Lecture 20

Topics: *Chapter 10. Defining Classes*

10.1 Quick review of objects

10.2 Example program: target

10.3 Defining new classes

10.1 Quick review of objects

In previous chapters we have developed techniques for *structuring the computation of the program*.

In the next few chapters we will review some techniques *structuring the data* that our programs use.

10.1 Quick review of objects

Object is an active data type that *knows stuff* an *can do stuff*.

An object consists of :

- a collection of related information (*knows stuff*)

  instance variables

- a set of operations to manipulate the information (*can do stuff*)

  methods

Collectively, *instance variables* and *methods* are called *attributes of an object*.

10.1 Quick review of objects

Objects *interact* by sending each other messages (*requests for an object to perform one of its operations*).

Every object is an *instance* of some class.

New objects are created by invoking a *constructor*.

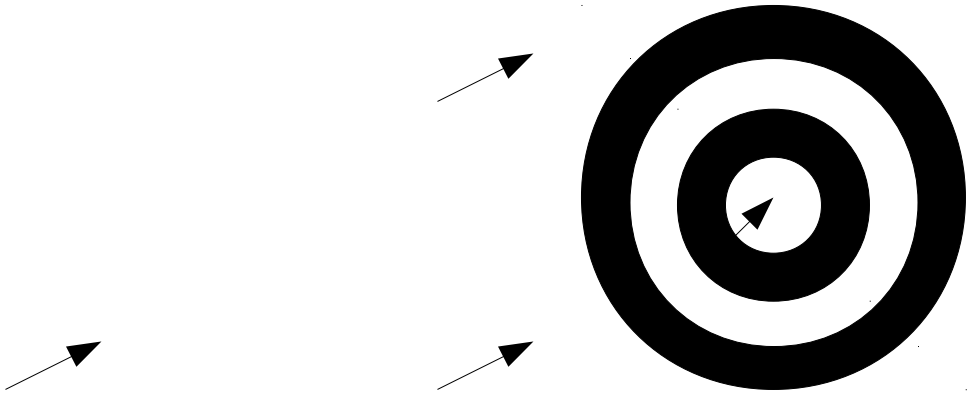
Example:

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

The parameters to the constructor are used to initialize some of the instance variables (*center*, *radius* for Circle).
Then we can manipulate the object (*draw, move, erase*).

10.2 Example program: target

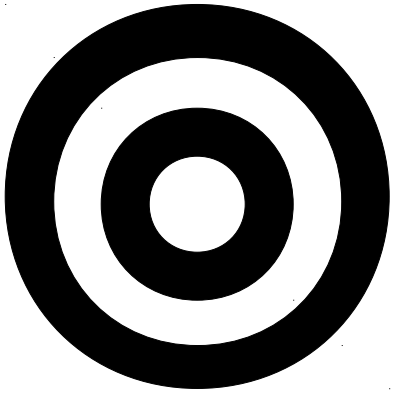
Example:
Let's create a dart board and emulate dart throwing



10.2 Example program: target

Example:
Let's create a dart board and emulate dart throwing

```
r = 200
for i in range(10):
    C = Circle(Point(400,300),r-20*i)
    if i%2 == 1:
        C.setFill("white")
    else:
        C.setFill("black")
        C.draw(w)
```



10.2 Example program: target

Example:
Let's create a dart board and emulate dart throwing

```
p = w.getMouse() # getting the mouse click
x = p.getX() # store x-coordinate of the click
y = p.getY() # store y-coordinate of the click

L = Line(Point(x-20,y+20),p) # create a dart
L.setArrow("last") # with the arrow at the end
L.draw(w) # draw it
```

10.2 Example program: target

Example:
Let's create a dart board and emulate dart throwing

See programs target.py and target_mod.py

10.3 Defining new classes

Class definition has the following form:

```
class <class-name>:
   <method-definitions>
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Exercise: Let's define a class for a die

- a die has *n* sides
  (set it up during the *initialization*),
  - *instance variable* `sides`
- when we roll a die it gets some value
  - *method* `roll`
- a die has a side up after we roll it
  - *instance variable* `value`

10.3 Defining new classes

Exercise: Let's define a class for a die

```
from random import randrange


class MSDie:

    def __init__(self, sides):
        self.sides = sides
        self.value = 1

    def roll(self):
        self.value = randrange(1,self.sides+1)
```

10.3 Defining new classes

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class name

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constructor

instance variables

method of the class MSDie

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first parameter of each method – a reference to the object it works on

10.3 Defining new classes

Exercise: Let's define a class for a die

`What other methods should we add?`

- `recall Point, Text, ...` from graphics library

10.3 Defining new classes

Exercise: Let's define a class for a die

What other methods should we add?

- recall `Point`, `Text`, `...` from graphics library

`getValue` and `setValue` methods

10.3 Defining new classes

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        self.value = randrange(1,self.sides+1)

    def getValue(self):
        return self.value

    def setValue(self,value):
        self.value = value
```

10.3 Defining new classes

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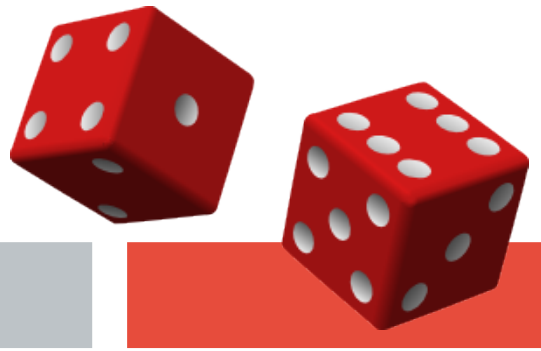
MSDie
self.sides self.value
__init__(self, sides) roll (self) getValue (self) setValue(self, value)

class diagram



10.3 Defining new classes

Exercise: Let's define a class for a die

MSDie	*class name*	MSDie
self.sides self.value	*instance variables*	sides value
__init__(self, sides) roll (self) getValue (self) setValue(self, value)	*methods*	__init__(sides) roll () getValue () setValue(value)
class diagram		*class diagram*

10.3 Defining new classes

Exercise: Let's define a class for a die

See program dice.py

and then dice_graphics.py