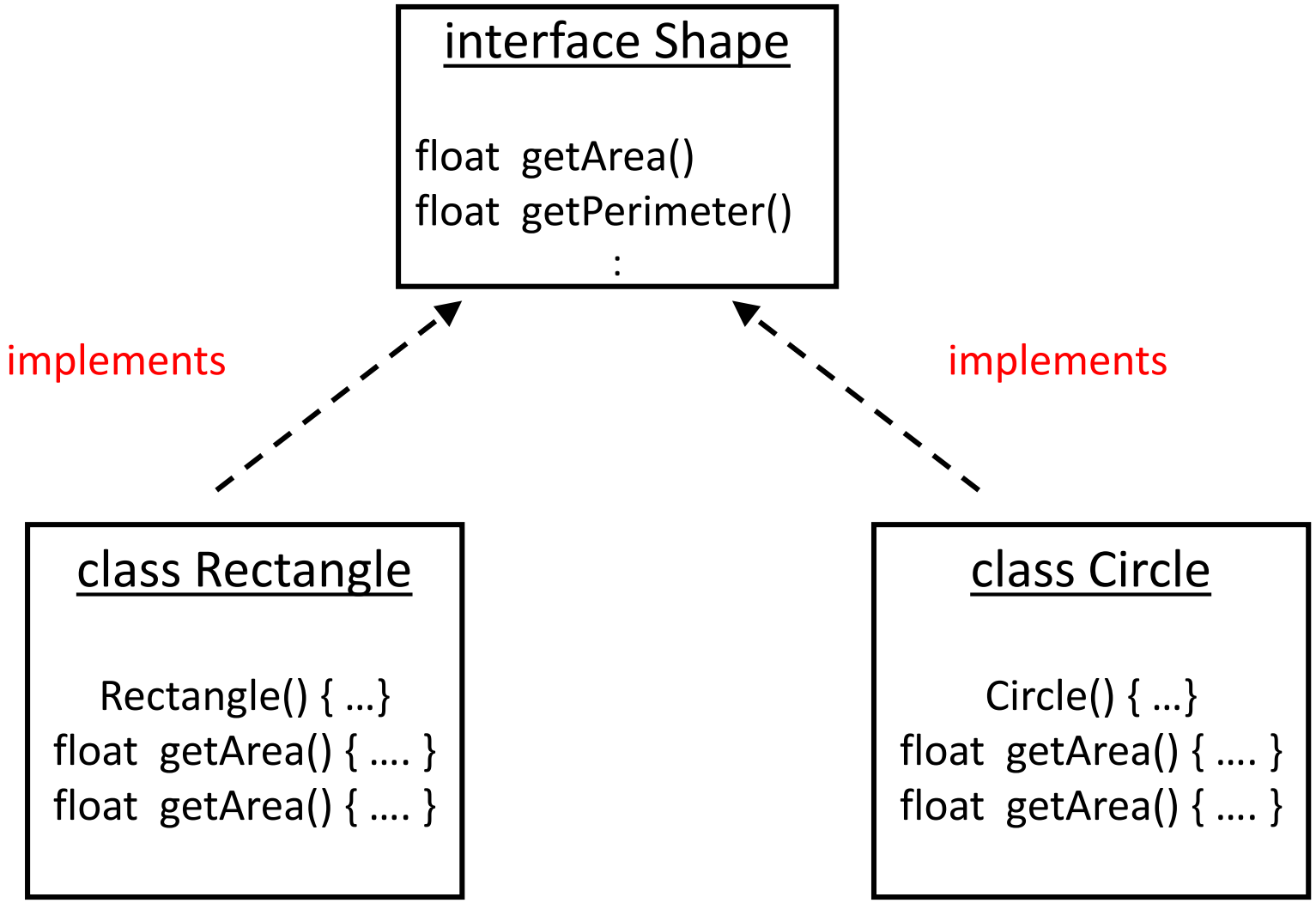
COMP 250

Lecture 31

abstract classes, type conversion

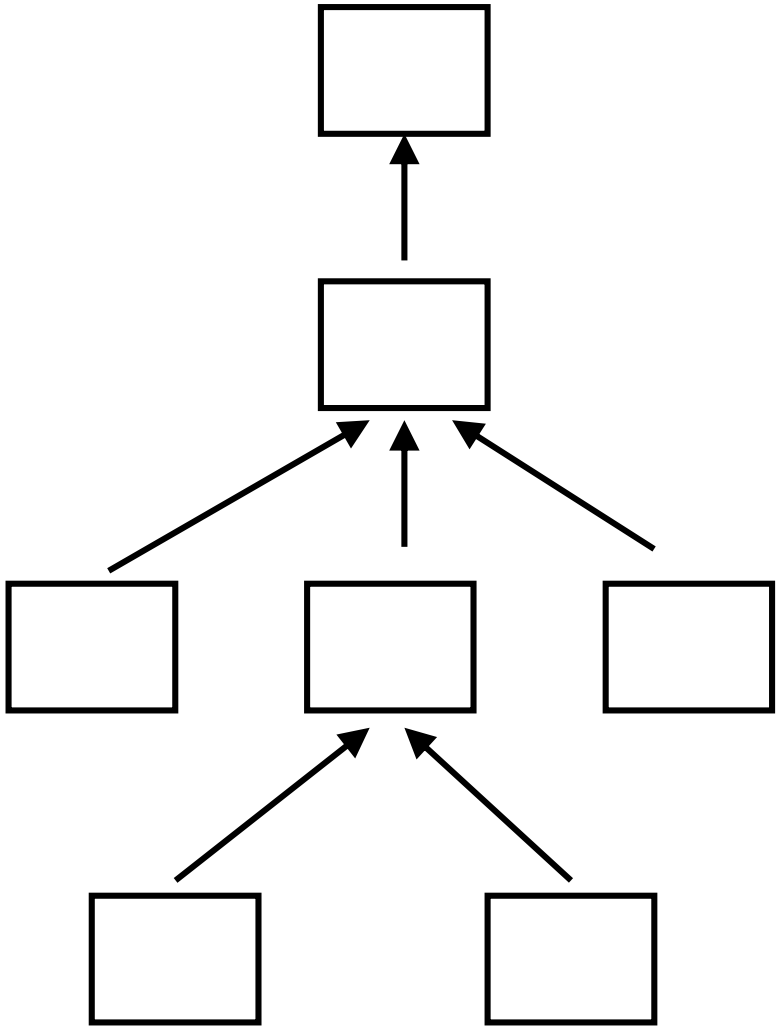
Nov. 23, 2016

RECALL: interfaces

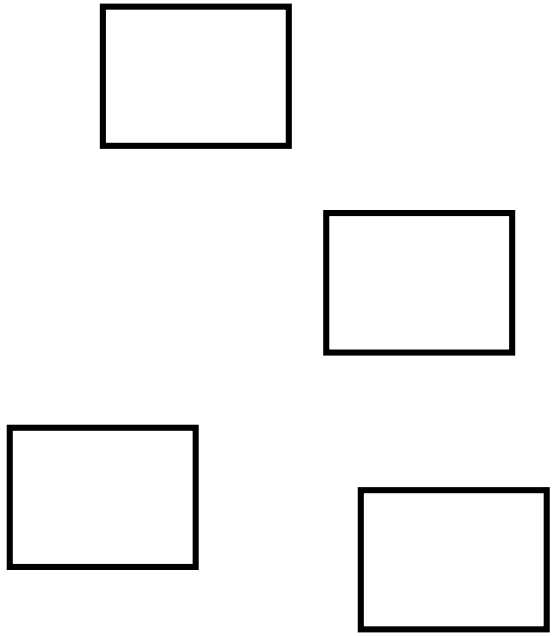


classes

(tree, parent links only)



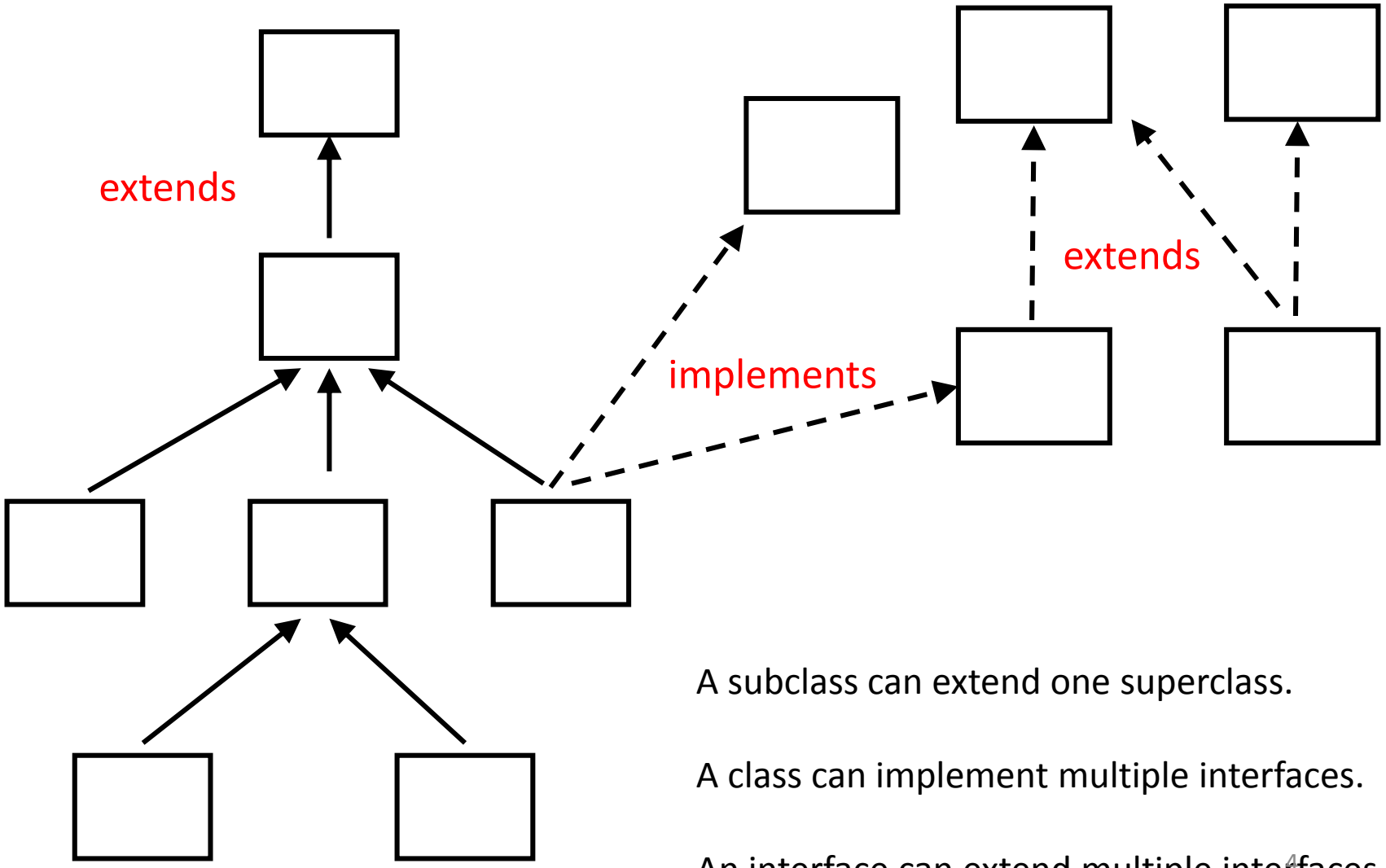
interfaces



classes

(tree, parent links only)

interfaces



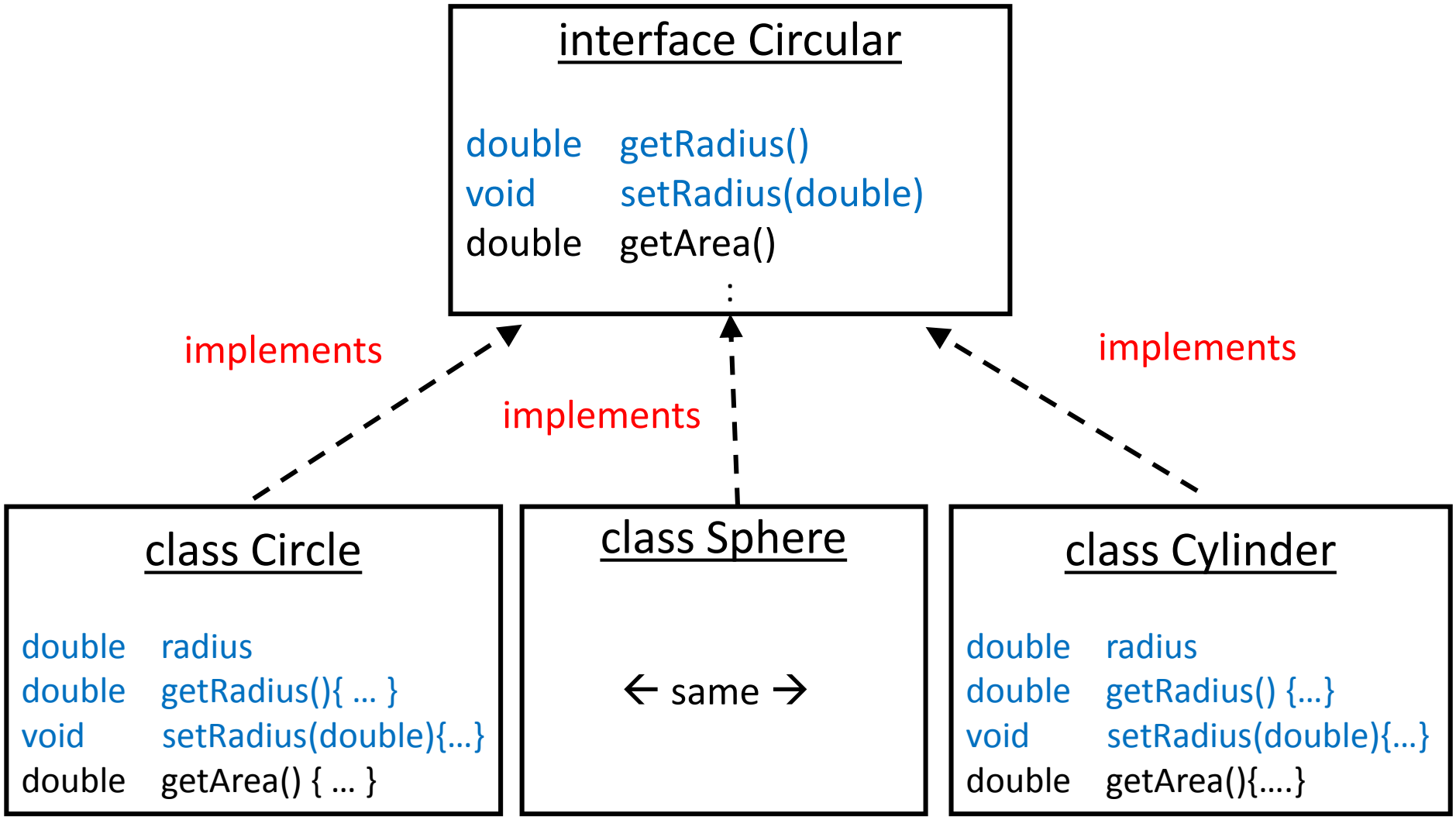
A subclass can extend one superclass.

A class can implement multiple interfaces.

An interface can extend multiple interfaces.

Example: Circular

Circle Sphere Cylinder

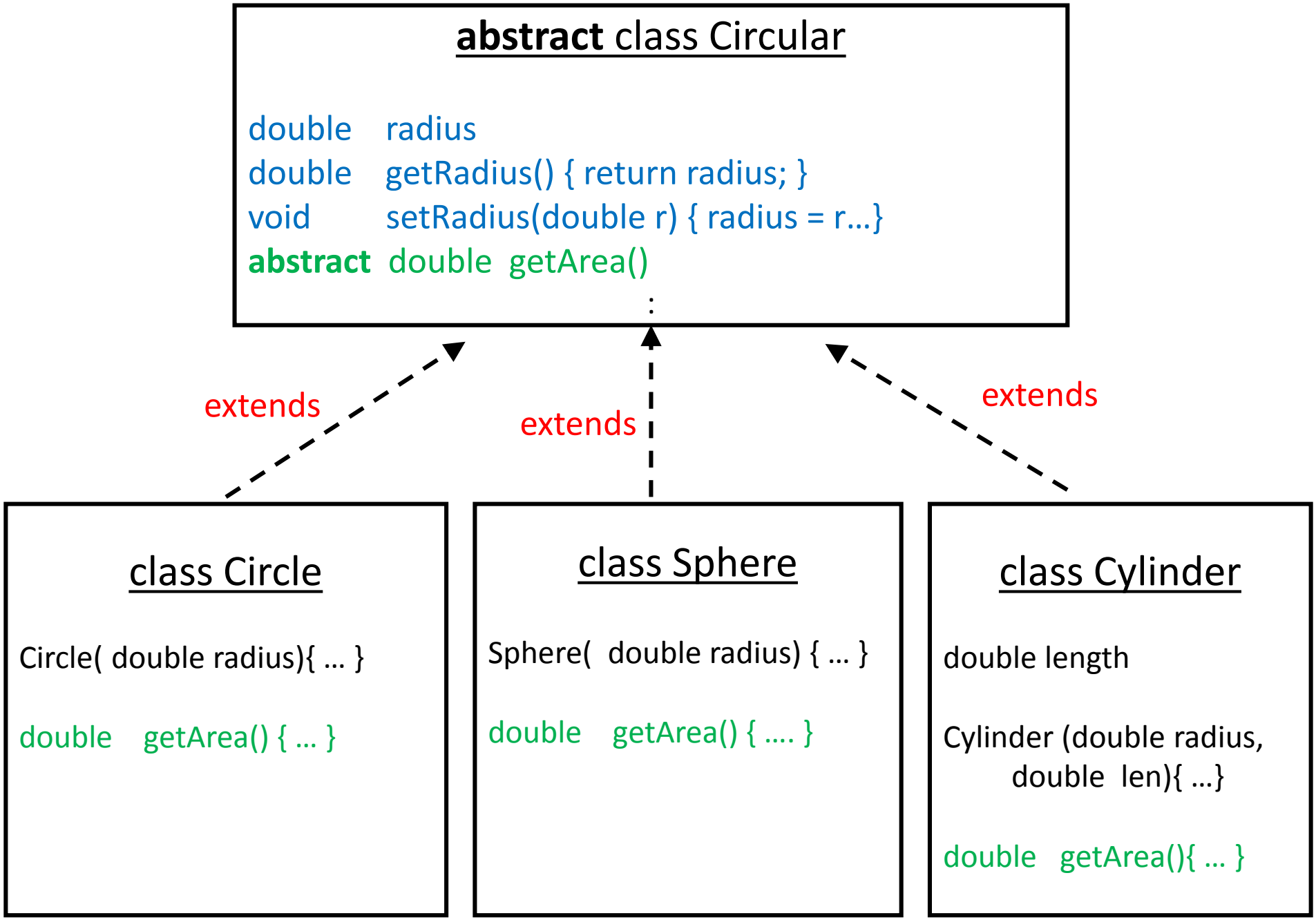


Can we avoid repeating these method definitions?

Abstract Class

- Like a class, it can have fields and methods with bodies

- Like an interface, it can have methods with only signatures.

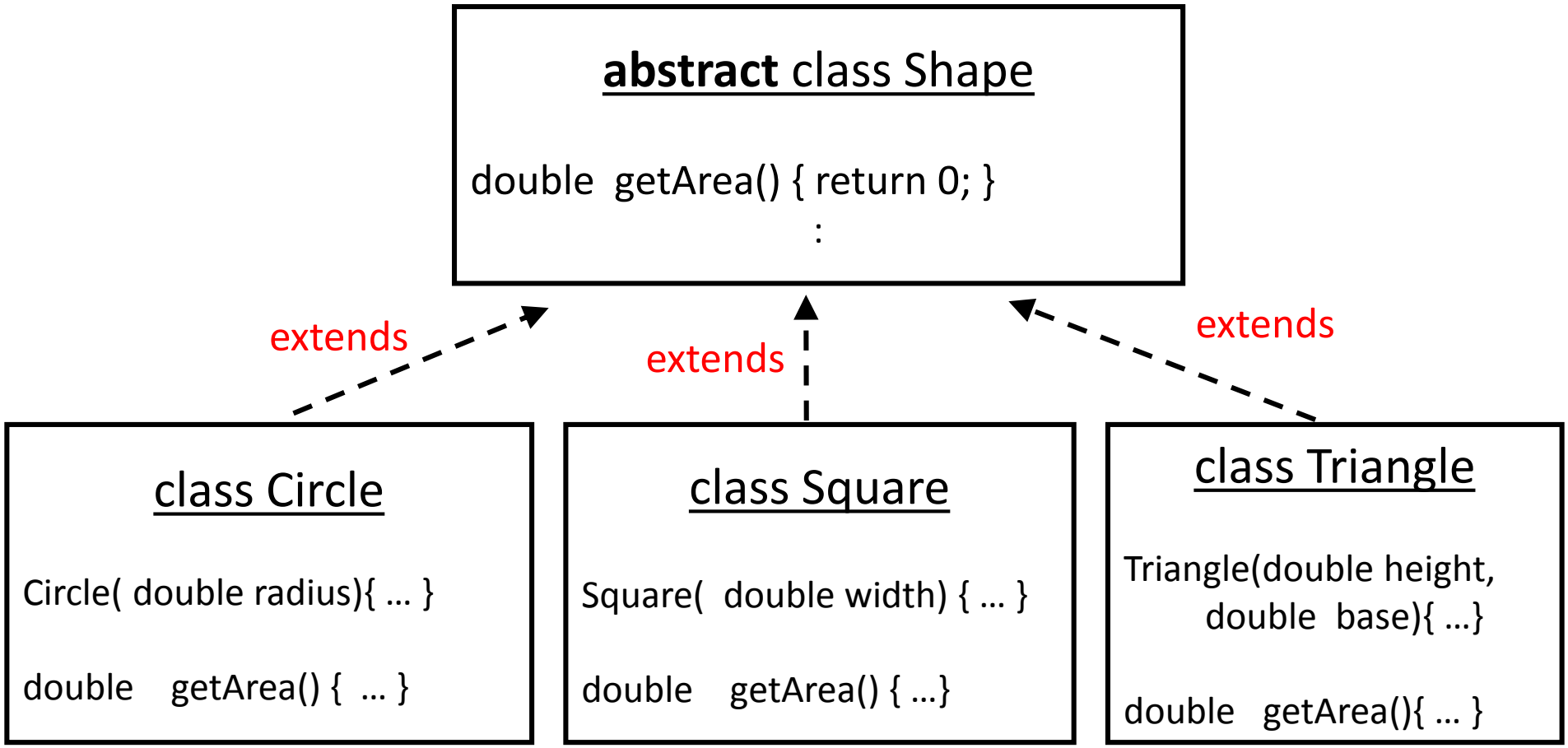

abstract class Circular
double radius
double getRadius() { return radius; }
void setRadius(double r) { radius = r…}
abstract double getArea()
extends
extends
extends
class Circle
Circle(double radius){ … }
double getArea() { … }
class Sphere
Sphere(double radius) { … }
double getArea() { …. }
class Cylinder
double length
Cylinder (double radius,
double len){ …}
double getArea(){ … }

```
abstract class Circular {

        double radius;                  //  field

        Circular(double radius){        //  constructor
                this.radius = radius;
        }

        double getRadius(){             //  implemented methods
                return radius;
        }

        void setRadius(double r){
                this.radius = r;
        }

        abstract double  getArea();    //  abstract method
}
```

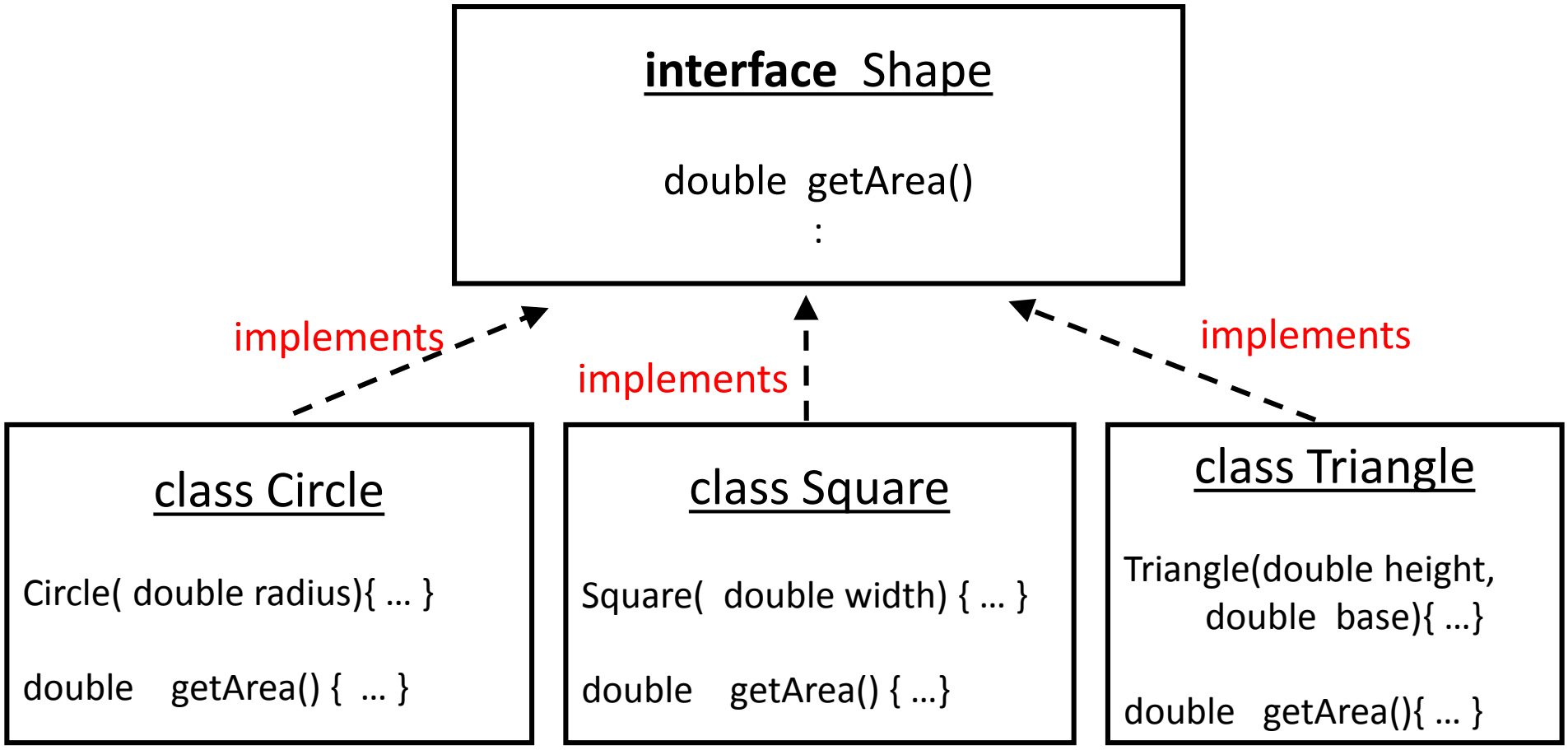
```
class Circle extends Circular{

        Circle(double radius){          // constructor
                super(radius);          //   superclass field
        }

        double getArea(){
                double r = this.getRadius();
                return  Math.PI * r*r;
        }
}
```

```
class Cylinder extends Circular{

        double height;

        Cylinder(double radius, double h){  // constructor
                super(radius);
                this.height = h;
        }

        double getArea(){
                double r = this.getRadius();
                return  2 * Math.PI * radius * height;
        }
}
```

MY BAD Example: Assignment 4



It should have been:



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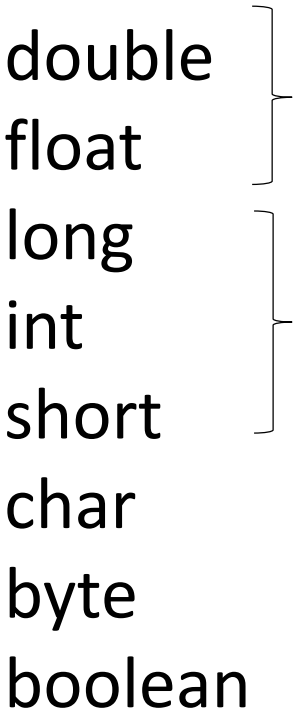
Primitive Type Conversion



In COMP 273, you will learn exactly how these number representations are related to each other.

But you should have some intuitive ideas….

https://docs.oracle.com/javase/tutorial/java/nutsandbolts/datatypes.html

Primitive Type Conversion

wider

Wider usually (but not always) means more bytes.

	number of bytes
double	8
float	4
long	8
int	4
short	2
char	2
byte	1
boolean	1

narrower

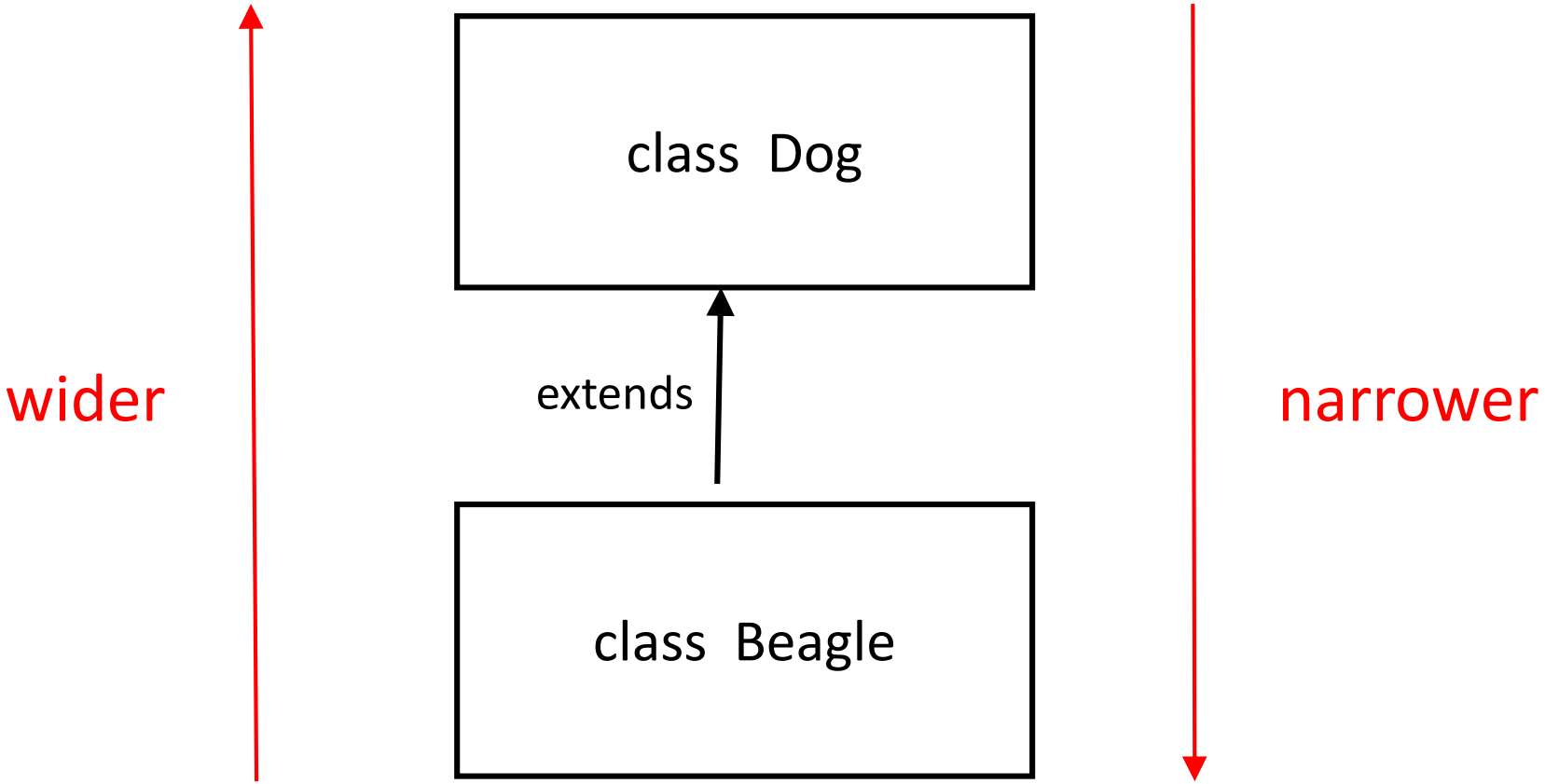
Examples

```
int     i = 3;
double  d = 4.2;
        d = i;                  // widening

        d  =  5.3 * i;          // widening     (by "promotion")
        i  =  (int)   d;        // narrowing    (by casting)
float   f  =  (float) d;        // narrowing    (by casting)

char   c = 'g';
int    index = c;               // widening
c = (char) index;               // narrowing
```

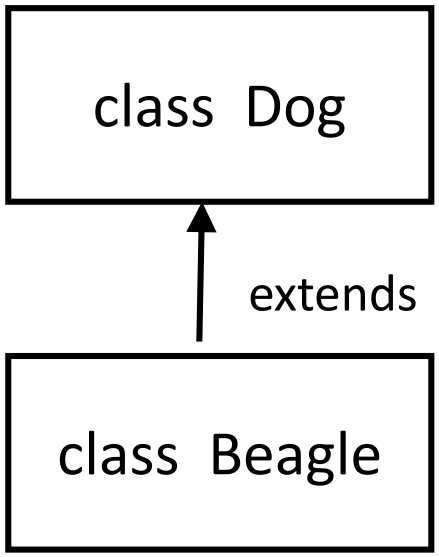
For narrowing conversions, you get a compiler error if you don't cast.



Heads up! Although the subclass is narrower, it has more bytes than the superclass.

```
Dog     myDog   =   new Beagle();

                // upcast, widening
```



This is similar to:

```
double  myDouble   =   3;     //    from int to double.
```

```
Dog       myDog = new Beagle();       // Upcasting.


Poodle    myPoodle  =   myDog;        // Compiler error.

          // implicit downcast Dog to Poodle not allowed.


myDog.show()                  //  Compiler error.

                          //   Poodle has show() method,
                          //   but Dog  does not.
```

```
Dog       myDog = new Beagle();       // Upcasting.


Poodle   myPoodle  =  (Poodle)  myDog;

          //   allowed by compiler

myPoodle.show()        //   allowed by compiler
                       //   Runtime error:   Dog object
                       //   does not have show()  method

((Poodle)  myDog).show()

   //   allowed by compiler,  but will generate runtime
   //   error if  actual object doesn't have a show method.
```

How to avoid such runtime errors?

```
if   (myDog  instanceOf  Poodle){

      ( (Poodle) myDog ).show();
}


if   (myPoodle  instanceOf  Poodle){

       myPoodle.show();
}
```