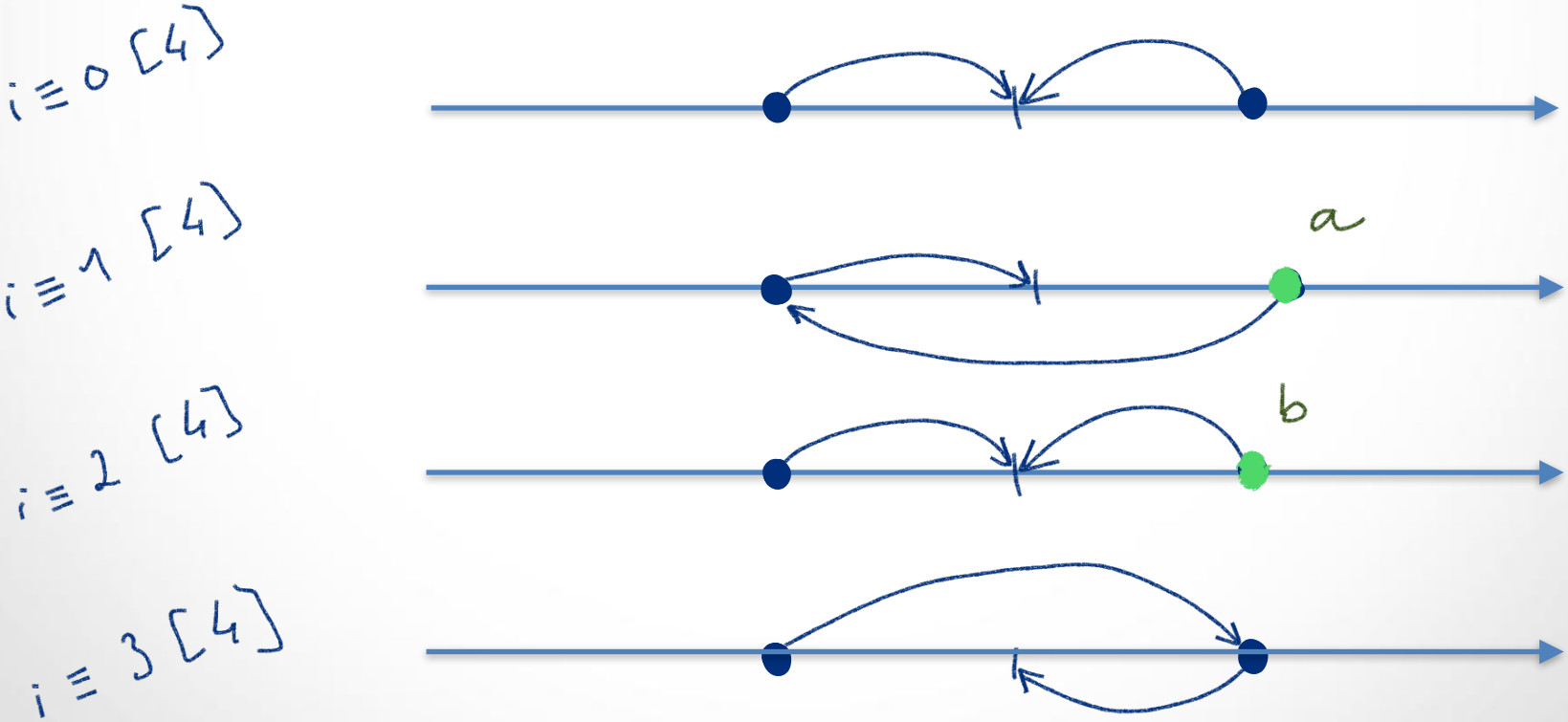

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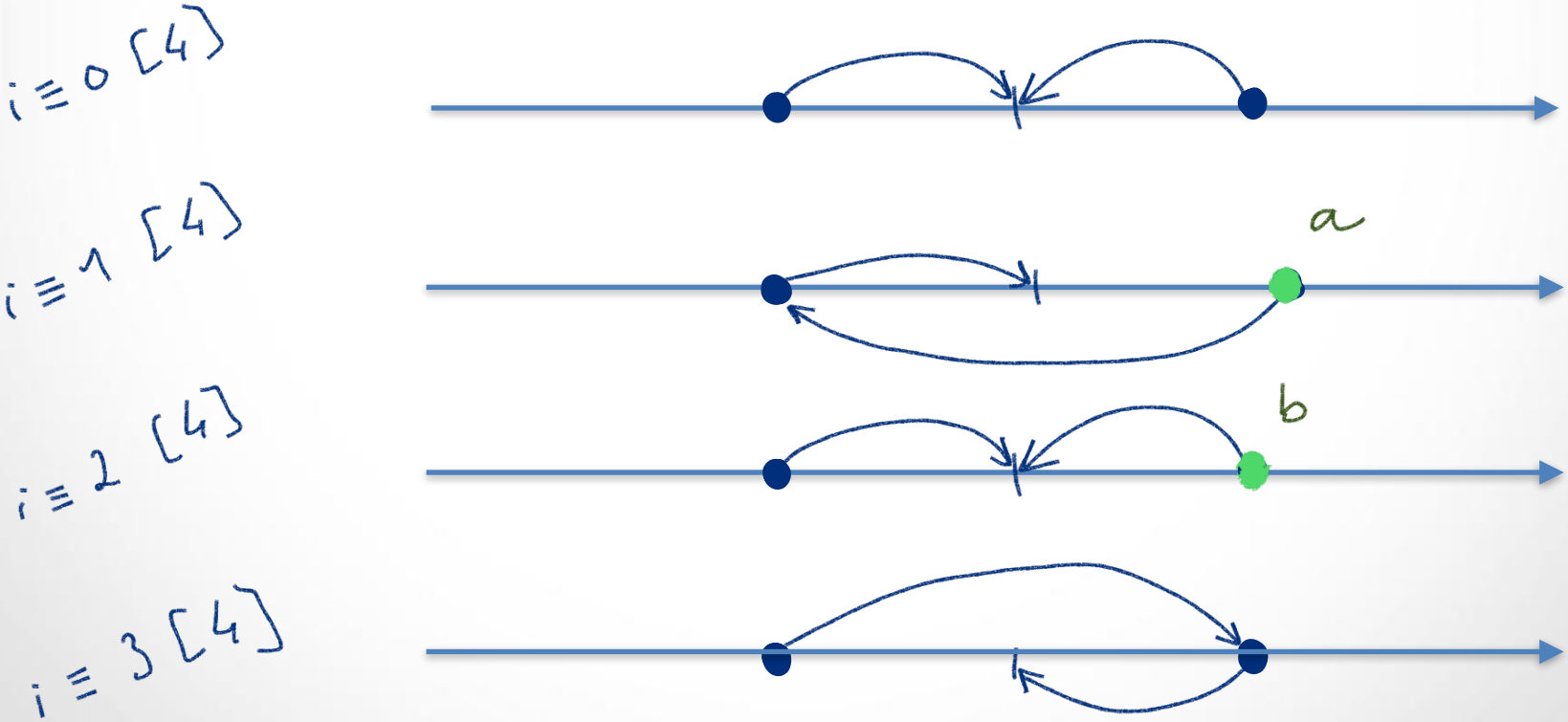

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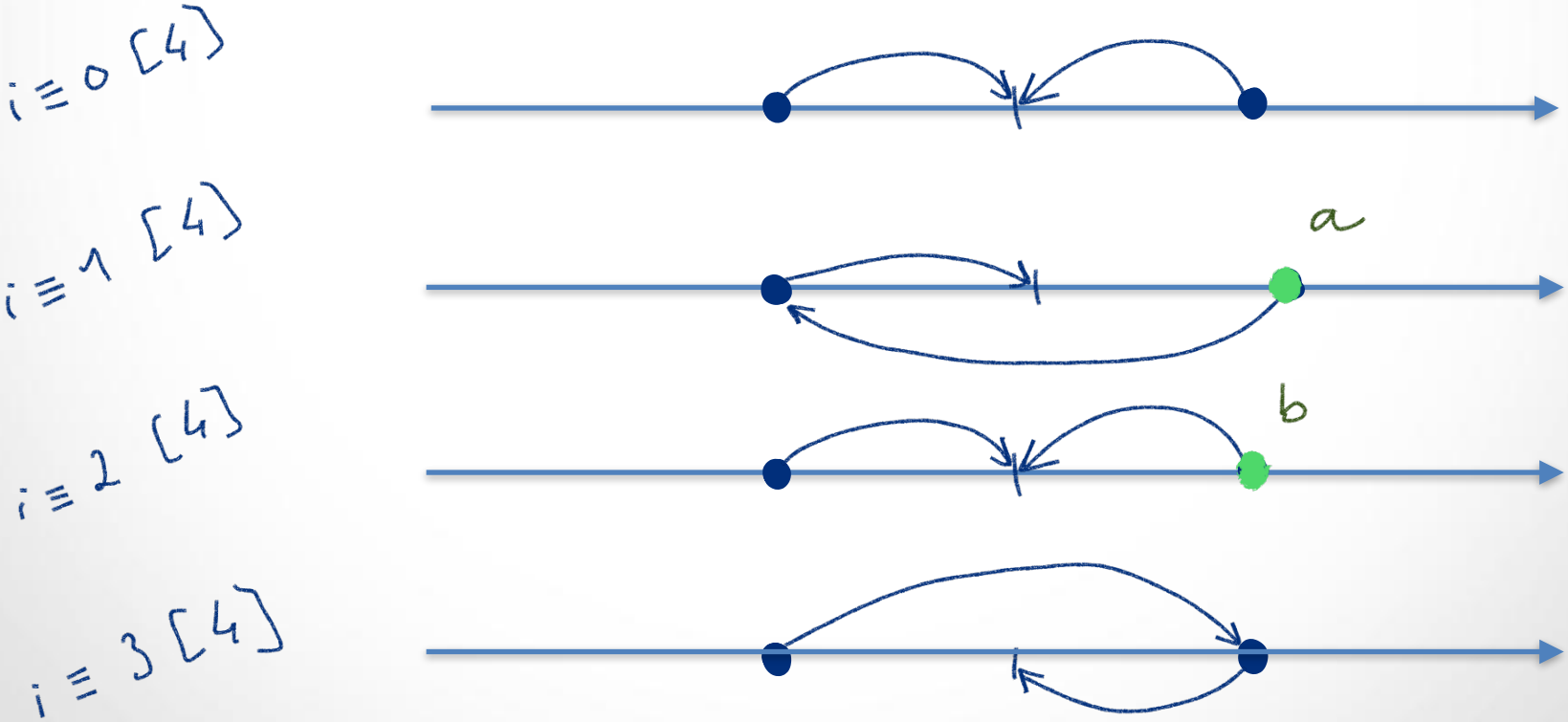

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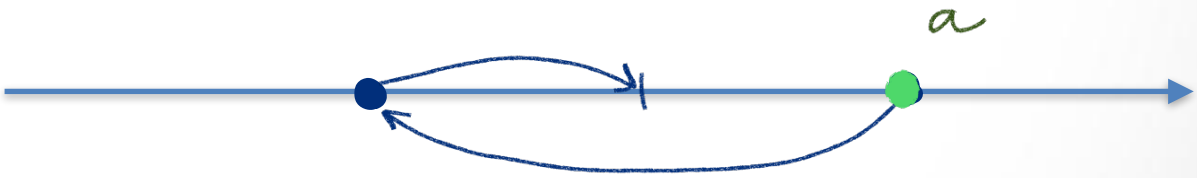

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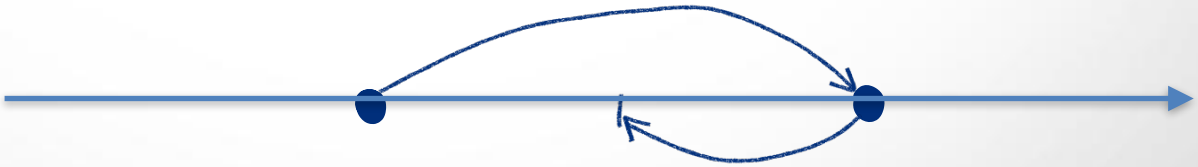

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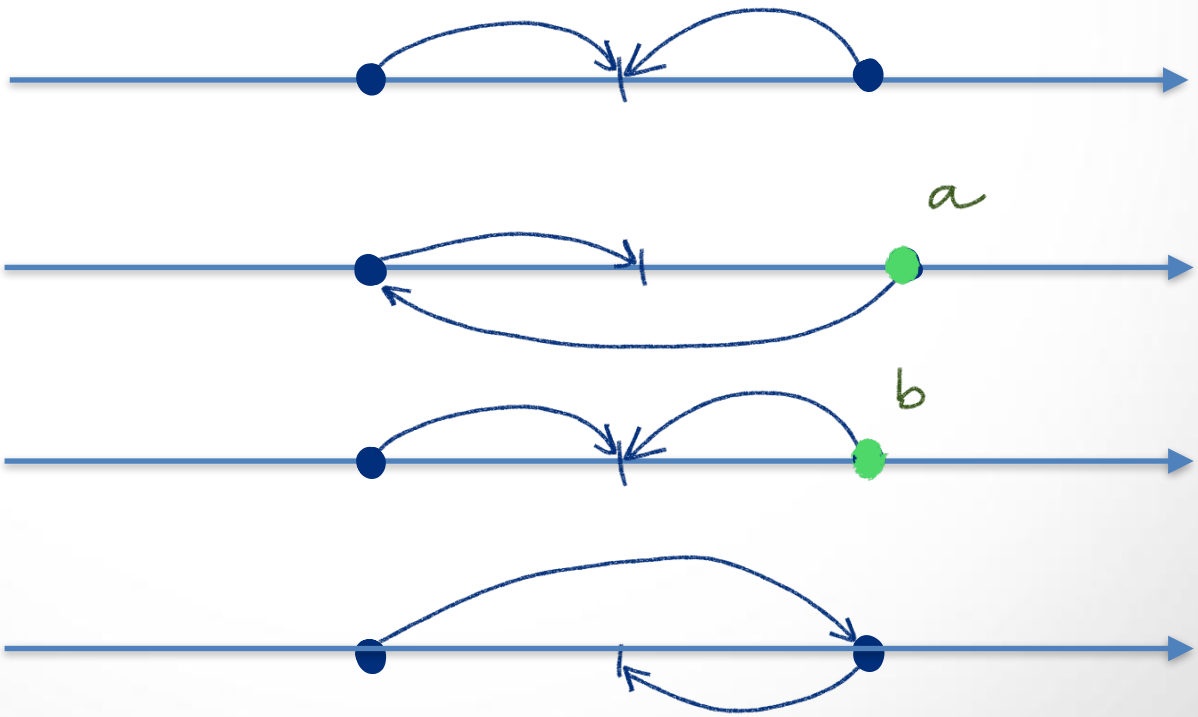

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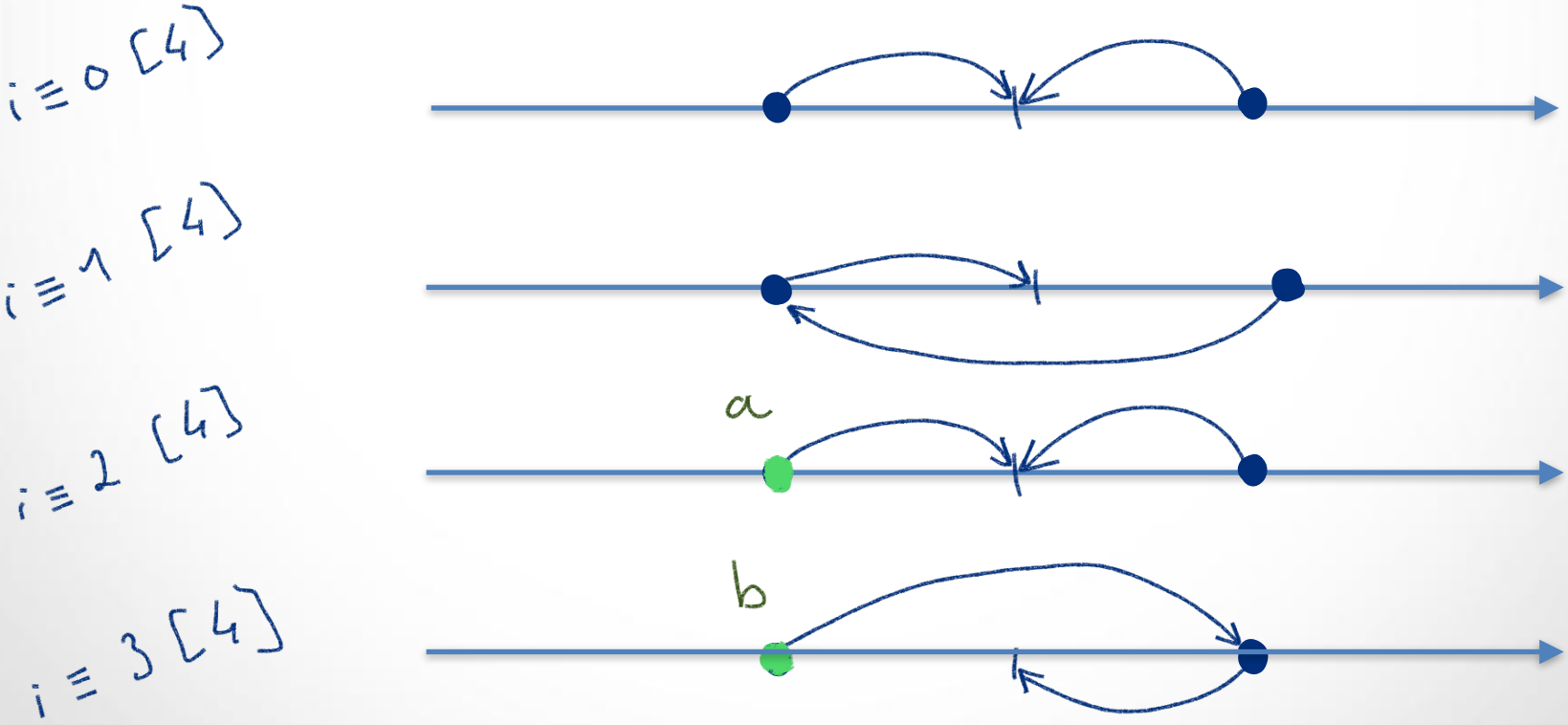

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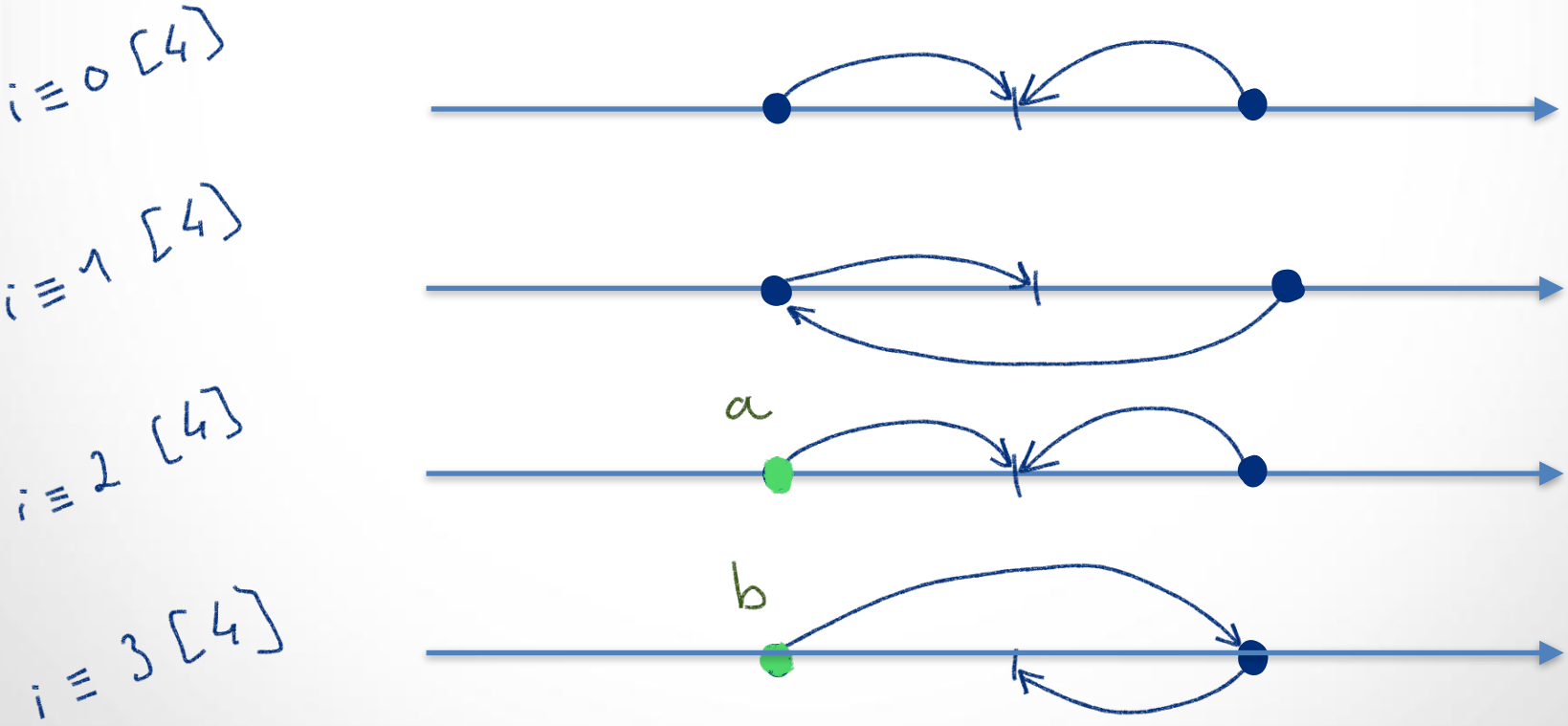

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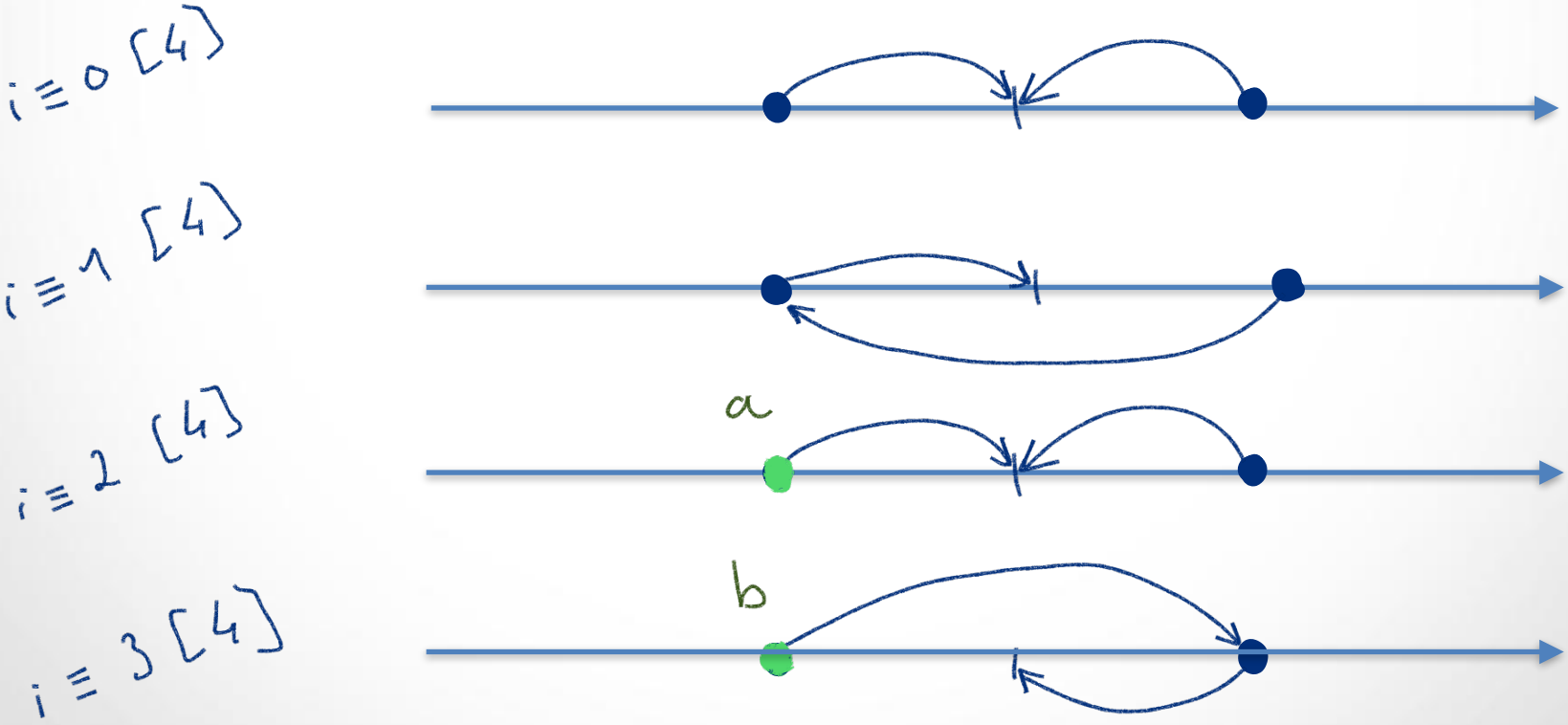

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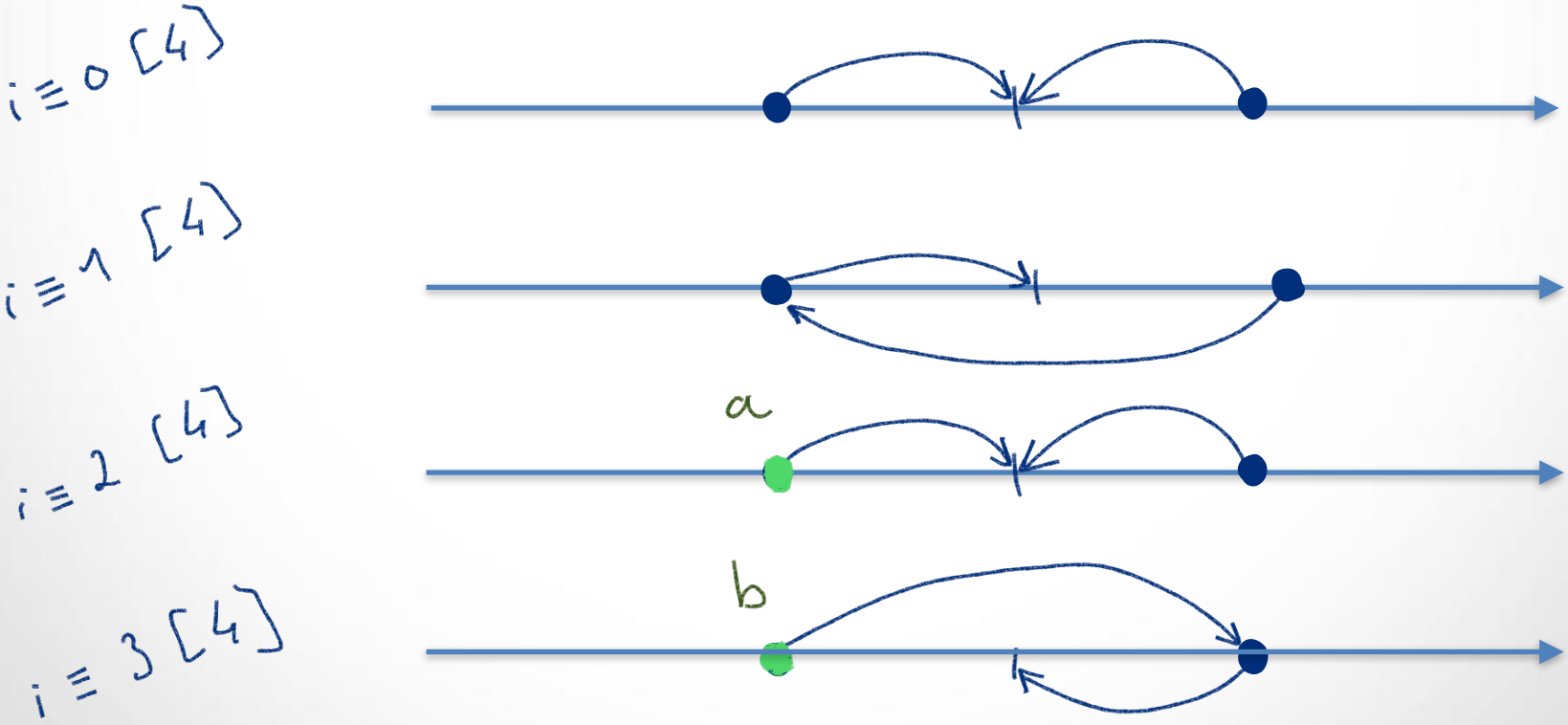

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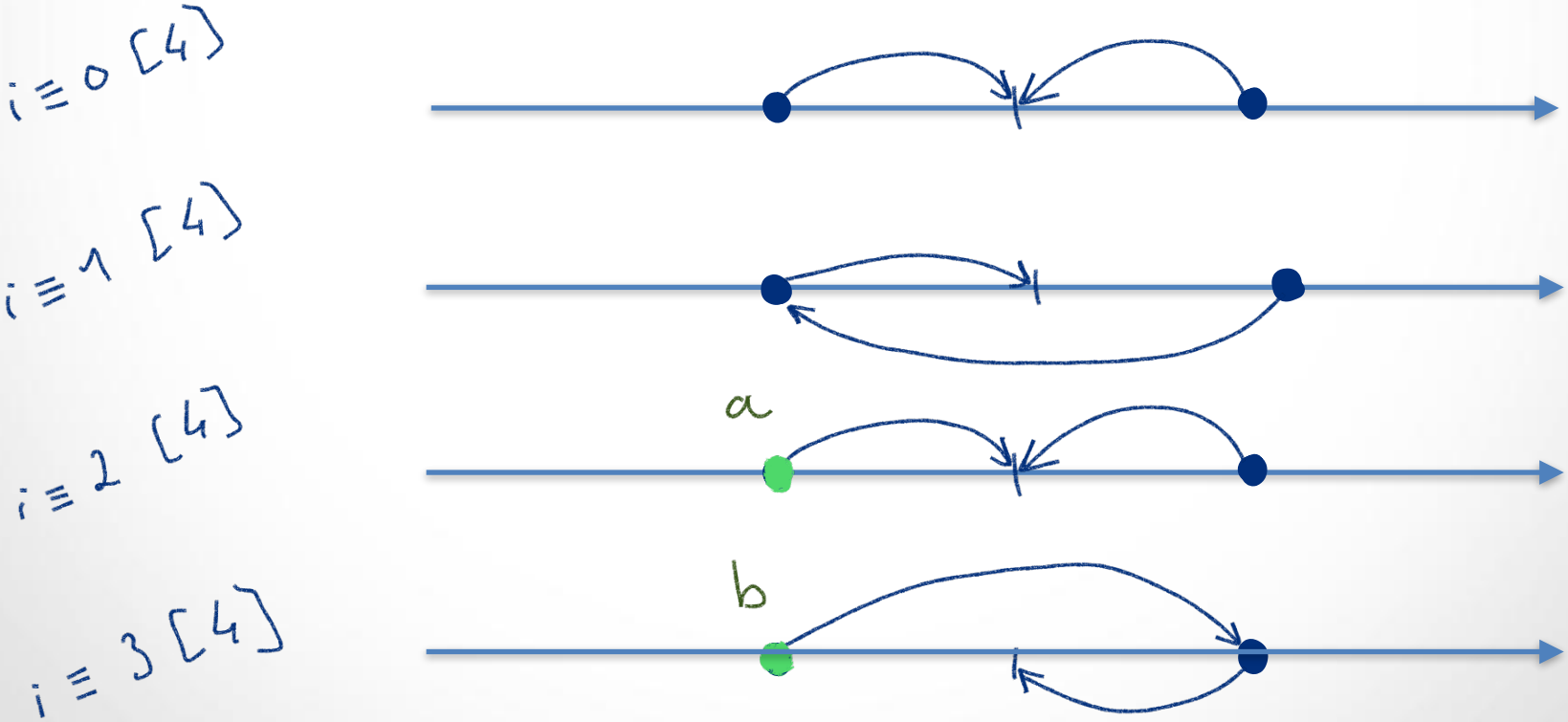

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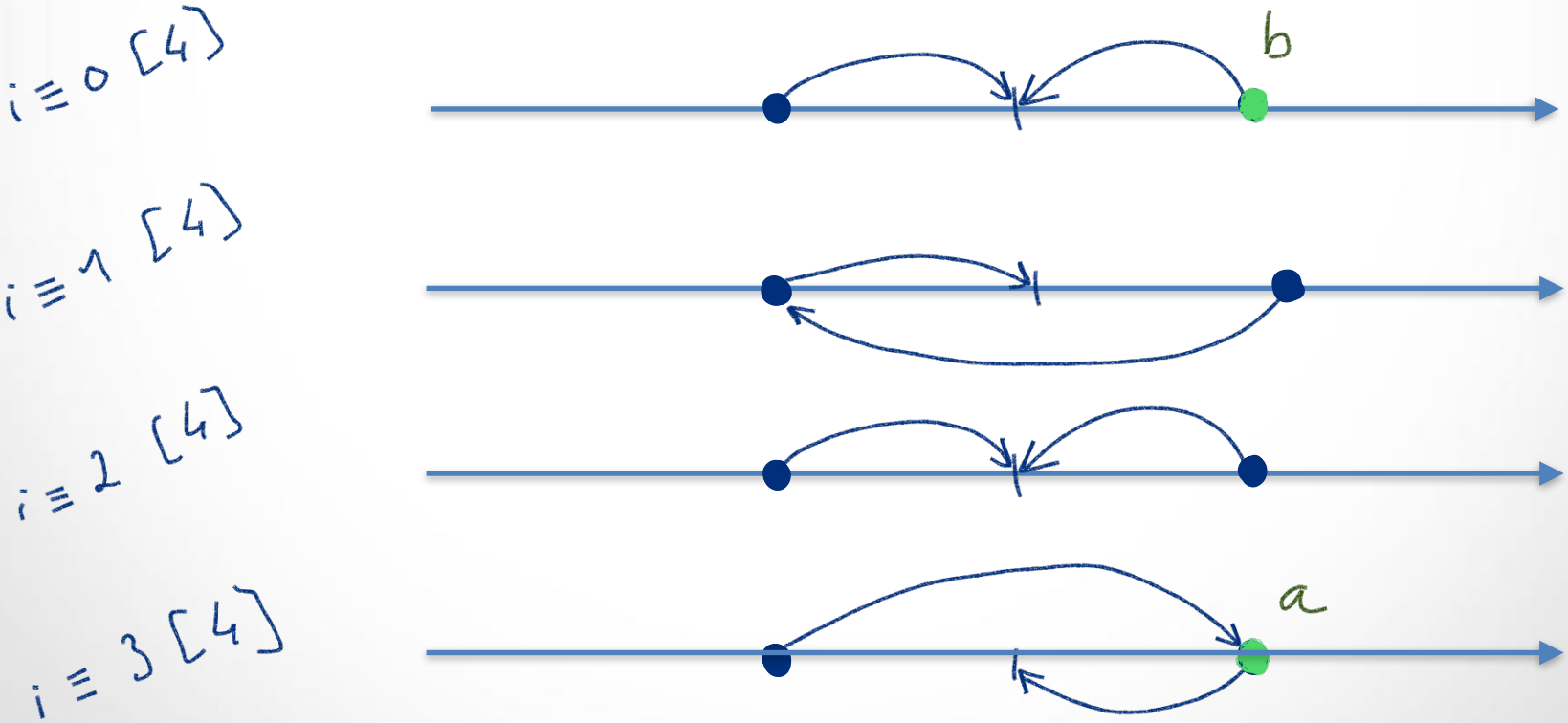

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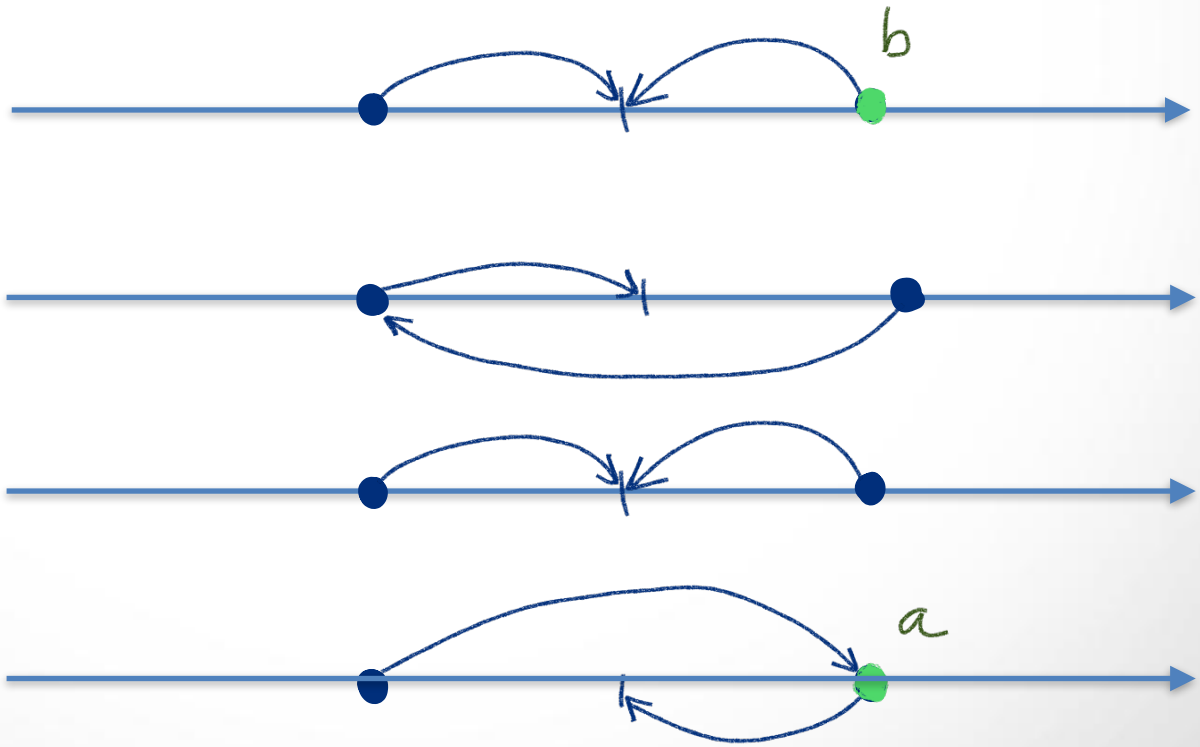

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Thank you for your attention