Class relations: has-a

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Fall 2017

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

Compare:

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

Versus:

```
class Segment {
private:
  Point starting_point;
  float length,angle;
}
```

Implementation vs API.

Exercise 1

Make a class `Rectangle` (sides parallel to axes) with two constructors:

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

and functions

```
float area(); float width(); float height();
```

Let the `Rectangle` object store two `Point` objects.

Then rewrite your exercise so that the `Rectangle` stores only one point (say, lower left), plus the width and height.

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!