

Precondition violation: client's fault

Assertions

```
double sqrt(double x) {  
    assert x >= 0;  
    :  
}
```

assert catches mistakes earlier

Stop program if
assertion is false.
and -ea option
is used
(debug configuration)

Interfaces

interface = how module interacts w/ client code

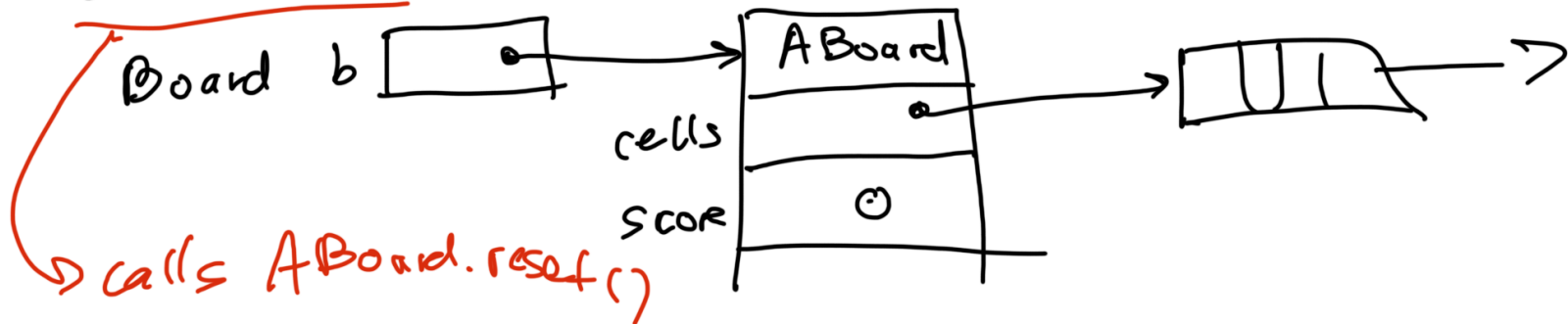
Java interface = language feature for making interfaces to classes.

= names & signatures (& specs)
of public methods of class

static
type

```
Board b = new ABoard();  
b.reset();
```

dynamic
type



Abstraction barrier $\Rightarrow$ client can't tell (easily) which implementation it is!

EX/

```
void display (Board b) {  
    :  
    b.value(r, c);  
    :  
}
```

calls ABoard.value if b is an ABoard,
TBoard.value if TBoard.

Subtyping

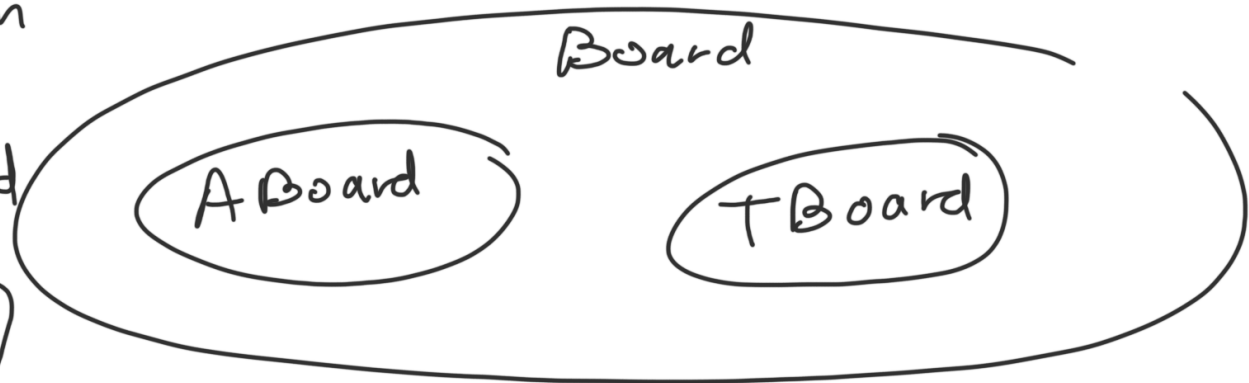
ABoard can be used whenever Board is expected.

TBoard "

Venn Diagram

ABoard <: Board

"is a subtype of"



<: means $\subseteq$

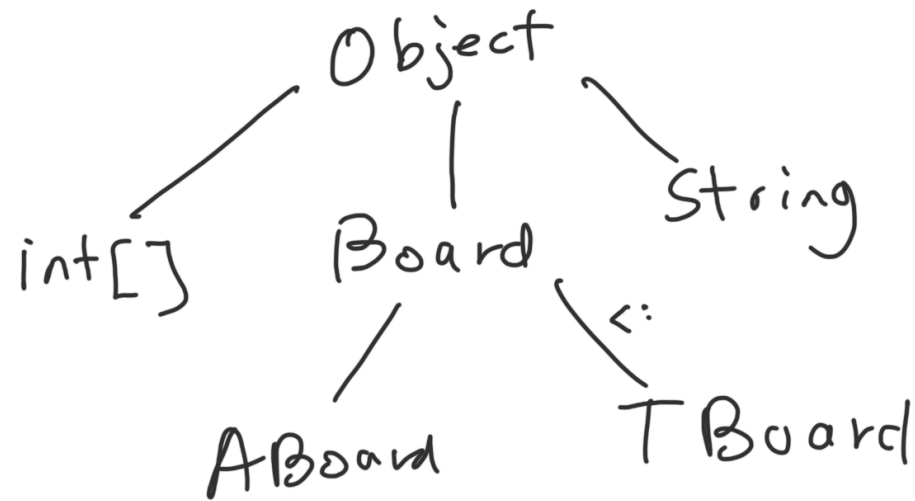
Java: "class C implements I" = $C <: I$

"interface I₁ extends I₂" = $I_1 <: I_2$

"C₁ extends C₂" = $C_1 <: C_2$

dynamic type
subtype of static type

Subtype hierarchy



int boolean

Casts

upcast: subtype $\rightarrow$ supertype

(Board) new ABoard();
static type: Board

— must succeed. — safe

downcast supertype $\rightarrow$ subtype

— may fail with exception

— danger sign

instanceof : dynamic check