Objectives

- To provide examples of computer science in the real world
- To provide an overview of common problem-solving strategies
- To introduce Python's numeric data types
- To show examples of simple programs
- To introduce loops and simple functions
- To introduce turtle graphics

Computer Science

- Problem Solving
- Algorithms
- Abstraction
- Programming

Problem Solving

- Simplification
- Generalization

Figure 1.1

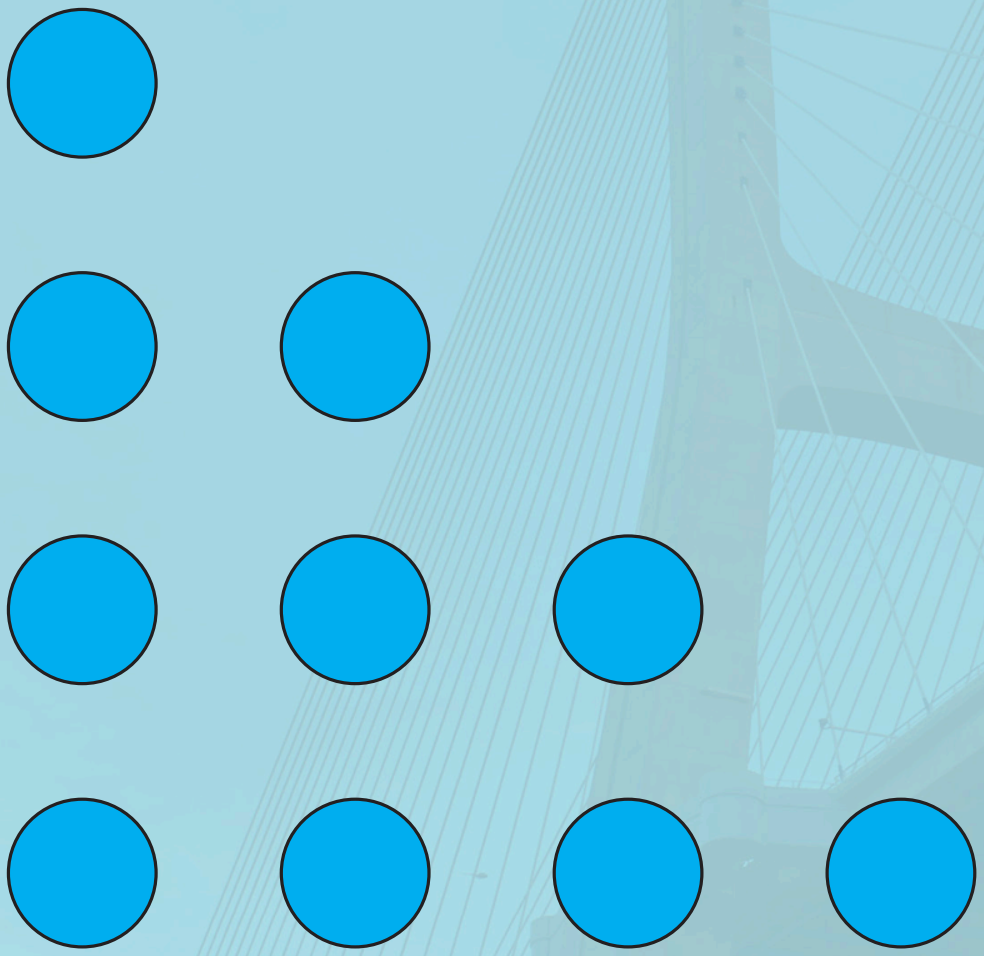
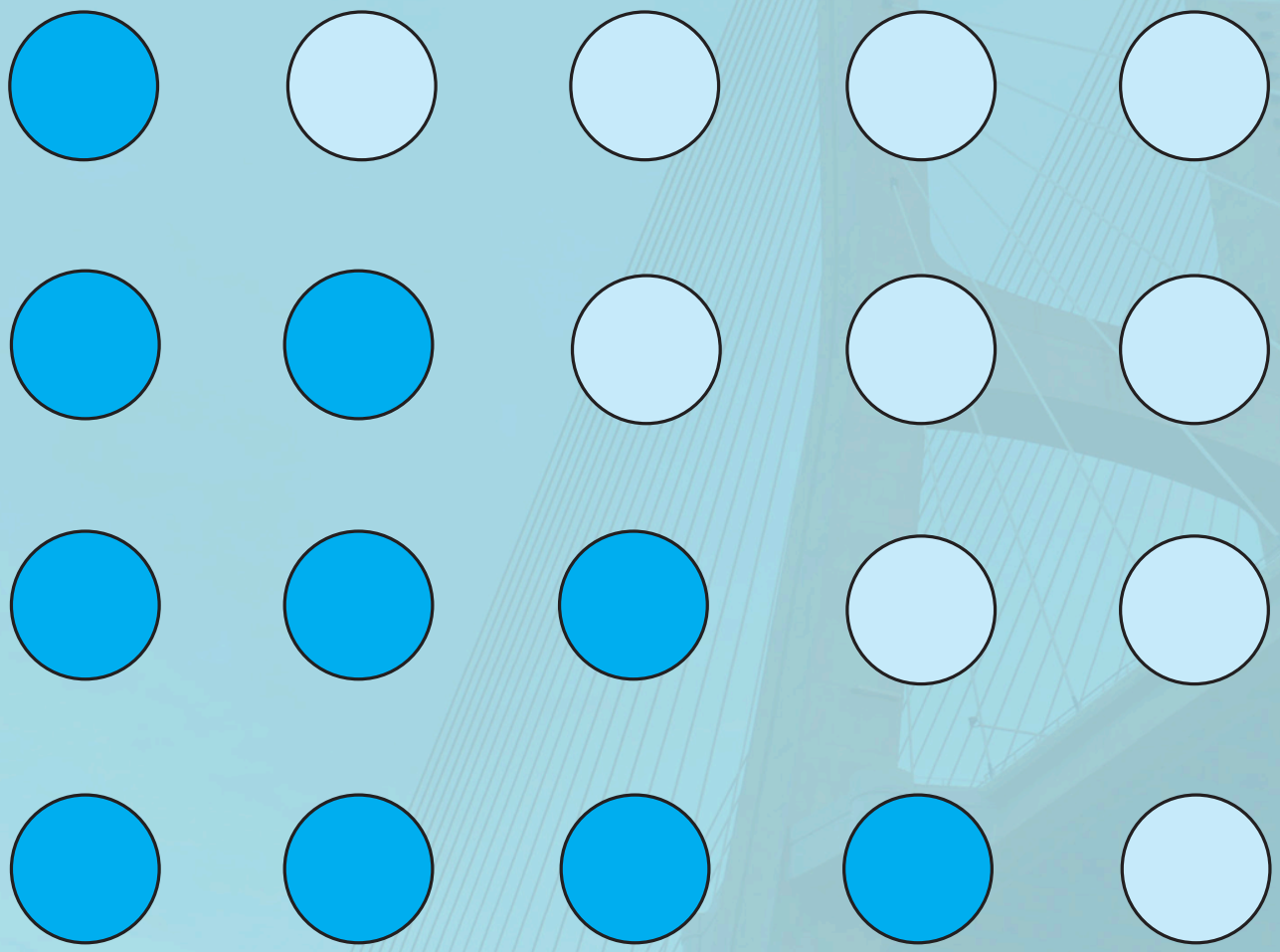


Figure 1.2



Python Overview

- Data Objects
- Operators
- Expressions
- Assignment Statements (variables, names)
- Python Interpreter (read, evaluate, print)

Figure 1.3

Figure 1.4

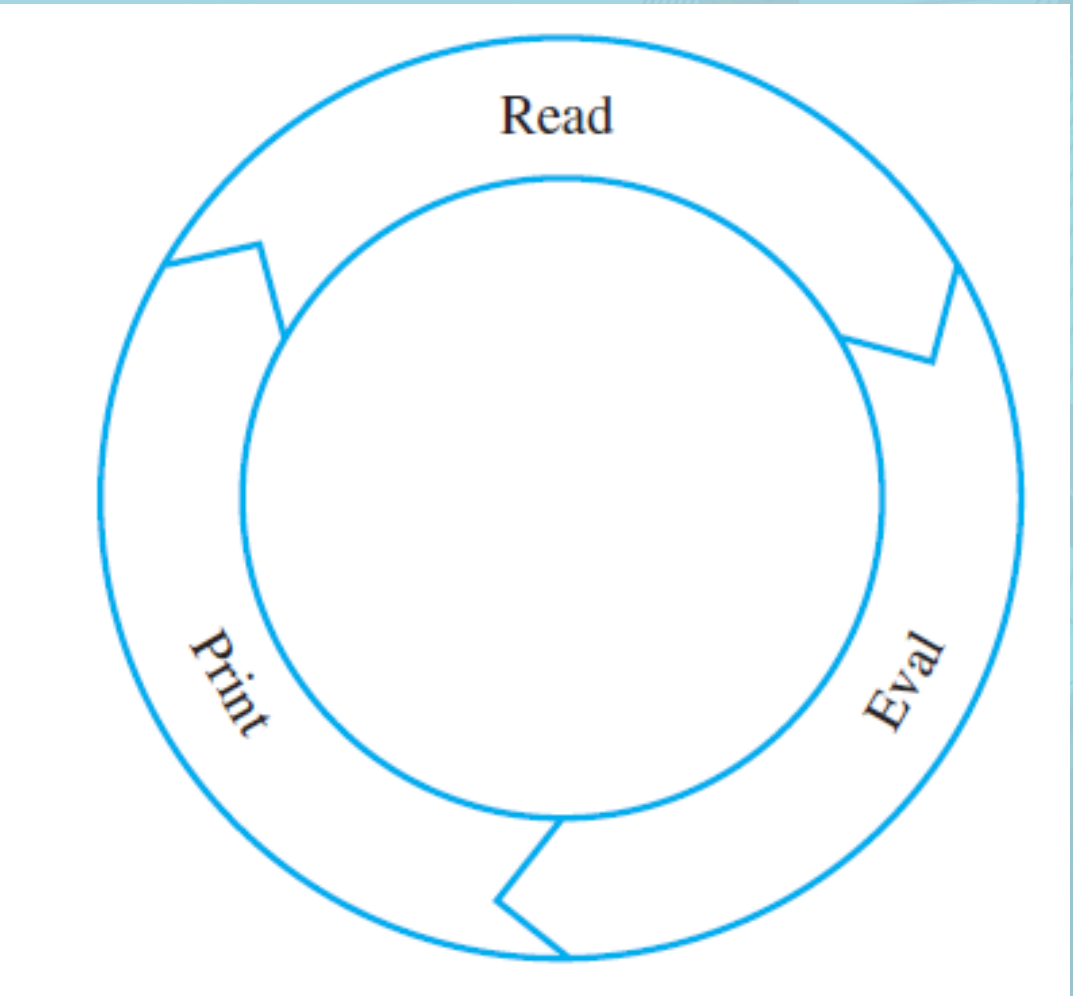


Figure 1.5

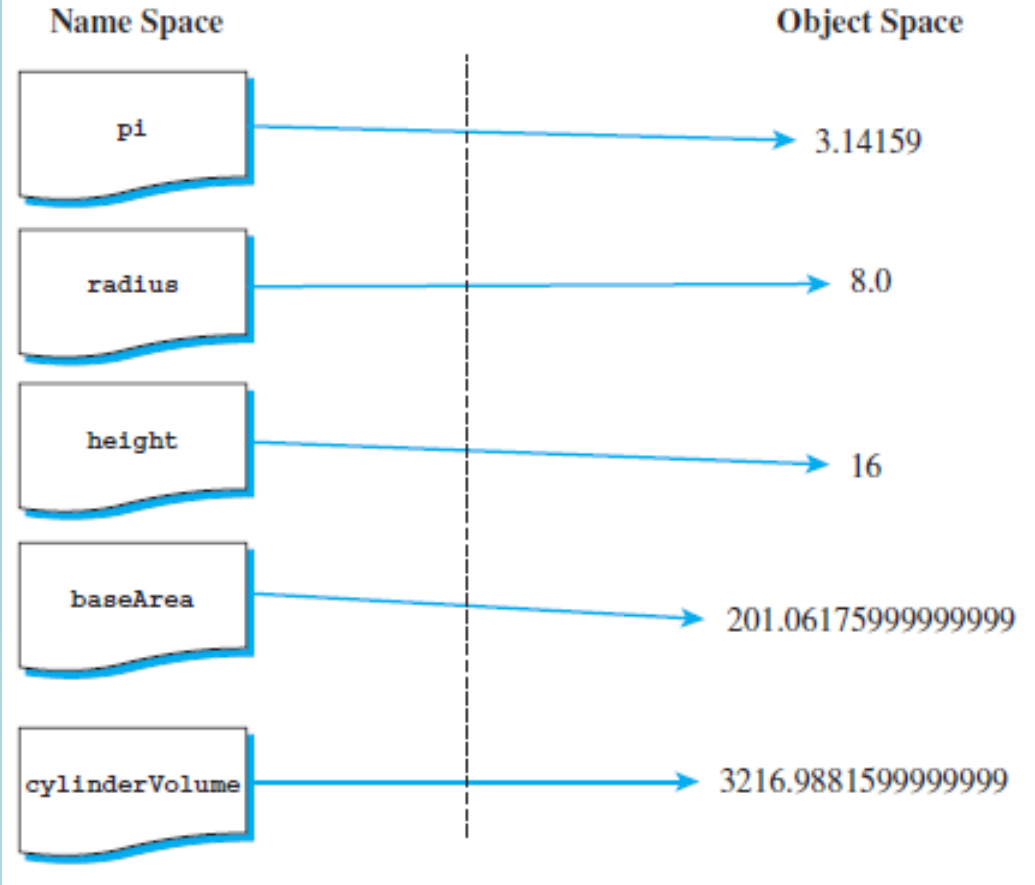


Figure 1.6

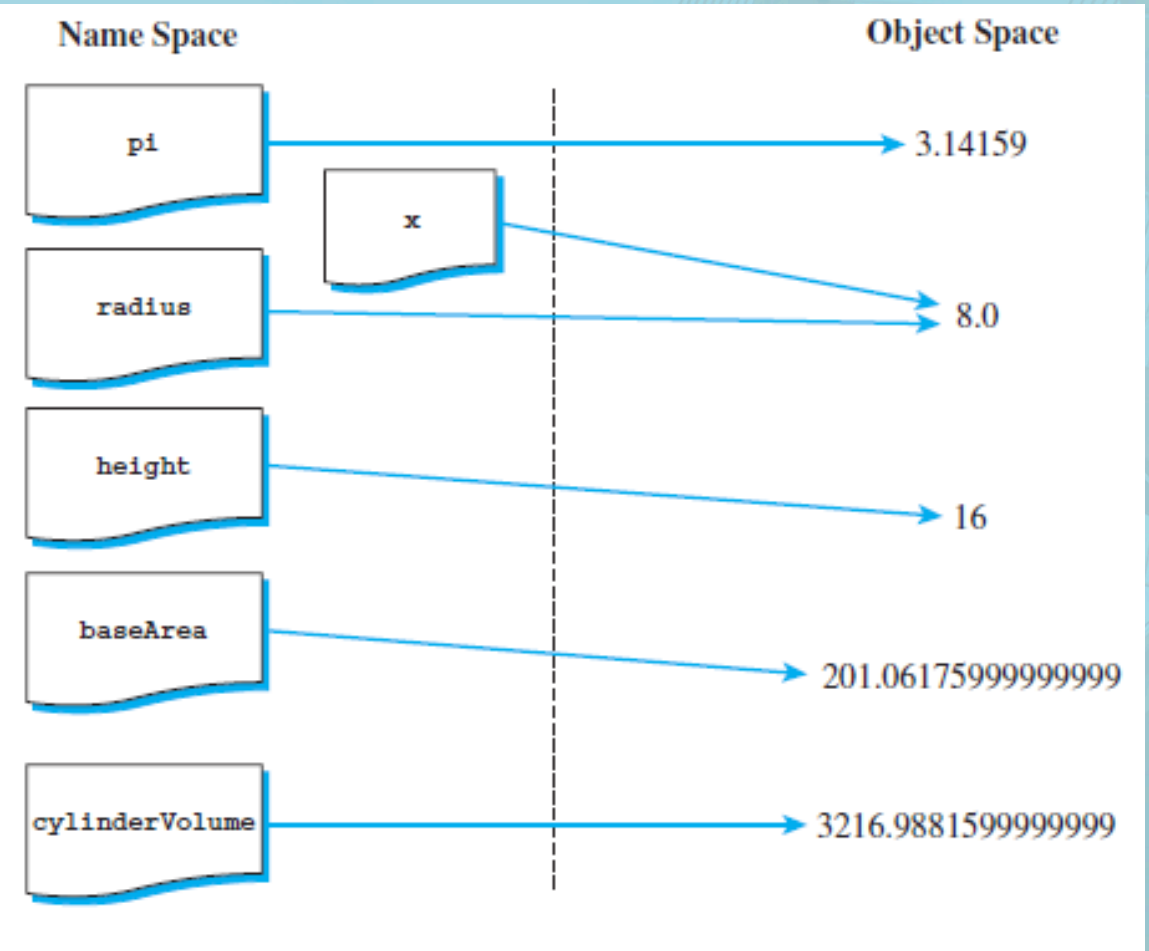


Figure 1.7

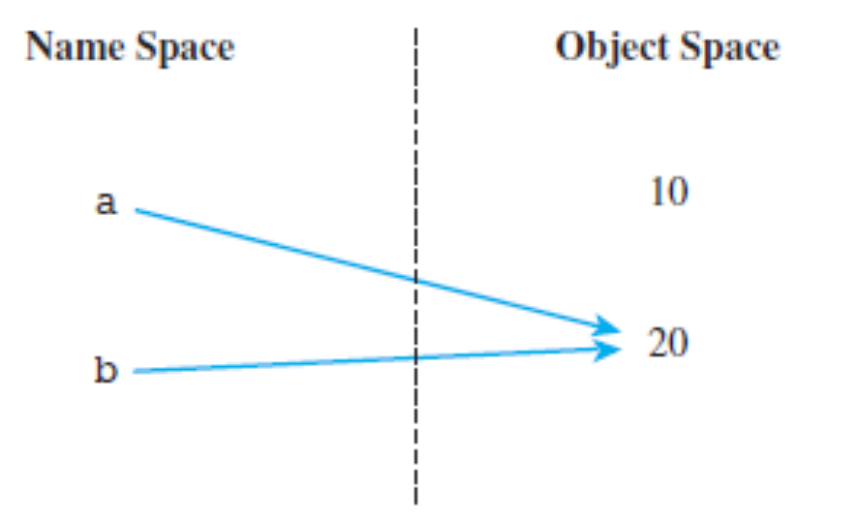
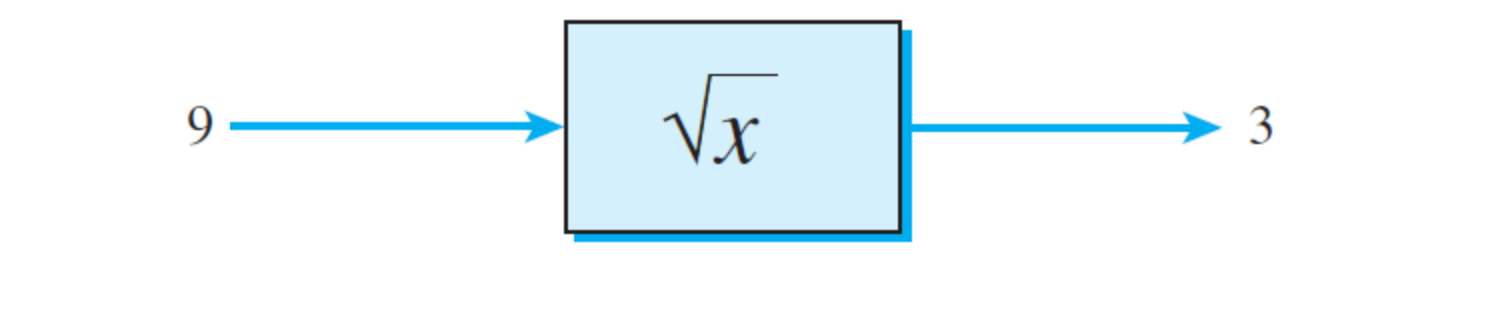


Figure 1.7 Result of assignment `a = b`

Abstraction and Functions

- Black Box
- Container for a sequence of actions
- Use the function by name

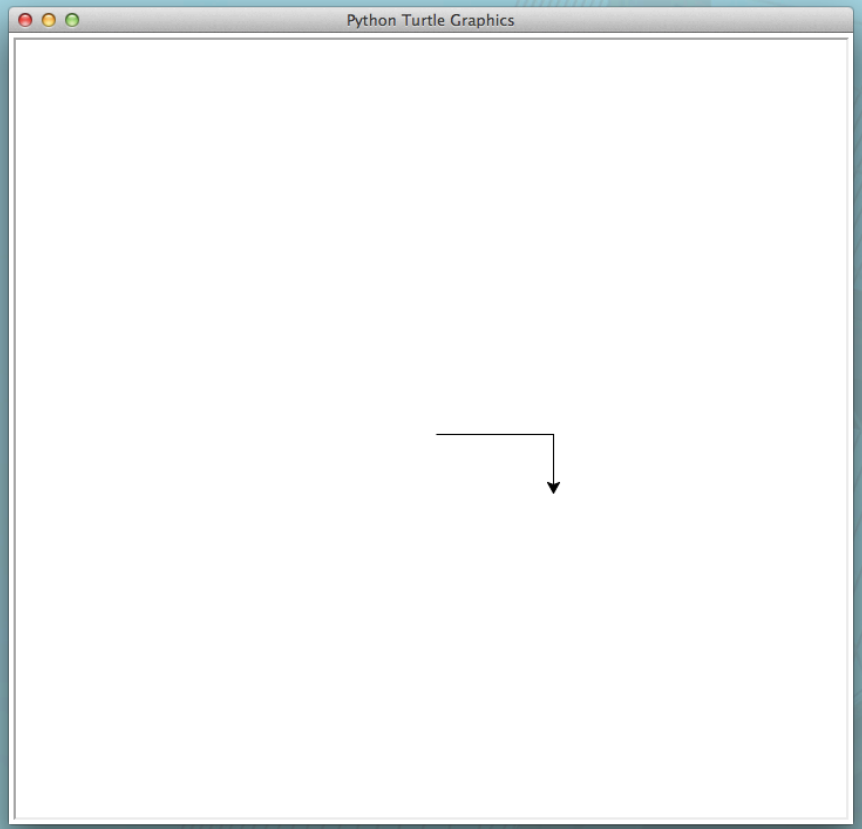
Figure 1.8



turtle module

- Simple graphics programming
- Abstraction
- Fun and easy

Figure 1.9



Defining Functions

- Name
- Parameters
- Body

Listing 1.1

```
def functionName(param1,param2,...):
    statement1
    statement2
    ...
```

Listing 1.2

```
def drawSquare(myTurtle,sideLength):
    myTurtle.forward(sideLength)
    myTurtle.right(90)   # side 1
    myTurtle.forward(sideLength)
    myTurtle.right(90)   # side 2
    myTurtle.forward(sideLength)
    myTurtle.right(90)   # side 3
    myTurtle.forward(sideLength)
    myTurtle.right(90)   # side 4
```

Figure 1.10

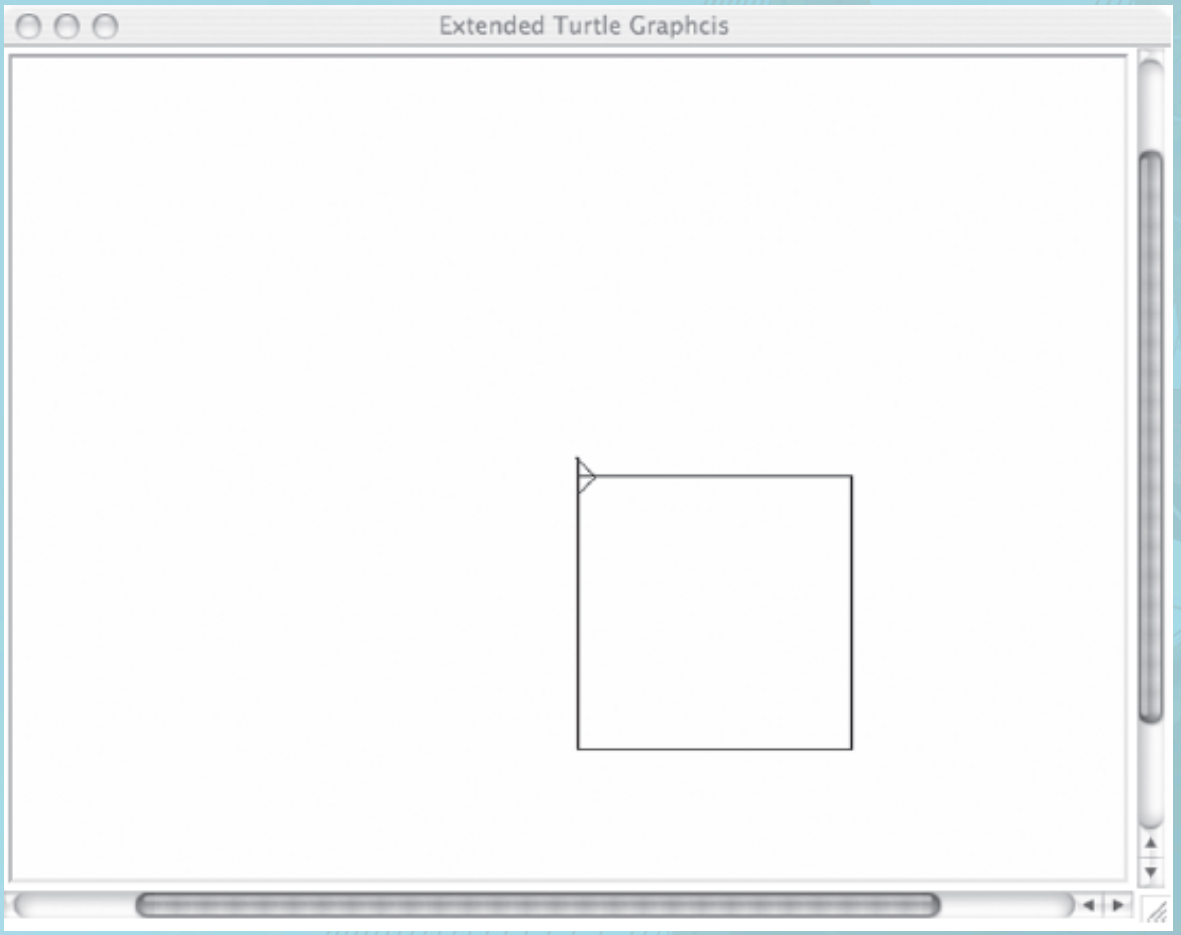
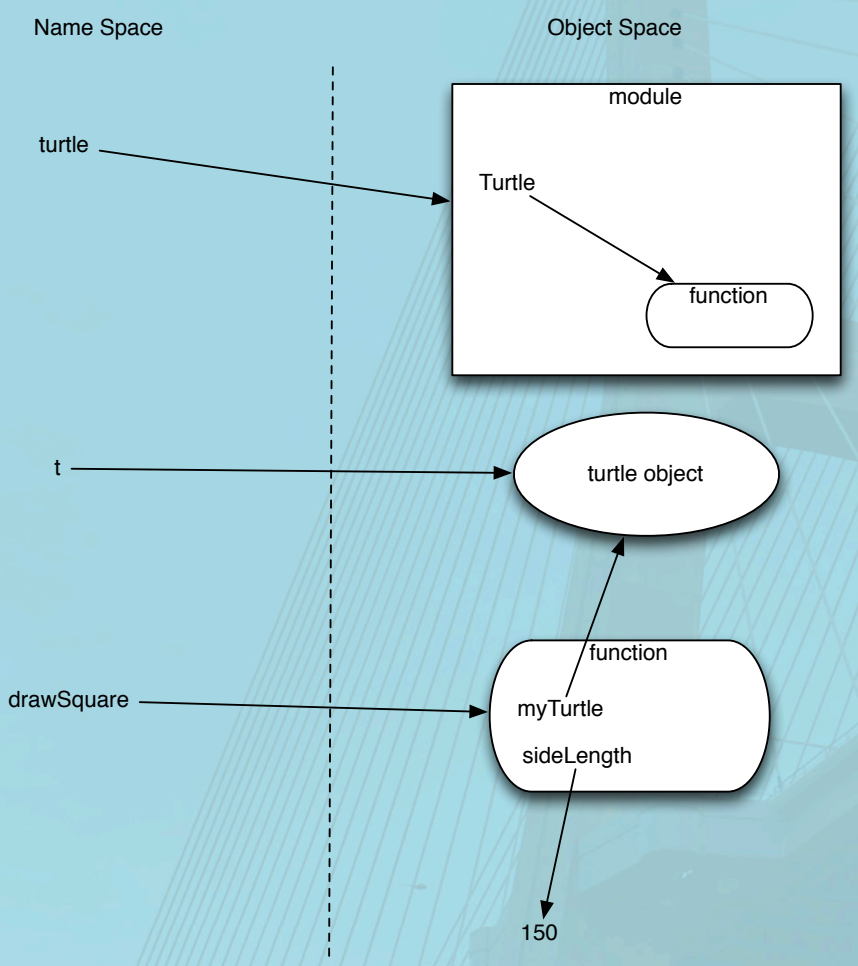


Figure 1.11



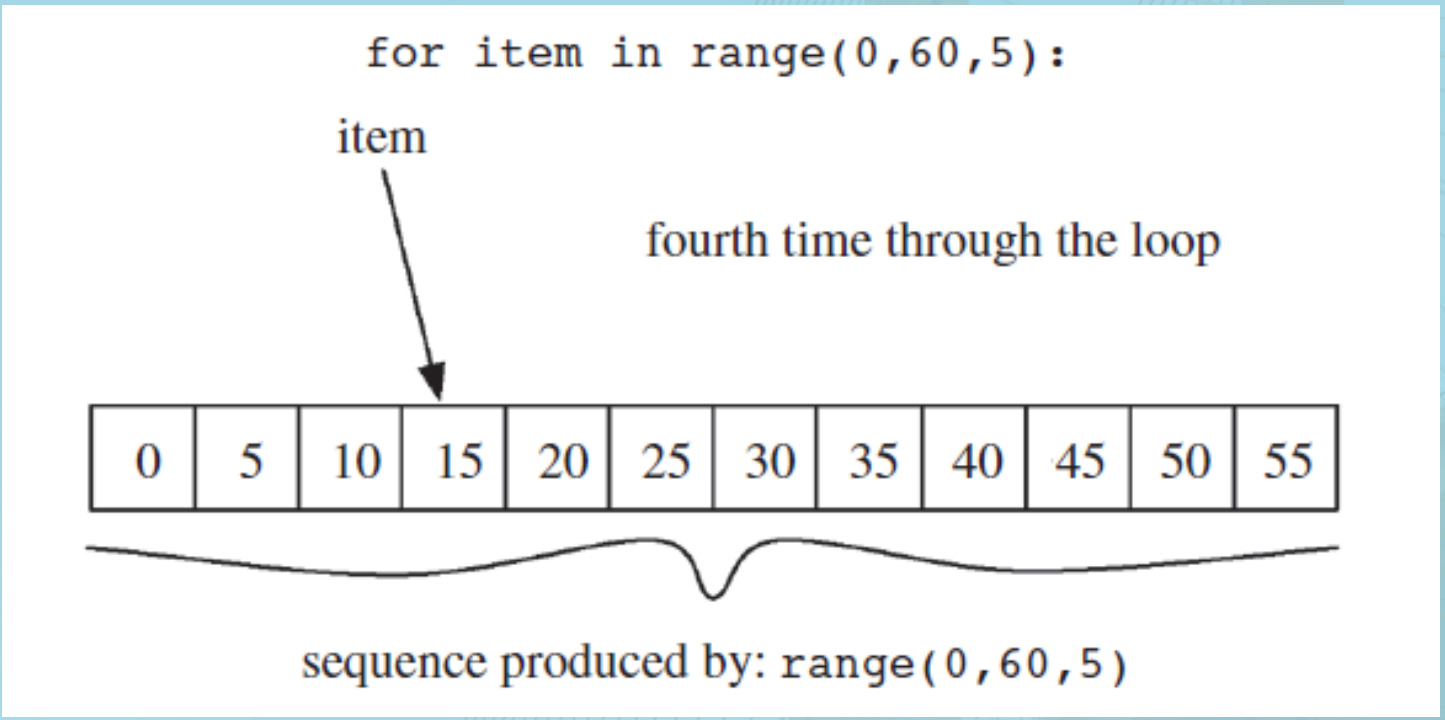
Iteration

- Repeat a sequence of steps
- Use a for statement
- range function

Listing 1.3

```
def drawSquare(myTurtle,sideLength):
    for i in range(4):
        myTurtle.forward(sideLength)
        myTurtle.right(90)
```

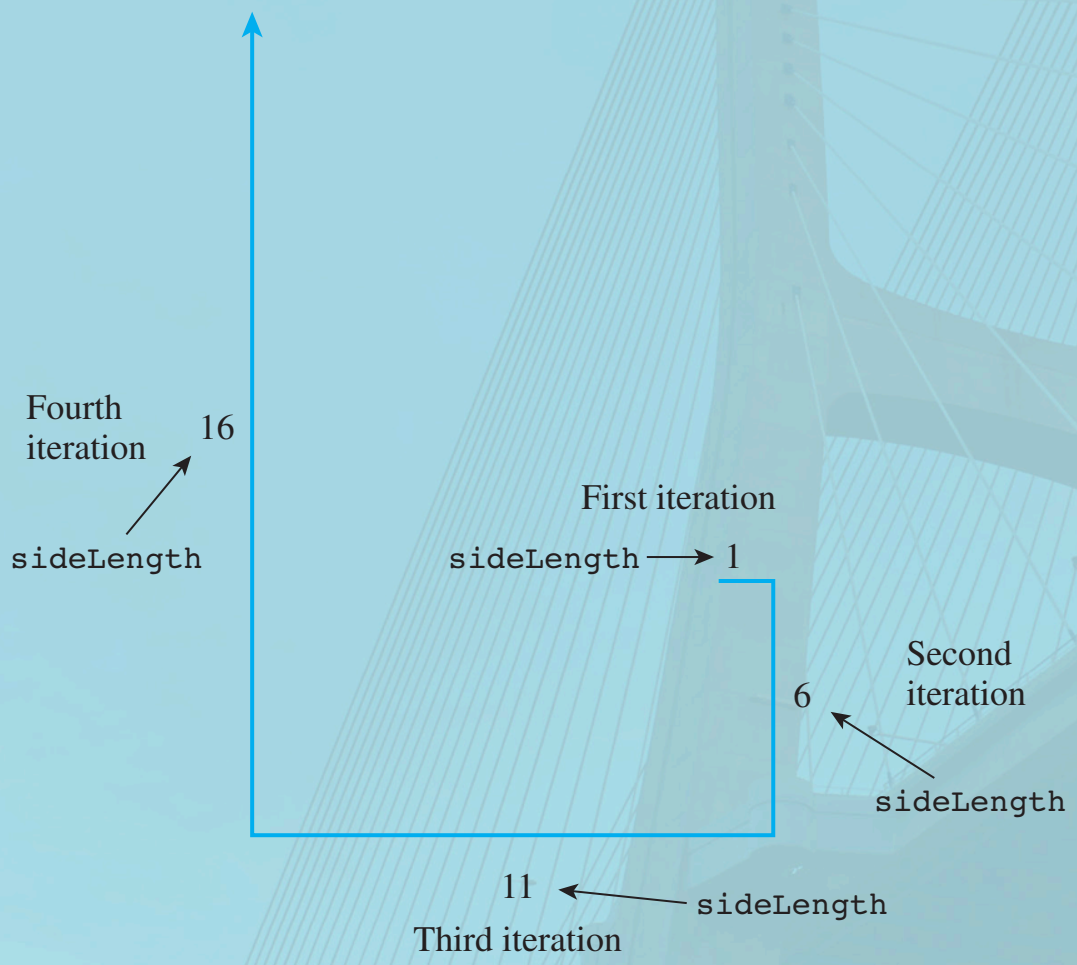
Figure 1.12



Listing 1.4

```
def drawSpiral(myTurtle,maxSide):
    for sideLength in range(1,maxSide+1,5):
        myTurtle.forward(sideLength)
        myTurtle.right(90)
```

Figure 1.13



Drawing a Circle

- Simplify and Generalize
- Polygon with more and more sides

Listing 1.5

```
def drawTriangle(myTurtle,sideLength):
    for i in range(3):
        myTurtle.forward(sideLength)
        myTurtle.right(120)
```

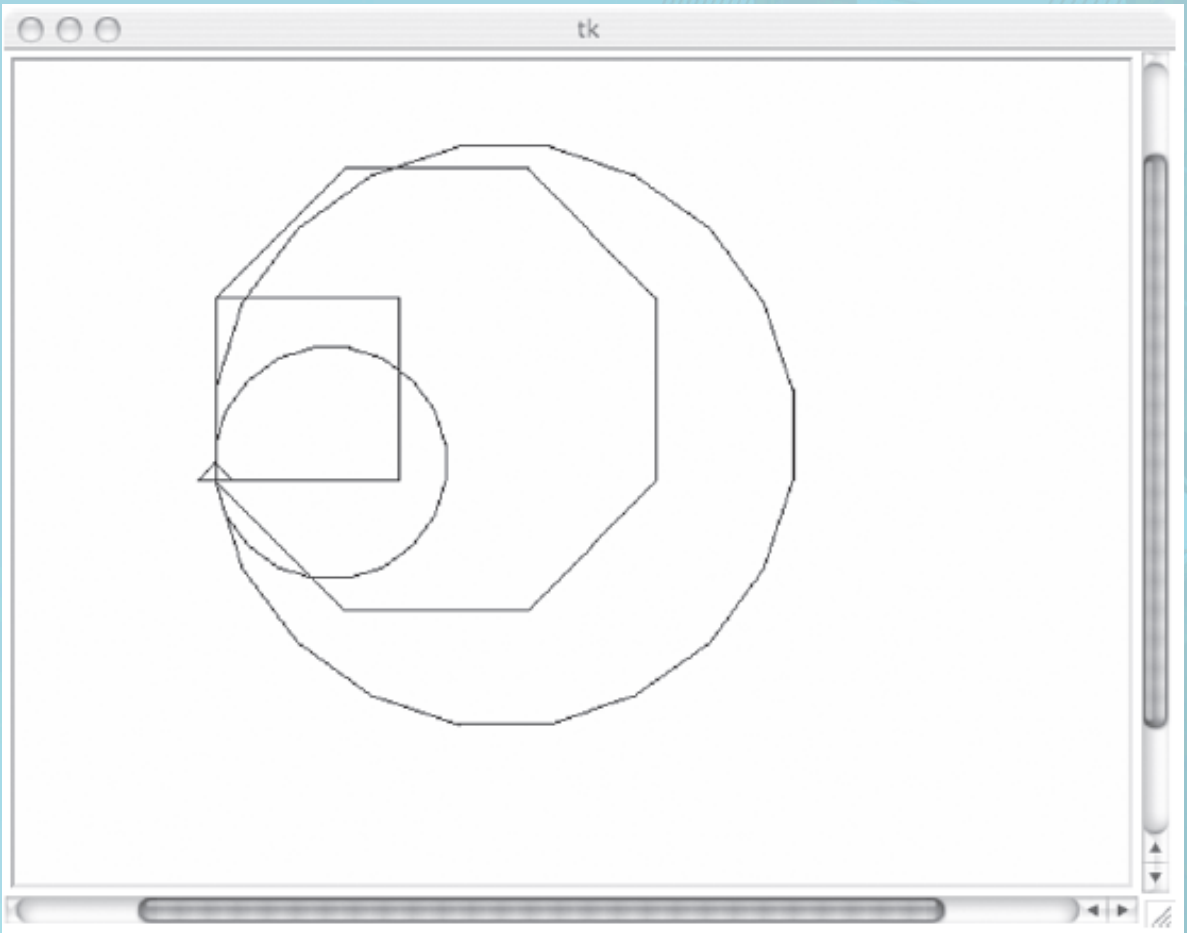
Generalize

- 3 sides – 120 degrees
- 4 sides – 90 degrees
- 5 sides – 72 degrees
- 8 sides – 45 degrees
- N sides - ? Degrees

Listing 1.6

```
def drawPolygon(myTurtle,sideLength,numSides):
    turnAngle = 360 / numSides
    for i in range(numSides):
        myTurtle.forward(sideLength)
        myTurtle.right(turnAngle)
```

Figure 1.14



Listing 1.7

```
def drawCircle(myTurtle,radius):
    circumference = 2 * 3.1415 * radius
    sideLength = circumference / 360
    drawPolygon(myTurtle,sideLength,360)
```

Figure 1.15