Art with Python

Turtle
Announcement

- Homework 2 will be posted today after TA William’s tutorial.
Learn

Iterations and recursions
Python

Just a little bit more Coding Basics

Credit: lecture notes modeled after http://www.openbookproject.net/thinkcs/python/english2e/index.html
for Loop

http://www.pythontutor.com/index.html
for iterating_var in sequence:
    STATEMENTS
fruit = 'apple'
for each_char in fruit:
    print each_char
Range function
A=range(10)
B=range(2,7)
C=range(0,10,2)
D=range(-10, -30, -5)
print A
print B
print C
print D
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
[2, 3, 4, 5, 6]
[0, 2, 4, 6, 8]
[-10, -15, -20, -25]
a = ['I', 'love', 'Python', 'programming']
for i in range(len(a)):
    print i, a[i]
I love Python programming
while Statement
while EXPRESSION:
    STATEMENTS
def newyear_countdown(n):
    while n > 0:
        print n
        n = n-1
    print "Happy New Year!"
newyear_countdown(10)
Happy New Year!
def num_digits(n):
    count = 0
    while n:
        count = count + 1
        n = n / 10
    return count

print num_digits(54320)
print num_digits(int('012345'))
print num_digits(int(23.45))
print num_digits(23.45)
And an infinite loop
def print_powers(n):
    i = 1
    while i <= 6:
        print n ** i, '\t',
        i += 1
    print
print_powers(2)
Lists
List is an ordered set of values.
It can contain mixed types.
A = [1, 2, 3, 4]
print A
B = ["hello", "and", "good morning"]
print B
C = ["hello", 100, 'person', 2.5, [1, 2]]
print C
[1, 2, 3, 4]
['hello', 'and', 'good morning']
['hello', 100, 'person', 2.5, [1, 2]]
empty = []
print empty
print 'this is[',empty,']'
this is [ ]
empty = []
print empty
print 'this is[',empty,']'
print type(empty)
this is
<type 'list'>
numbers = [1, 2, 3, 4, 5, 6]
print numbers[0]
print numbers[5]
print numbers[-1]
print numbers[-2]
rainyday = ["today", "is", "a", "rainy", "day"]

i = 0
while i < len(rainyday):
    print rainyday[i]
    i += 1

#See the flow of the program
today
is
a
rainy
day
rainyday = ['today', 'is', 'a', 'rainy', 'day']

print "today" in rainyday
print 'Today' in rainyday
print 'is' in rainyday
True
False
True
a = [1, 2, 3]
b = [10, 20, 30]
c = a + b
print c
d = a[1]*b
print d
e = a*4
print e
[1, 2, 3, 10, 20, 30]
[10, 20, 30, 10, 20, 30]
[1, 2, 3, 1, 2, 3, 1, 2, 3, 1, 2, 3]
alphabet = ['a', 'b', 'c', 'd', 'e', 'f']
print alphabet[1:3]
print alphabet[:]
print alphabet[0:1]
print alphabet[0:8]
['b', 'c']
['a', 'b', 'c', 'd', 'e', 'f']
['a']
['a', 'b', 'c', 'd', 'e', 'f']
['a', 'b', 'c', 'd', 'e', 'f']
Lists are mutable.
pie = ["banana", "apple", "pear", "strawberry"]
pie[0] = "peach"
pie[-1] = "chocolate"
print pie
['peach', 'apple', 'pear', 'chocolate']
if []:
    print "empty"
else:
    print "full"

# [] acts like 0 here
Lists are mutable, strings are not. Strings are immutable.
Tuple is a sequence of items of any type. Tuple is immutable.
my_tup = (1, 2, 3, 4, 5)
print type(my_tup)
print my_tup[0]
my_tup[0] = 6 #Assignment is not supported
TypeError: 'tuple' object does not support item assignment
Recursion
def recursive_sum(nested_num_list):
    sum = 0
    for element in nested_num_list:
        if type(element) == type([]):
            sum = sum + recursive_sum(element)
        else:
            sum = sum + element
    return sum

print recursive_sum([1,2,3,4])
Tail Recursion
def newyear_countdown(n):
    if n == 0:
        print "Happy New Year!"
    else:
        print n
        newyear_countdown(n-1)
newyear_countdown(5)
Happy New Year!

#see the order of execution
More Recursion Examples
def factorial(n):
    if n == 0:
        return 1
    else:
        return n * factorial(n-1)
print factorial(4)
Fibonacci number
def fibonacci(n):
    if n == 0 or n == 1:
        return 1
    else:
        return fibonacci(n-1) + fibonacci(n-2)

print fibonacci(3)
Python Turtle Review

https://trinket.io/python
import turtle

johnny = turtle.Turtle()

for i in range(0,4):
    johnny.forward(100)
    johnny.right(90)

https://trinket.io/python
import turtle
def draw_polygon(sides, length):
    johnny = turtle.Turtle()
    for i in range(0,sides):
        johnny.forward(length)
        johnny.right(360/sides)

draw_polygon(4,20)
draw_polygon(6,20)
import turtle

def draw_spiral(angle, length_start, length_increase, sides):
    for i in range(0, sides):
        johnny.forward(length_start+(i*length_increase))
        johnny.right(angle)

johnny = turtle.Turtle()
draw_spiral(30, 10, 2, 20)

Credit: https://www.linuxvoice.com/issues/002/02drawing.pdf
import turtle

def draw_petals(length, number):
    for i in range(0, number):
        johnny.forward(length)
        johnny.right(180-(360/number))  # number divisible by 360

johnny = turtle.Turtle()
draw_petals(50, 20)
Recursion with Python Turtle

https://trinket.io/python
import turtle

myTurtle = turtle.Turtle()
myWin = turtle.Screen()

def drawSpiral(myTurtle, lineLen):
    if lineLen > 0:
        myTurtle.forward(lineLen)
        myTurtle.right(90)
        drawSpiral(myTurtle, lineLen-5)

drawSpiral(myTurtle, 100)

Credit:
http://interactivepython.org/runestone/static/pythonds/index.html
import turtle

def tree(branchLen, t):
    if branchLen > 5:
        t.forward(branchLen)
        t.right(20)
        tree(branchLen-15, t)
        t.left(40)
        tree(branchLen-15, t)
        t.right(20)
        t.backward(branchLen)

Credit:
http://interactivepython.org/runestone/static/pythonds/index.html
def main():
    t = turtle.Turtle()
    myWin = turtle.Screen()
    t.left(90)
    t.up()
    t.backward(100)
    t.down()
    t.color("green")
    tree(75,t)
    myWin.exitonclick()
from turtle import *

def drawSnowFlake(length, depth):
    if depth > 0:
        for i in range(6):
            forward(length)
            drawSnowFlake(length // 3, depth - 1)
        backward(length)
    left(60)

drawSnowFlake(60,2)
drawSnowFlake(60,3)
William’s tutorial on his Python Turtle
Play with Python labs on your own!
THANKS!

Any questions?

You can find me at
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http://www.sci.utah.edu/~beiwang/teaching/cs1060.html
Credits

Special thanks to all the people who made and released these awesome resources for free:

- Presentation template by SlidesCarnival
- Photographs by Unsplash