References, classes and objects

Andy Guest
a.guest@yorksj.ac.uk

27 January 2019

Welcome to 1CB105 Programming 2

- My name is Andy Guest, my email is `a.guest@yorksj.ac.uk`

Welcome to 1CB105 Programming 2

- My name is Andy Guest, my email is `a.guest@yorksj.ac.uk`
- My office is in 44 Lord Mayor's Walk

Today

- Introduction to the module.

Today

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- Object-oriented programming.

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- Classes and member variables.

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  - What it is.

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  - As a bit of light relief.

Expectations

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- Keep the room calm when we are working on exercises.
- Do the exercises from each week before the next week's lecture.
- Ask for help if you get stuck or you're not sure how something works.

Timetable

- Monday: lecture/lab (9am–1pm or 2pm–6pm).

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- Tuesday: SOL (9am–12pm and 2pm–5pm).

How to do well in this module

- Practice

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- Practice, practice

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- Practice, practice, practice, then practice more.
- If you write code you will get good at writing code.
- If you don't write code you will (probably) not get good at writing code.
- If you are confused — ask.
- If you don't understand something, the next thing probably isn't going to make much sense either.
- I can normally explain things in more than one way, so try me!

Object-oriented programming (OOP)

There are two parts to learning about this.

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Object-oriented programming (OOP)

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- How do I do it.
- Why should I do it?

I am going to show you:

- How to do it.
- How it can make programs easier to read, write and think about.

A simple class

```
class Foo {
  int x;
  int y;
}

Foo f = new Foo ();
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class Foo {
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What just happened?

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Create a new object...

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...using a plan (or `class') called Foo...

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Create a new object...

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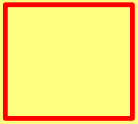

A simple class

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Foo f = new Foo();
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Create a new object...

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x = 0
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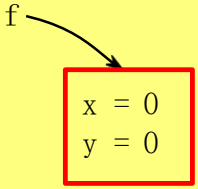

A simple class — changing the object

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class Foo {
  int x;
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}

Foo f = new Foo ();
f. x = 42;
f. y = 9;
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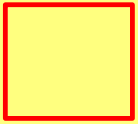

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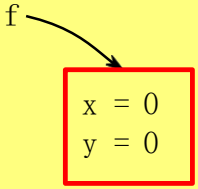

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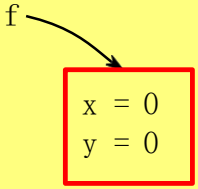

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Look in the object labelled f

```
Foo f = new Foo();
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Find its x variable

f

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A simple class — changing the object

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```
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Find its x variable

And set it to 42

f

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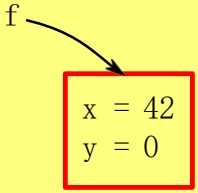

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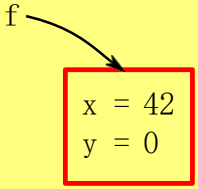

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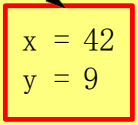

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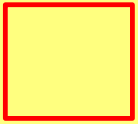

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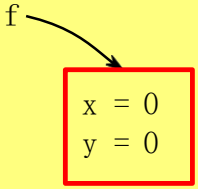

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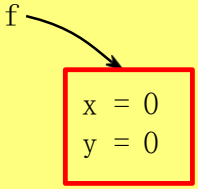

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Look in the object labelled f

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Foo f = new Foo();
f.x = 42;
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Find its x variable

f

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A simple class — reading the object

```
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Look in the object labelled f

Find its x variable

And set it to 42

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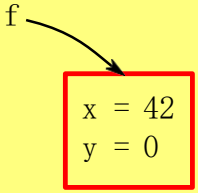

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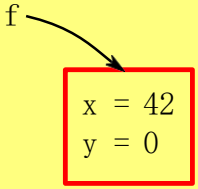

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Find its y variable

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Look in the object labelled f

Find its y variable

And set it to 9

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f.x = 42;
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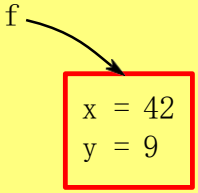

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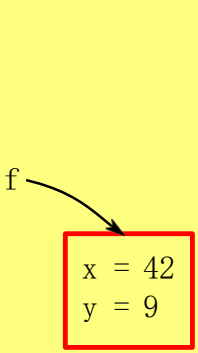

A simple class — reading the object

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Foo f = new Foo();
f.x = 42;
f.y = 9;
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Look in the object labelled f

Give me its x variable

f

```
x = 42
y = 9
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Foo f = new Foo();
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And print it out

Look in the object labelled f

Give me its x variable

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Exercise

Let’s try this ourselves. Look at exercise 1 on Moodle.

Multiple objects of the same class

```
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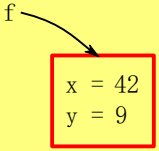
f.x = 42;
f.y = 9;
```



Multiple objects of the same class

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Foo f = new Foo();
f.x = 42;
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Foo g = new Foo();
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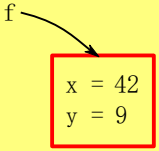

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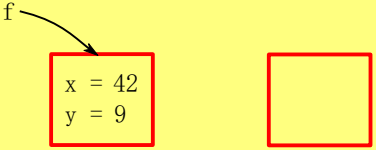

Multiple objects of the same class

```
Foo f = new Foo();
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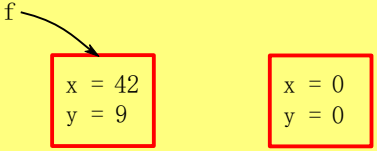
...using a plan (or `class') called Foo...

Create a new object...



Multiple objects of the same class

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Foo f = new Foo();
f.x = 42;
f.y = 9;
Foo g = new Foo();
```

...and give it the label g

Create a new object...

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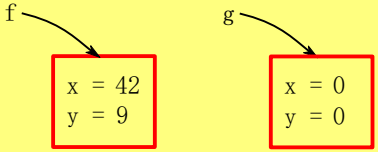
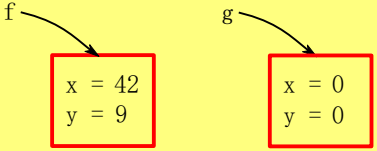


Multiple objects of the same class

```
Foo f = new Foo();
f.x = 42;
f.y = 9;
Foo g = new Foo();
g.x = 66;
```



Multiple objects of the same class

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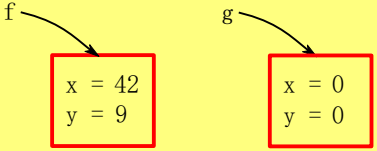
Look in the object labelled g



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Foo f = new Foo();
f.x = 42;
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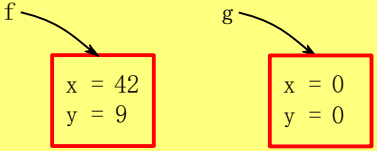
```

Look in the object labelled g

Find its x variable



Multiple objects of the same class

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Foo f = new Foo();
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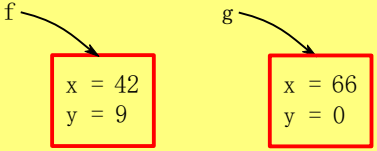
g.x = 66;
```

Look in the object labelled g

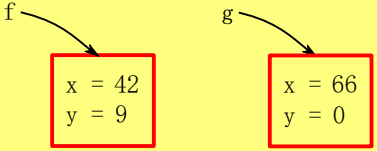
Find its x variable

And set it to 66



Multiple objects of the same class

```
Foo f = new Foo();
f.x = 42;
f.y = 9;
Foo g = new Foo();
g.x = 66;
g.y = 25;
```



Multiple objects of the same class

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Foo f = new Foo();
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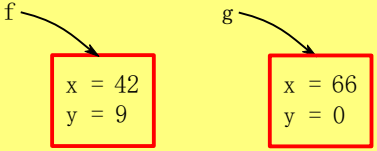
g.x = 66;
g.y = 25;
```

Look in the object labelled g



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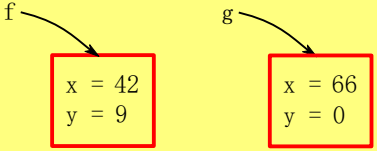
g.x = 66;
g.y = 25;
```

Look in the object labelled g

Find its y variable



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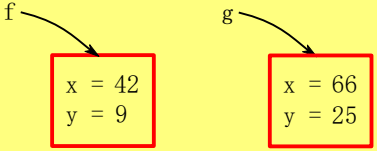
Find its y variable

And set it to 25



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- You can have more than one reference to the same object.
- If you have no references, you can't find the object any more (and Java will destroy it).

References

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Foo f = new Foo();
f.x = 42;
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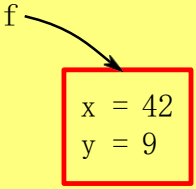

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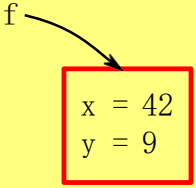

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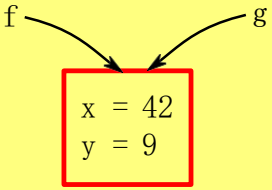

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Foo f = new Foo();
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Foo g = f;
g.x = 77;
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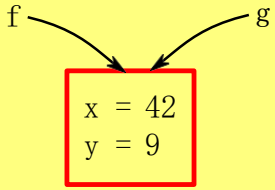
Look in the object labelled g



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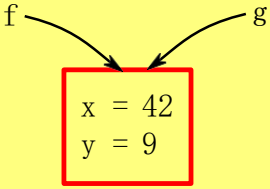

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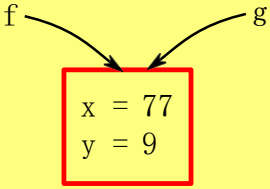

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- e.g. a coordinate:

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int player X = 1;
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Exercise

Let’s do some more coding with classes and objects. Look at exercise 2 on Moodle.

null references

What if we have:

```
class Ostrabagalous {
  int x;
  String y;
}

Ostrabagalous o;
```

null references

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null references

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- This is called `null` in Java.

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- What does `o` refer to?
- Nothing. It refes to no object.
- This is called `null` in Java.
- What happens if I do

  ```
  o.x = 42;
  ```

References with methods

What happens if I do this:

```
void main(String[] args) {
  int x = 42;

  myGreatMethod(x);
}

void myGreatMethod(int n) {
  System.out.println(n);
}
```

References with methods

```
void main(String[] args) {
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Call `myGreatMethod` giving it the value of `x`

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Copy the value of x into a new variable called n

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→ Output the value of n

References with methods

It's the same with references:

```
class Frobozz {
  String a;
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void main ( String [] args ) {
  Frobozz f = new Frobozz();
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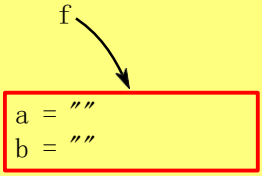

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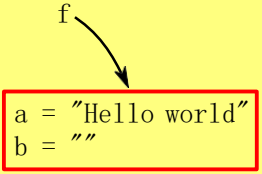

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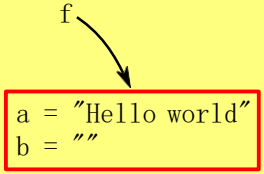

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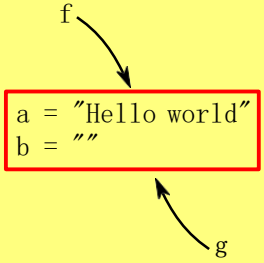

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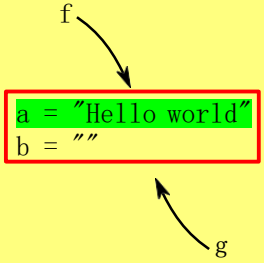

Exercise

Look at exercise 3 on Moodle.

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- These concepts are <u>hard</u> and <u>important</u>.
- Make sure you understand them!
- Ask for help if you need it!
- The rest of it is easy(-ish) if you really 'get' these ideas.
- Finish all the exercises from the lecture before next week.