

Class relations: has-a

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Has-a relationship

A class usually contains data members. These can be simple types or other classes. This allows you to make structured code.

```
class Course {  
private:  
    Person the_instructor;  
    int year;  
}  
class Person {  
    string name;  
    ....  
}
```

This is called the *has-a relation*.

Literal and figurative has-a

A line segment has a starting point and an end point.

A Segment class can store those or store one and derive the other:
points:

```
class Segment {
private:
    Point starting_point, ending_point;
public:
    Point get_the_end_point() {
        return ending_point; }
    ...
    Segment somesegment;
    Point somepoint =
        somesegment.get_the_end_point();
}

class Segment {
private:
    Point starting_point;
    float length, angle;
public:
    Point get_the_end_point() {
        /* some computation from the
           starting point */ }
}
```

Implementation vs API: implementation can be very different from user interface.

Exercise 1

- Make a class `Rectangle` (sides parallel to axes) with a constructor:

```
Rectangle(Point bl,float w,float h);
```

The logical implementation is to store these quantities.

Implement methods

```
float area(); float rightedge(); float topedge();
```

- Add a second constructor

```
Rectangle(Point bl,Point tr);
```

Can you figure out how to use member initializer lists for the constructors?

- Write another version of your class so that it stores two `Point` objects.

Polymorphism in constructors

You have to decide what to store and what to derive, but you can construct two ways:

```
class Segment {  
private:  
    // up to you how to implement!  
public:  
    Segment( Point start,float length,float angle )  
        { .... }  
    Segment( Point start,Point end ) { ... }
```

Advantage: with a good API you can change your mind about the implementation without bothering the user.