

Objects and classes

Victor Eijkhout and Charlie Dey

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Classes

Classes look a bit like objects

```
class Vector {  
public:  
    double x,y;  
};
```

```
int main() {  
    Vector p1;  
    p1.x = 1.; p1.y = 2.;  
}
```

We'll get to that 'public' in a minute.

Class initialization

Use a *constructor*:

```
class Vector {  
public:  
    double x,y;  
    Vector( double userx,double usery ) {  
        x = userx; y = usery;  
    }  
};
```

```
int main() {  
    Vector p1(1.,2.);
```

Member initialization

Other syntax for initialization:

```
class Vector {  
public:  
    double x,y;  
    Vector( double userx,double usery ) : x(userx),y(usery) -  
}  
};
```

Private data

```
class Vector {  
private:  
    double vx,vy;  
public:  
    Vector( double x,double y ) {  
        vx = x; vy = y;  
    };  
    double x() { return vx; };  
    double y() { return vy; };  
};  
  
int main() {  
    Vector p1(1.,2.);  
    cout << "p1 = " << p1.x() << ", " << p1.y() << endl;
```

Methods

Functions on objects

```
class Vector {  
private:  
    double vx,vy;  
public:  
    Vector( double x,double y ) {  
        vx = x; vy = y;  
    };  
    double length() { return sqrt(vx*vx + vy*vy); };  
};  
  
int main() {  
    Vector p1(1.,2.);  
    cout << "p1 has length " << p1.length() << endl;
```

We call such internal functions 'methods'

Methods that alter the object

```
class Vector {  
void scaleby( double a ) {  
    vx *= a; vy *= a; };  
};  
Vector p1(1.,2.);  
cout << "p1 has length " << p1.length() << endl;  
p1.scaleby(2.);  
cout << "p1 has length " << p1.length() << endl;
```

Methods that create a new object

```
class Vector {  
    Vector scale( double a ) {  
        return Vector( vx*a, vy*a ); }  
};  
  
cout << "p1 has length " << p1.length() << endl;  
Vector p2 = p1.scale(2.);  
cout << "p2 has length " << p2.length() << endl;
```

Constructor

```
Vector p1(1.,2.), p2;  
cout << "p1 has length " << p1.length() << endl;  
p2 = p1.scale(2.);  
cout << "p2 has length " << p2.length() << endl;
```

gives:

```
pointdefault.cxx: In function 'int main()':  
pointdefault.cxx:32:21: error: no matching function for call to  
      'Vector::Vector()'  
      Vector p1(1.,2.), p2;
```

So:

```
Vector() {};  
Vector( double x,double y ) {  
    vx = x; vy = y;  
};
```

Exercise 1

Make class `Point` with a constructor

```
Point( float xcoordinate, float ycoordinate );
```

and a function `distance` so that if `p,q` are `Point` objects, the call

```
p.distance(q)
```

computes the distance.

Exercise 2

Make a class `LinearFunction` with a constructors:

```
LinearFunction( Point input_p1,Point input_p2 );
```

and a function

```
float evaluate_at( float x );
```

which you can use as:

```
LinearFunction line(p1,p2);  
cout << "Value at 4.0: " << line.evaluate_at(4.0) << endl;
```