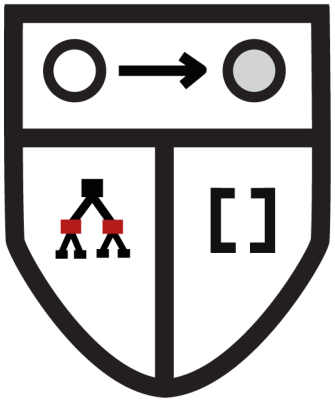


CS 3110

Abstraction Functions and Representation Invariants

Nate Foster

Spring 2019

Today's music: *Never Change* by JAY-Z

Review

Previously in 3110:

- Specifying functions

Today:

- Specifying data abstractions

Back to: Audience of specification

- **Clients**
  - Spec informs what they must guarantee (preconditions)
  - Spec informs what they can assume (postconditions)

- **Implementers**
  - Spec informs what they can assume (preconditions)
  - Spec informs what they must guarantee (postconditions)

But the spec isn't **enough** for implementers...

REPRESENTATION TYPES

Dem
o

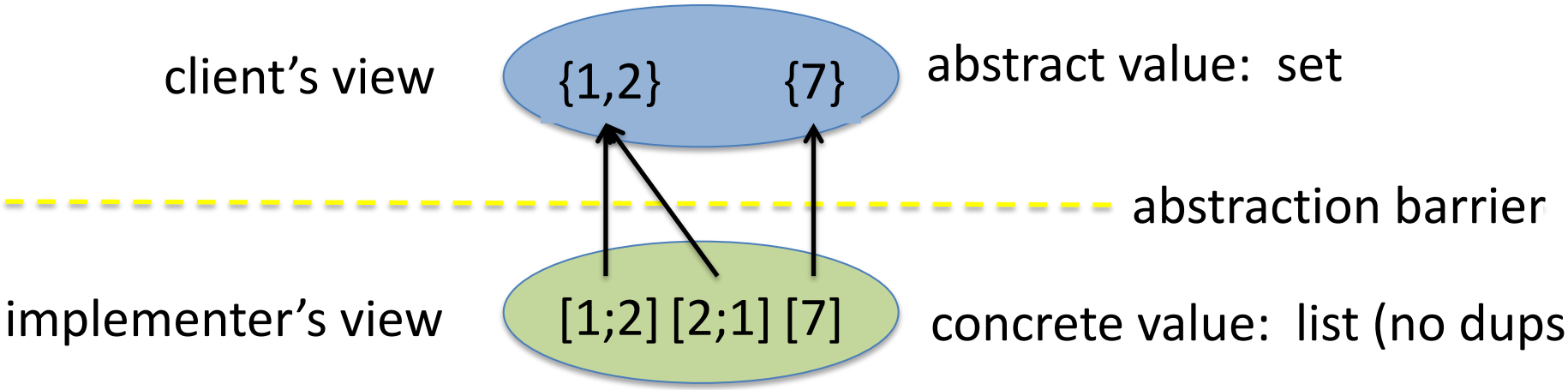
Representation types

- **Q:** How to interpret the representation type as the data abstraction?
- **A:** Abstraction function

- **Q:** How to determine which values of representation type are meaningful?
- **A:** Representation invariant

ABSTRACTION FUNCTIONS

Abstraction function



the black arrows are the abstraction function

Abstraction function

maps

valid concrete values

to

abstract values

Documenting the AF

- Above rep type in implementation you write:

  ```
  (* AF: comment *)
  ```

- Write it first before implementing operations

Demo

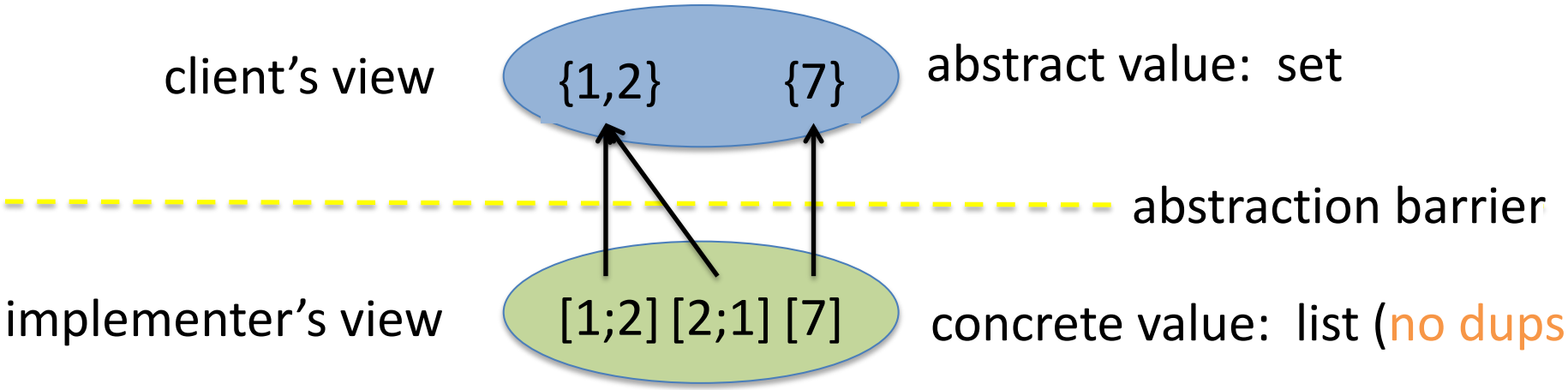
Representation types

- **Q:** How to interpret the representation type as the data abstraction?
- **A:** Abstraction function

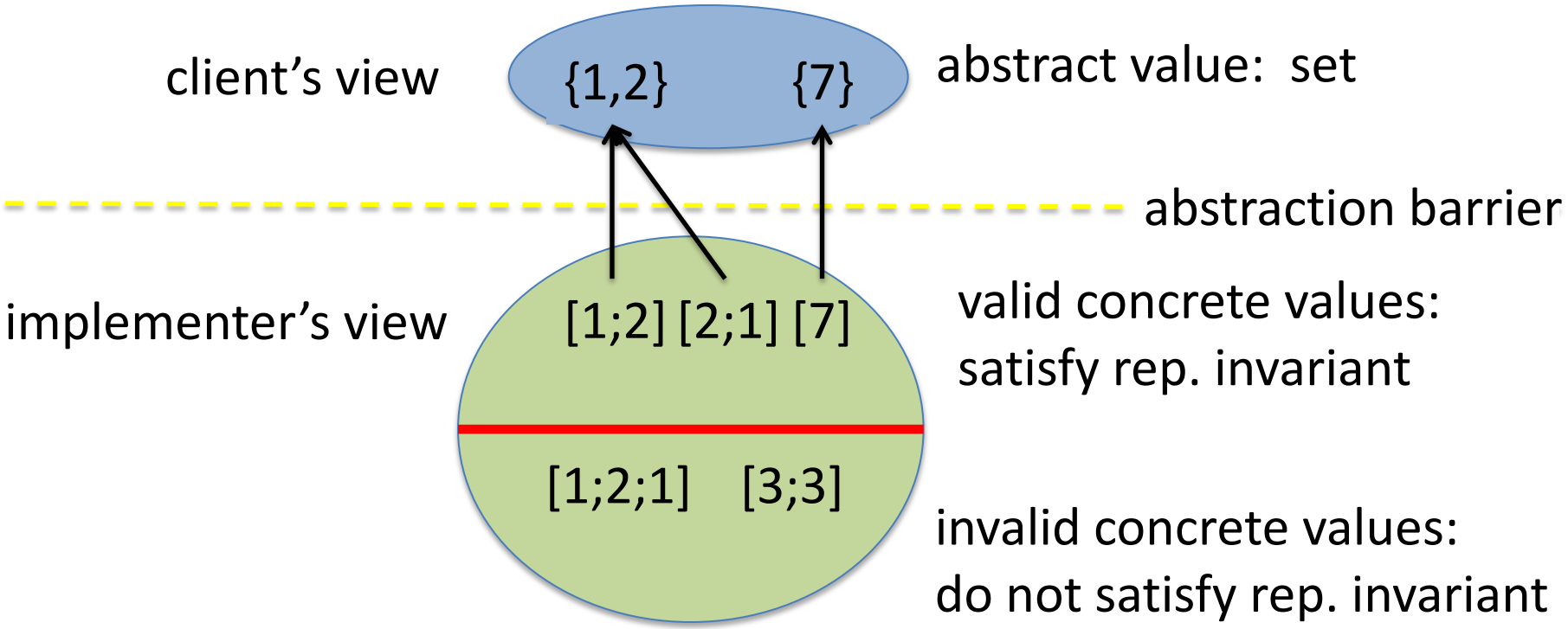
- **Q:** How to determine which values of representation type are meaningful?
- **A:** Representation invariant

REPRESENTATION INVARIANTS

Abstraction function



Representation invariant



the thick red line is the rep. invariant

Rep. invariant

distinguishes

valid concrete values

from

invalid concrete values

Documenting the RI

- Above rep type in implementation you write:

  ```
  (* RI: comment *)
  ```

- Write it first before implementing operations

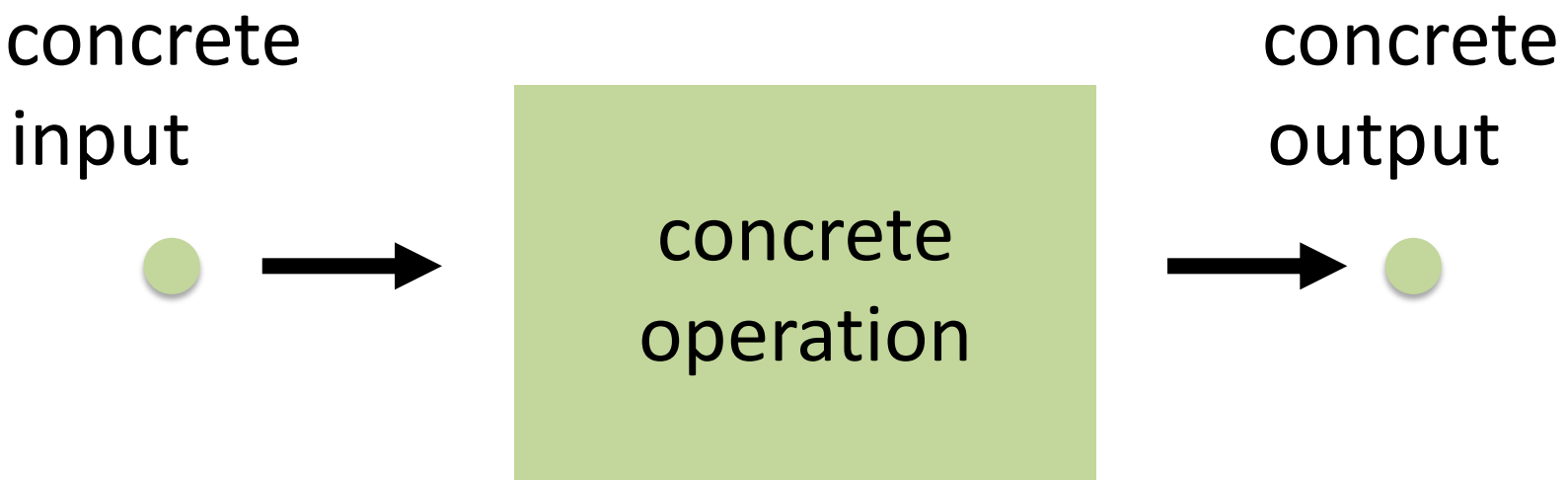
Demo

Rep. invariant

implicitly part of
every precondition and
every postcondition
in abstraction

Dem
o

Invariant may temporarily be violated



Dem
o

Discussion

When and how would you implement a RI as part of a data abstraction?

Implementing the RI

Idiom: if RI fails then raise exception, otherwise return concrete value

Dem
o

Recap

- **Q:** How to interpret the representation type as the data abstraction?
- **A:** Abstraction function

- **Q:** How to determine which values of representation type are meaningful?
- **A:** Representation invariant

Upcoming events

- [Today] Foster Office Hours 1:15-2:15pm

This is invariant.

THIS IS 3110