CSI 31 Lecture 8

Topics: *Chapter 4. Objects and Graphics*

4.1 Overview

4.2 The object of objects

4.3 Simple graphical programming

4.4 Using Graphical Objects

link to the graphics library:

http://mcsp.wartburg.edu/zelle/python/

4.1 Overview
4.2 The Object of Objects

So far we used built-in Python data types for our programs (*int*, *float*, *long*, *str*).

Each type:

- can represent the certain set of data values, and
- has a set of associated operations.

Data – *passive* entities, they are manipulated and combined via *active* operations.

- a traditional way to view computation.

4.1 Overview
4.2 The Object of Objects

Another (modern) approach:
programs are built using Object Oriented (OO) approach.

The basic idea:
we view a complex system as an interaction of simpler objects.

OO objects:
- *contain data* (*know staff*)
- *have operations* (*can do staff*)

- in other words, it is a sort of *active* data type.

Objects *interact* by sending each other messages in the form of requests for an object to perform one of its operations.

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Objects *interact* by sending each other messages in the form of requests for an object to perform one of its operations.

We will use graphics to show the object oriented approach.

4.3 Simple Graphics Programming

Instructions for getting the graphics library:

we will use the library written specifically for our book: graphics.py

You can download it from here:
http://mcsp.wartburg.edu/zelle/python/

or

you can copy this file from the disk distributed with the book

Put/copy it into the folder 'Lib' in the Python's folder.

The library is already placed there in our tutoring lab and will be shortly placed there on our lab computers.

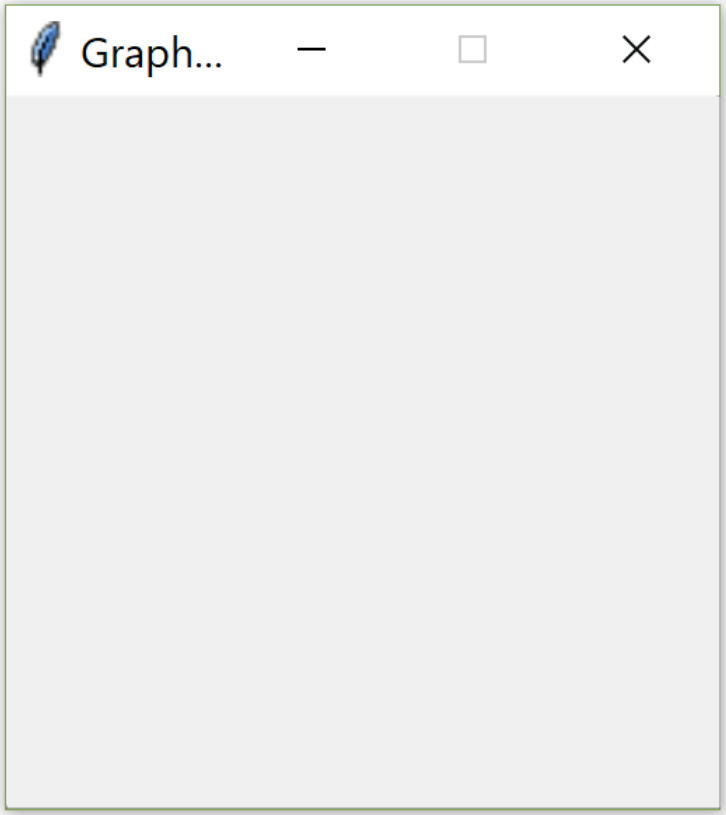
4.3 Simple Graphics Programming

type in the following in the interactive window:

```
>>> import graphics
>>> win = graphics.GraphWin()
```

- this will create a new object with the name 'win'

you can see that there is a new window called 'Graphics Window' (if you re-size it)



4.3 Simple Graphics Programming

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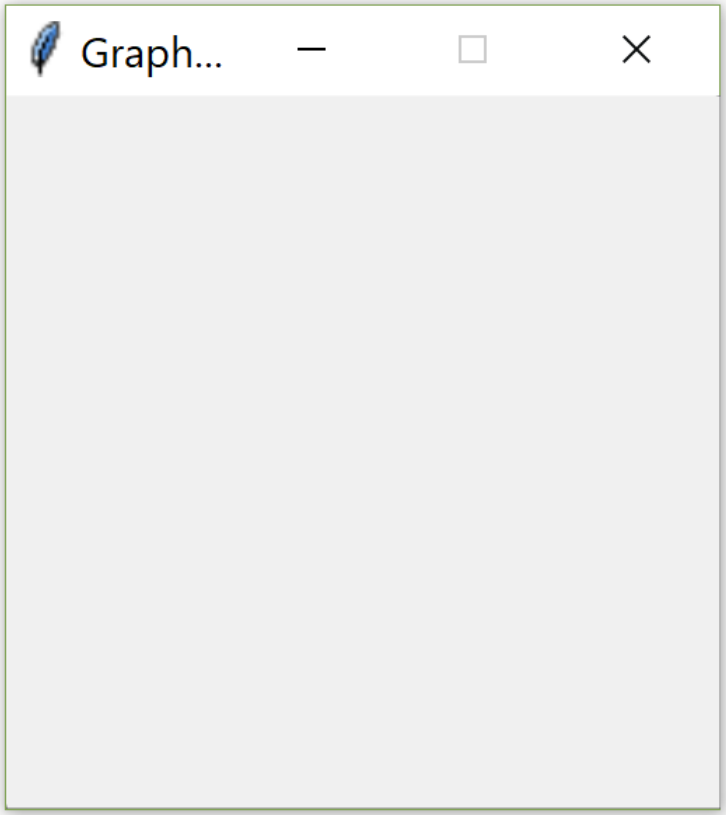


you can see that there is a new window called 'Graphics Window' (if you re-size it)

Type in:

```
>>> win.close()
```

- the object 'win' is destroyed and we won't see that Graphics Window anymore.

4.3 Simple Graphics Programming

We will be working with lots of commands (functions) from graphics library, let's do an alternative import of that library:

```
>>> from graphics import *
```

- it means *'load all the operations/commands and constants from the library module graphics'*
- the imported commands become directly available, without the dot-notation.

Now we can work more comfortably:

```
>>> win = GraphWin()
```

4.3 Simple Graphics Programming

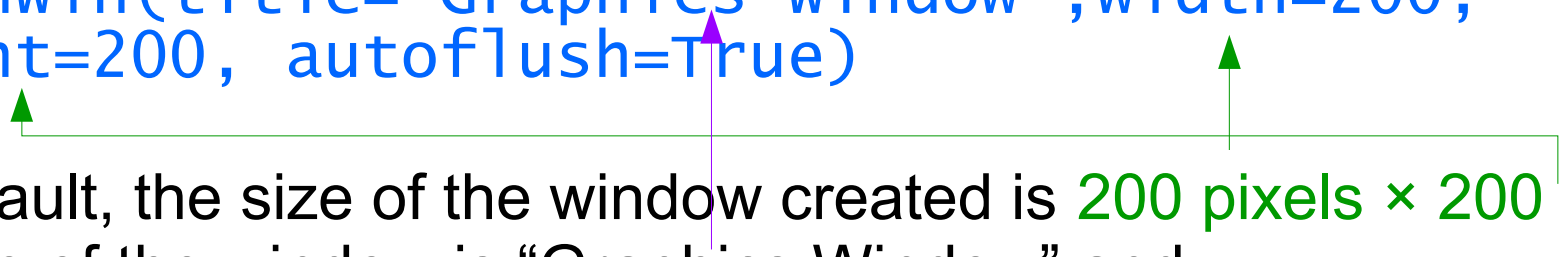
GraphWin()

```
GraphWin(title="Graphics Window",width=200,
height=200, autoflush=True)
```

4.3 Simple Graphics Programming

`GraphWin()`

```
GraphWin(title="Graphics Window",width=200,
height=200, autoflush=True)
```



by default, the size of the window created is 200 pixels × 200 pixels
the title of the window is “Graphics Window” and
all the changes in it are automatically displayed

See example program **example1.py**

4.3 Simple Graphics Programming

Pixels

Pixels (picture elements)– are tiny points on our displays. Each of them has color.
By controlling the color of each pixel we can control what is displayed on the screen.

The position of each pixel is a pair (x,y) :
x-coordinate and y-coordinate.

4.3 Simple Graphics Programming

upper left corner : (0,0),
lower right corner: (max_vertical_resolution, max_horizontal_resolution)
Origin of our "rectangular coordinate system" is at the top-left corner.

Origin (0,0)

See example program **points.py**

4.4 Using Graphical Objects

The module provides the following drawable objects: Point, Line, Circle, Oval, Rectangle, Polygon, and Text.
Each of these kinds are examples of classes.

When we write an assignment `p1=Point(10,30)`, the following happens:
An *instance* of class Point is created (called object), and is assigned to variable `p1`.

In over words, we never «use» classes themselves, we create instances of classes (objects) and work with them.

4.4 Using Graphical Objects

Every object is an instance of some class, and the class describes the properties the instance has.

4.4 Using Graphical Objects

To define a class we

1. define a constructor(s)
   (expression that creates instance of this class)
2. define variable(s)
3. define method(s) (function(s))

4.4 Using Graphical Objects

1. defining a constructor(s)

constructor is an expression that creates brand new object.

The general form is: `<class-name>(<param1>,<param2>,...)`

name of class
(Circle or Point or ...)

parameters that are required to initialize the object

4.4 Using Graphical Objects

1. defining a constructor(s)

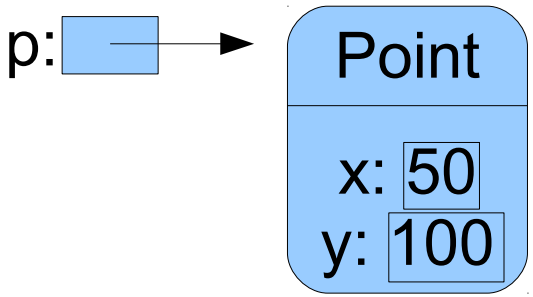
constructor is an expression that creates brand new object.

The general form is: `<class-name>(<param1>,<param2>,...)`

Example:

```
p = Point(50,100)
```

- the class name is Point, and here is a call to the constructor with two parameters (x-coordinate, y-coordinate)



4.4 Using Graphical Objects

1. defining a constructor(s)

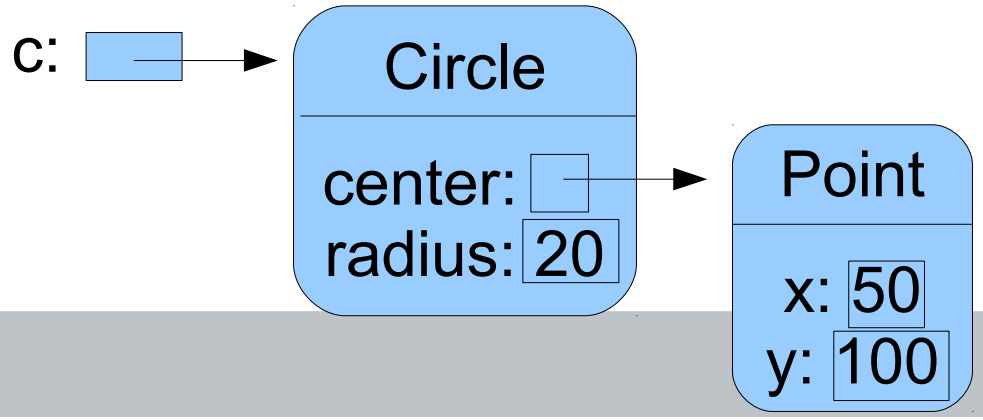
constructor is an expression that creates brand new object.

The general form is: `<class-name>(<param1>,<param2>,...)`

Example:

```
c = Circle(Point(50,100),20)
```

- the class name is `Circle`, the constructor needs two parameters:
  center (should be of type Point), and radius.



4.4 Using Graphical Objects

2. define variable(s)

In the Point class, x-coordinate value and y-coordinate value are stored as *instance variables* inside of the object.

4.4 Using Graphical Objects

3. define method(s) (function(s))

To perform an operation on an object we «send» the object a message.

Example:

```
p1=Point(30,30)
p1.draw(win)
```

calls a method «draw» of object p1

«draw» is a function (method) of class Point, that draws a point. It requires one parameter (where to draw the object).

The general form of a method call:

```
<object>.<method-name>(<param1>,<param2>,...)
```

4.4 Using Graphical Objects

3. define method(s) (function(s))

Methods can be without parameters (when they are not needed):

```
p1.getX()
```

Methods like this, that allow us to access information from the instance variables of the objects are called *accessors*.

4.4 Using Graphical Objects

3. define method(s) (function(s))

Methods can change the values of an object's instance variables, hence changing the state of an object:
`p1.move(10,30)` – moves the point 10 pixels to the right and 30 pixels down.

Such methods are called *mutators*.

The general form of the move method is `move(dx,dy)`.
All the graphical objects have this method.