

CS1110 Lab 4 (Feb 24-25, 2015)

First Name: _____ Last Name: _____ NetID: _____

The lab assignments are very important and you must have a CS 1110 course consultant “tell CMS” that you did the work. (Correctness does not matter.) This can be done any time up until the start of the next lab (Mar 3-4). Thus, if you have trouble with a problem, then you have a 1 week to get help from the teaching staff. But it is in your interest to complete this Lab before the A3 due date (Feb 26). If you finish before the hour is over, then you can leave early or you can work on the current assignment. Indeed, you are not required to physically attend the labs at all. Just make sure your work is “checked off” by a consultant. And remember this: *The lab problems feed into the assignments and the assignments define what the exams are all about.*

1 Getting Set Up

From the Lab webpage, download `Asteroid.py`, `Checkers.py`, `FunctionTrace.py`, `ShowLineSeg`, and `simpleGraphicsE.py`. Put them all in the same folder, say `Lab4`. In the command shell, navigate the file system so that this folder is THE CURRENT WORKING DIRECTORY.

2 String Methods

Assume that `s = 'February 15, 2015'`

	Expression	I Think the Value Is	Python Says	Notes
1	<code>s.count('1')</code>			
2	<code>s.find('f')</code>			
3	<code>s.replace(' ', '/')</code>			
4	<code>s[s.find('1'):]</code>			
5	<code>s[s.upper()]</code>			

6. Suppose `s1` and `s2` are strings and that the boolean expression

`s1.find(s2)>=0` and `s2.find(s1)>=0`

is `True`. What can you say about `s1` and `s2`? Explain.

3 Loops of the form for c in s

1. Consider the following script:

```
s = 'abcdefgh'
t = ''
for c in s:
    t = c + t + c
print t
```

What is the output? (Use pencil and paper. Then confirm with the computer.)

2. Consider the following function:

```
def f(s1,s2)
    """
    PreC: s1 and s2 are strings.
    """
    s = s1
    nullstring = ''
    for c in s2:
        s = s.replace(c,nullstring)
    return s
```

Describe in English what this function does.

3. Consider the following script:

```
s = 'aBBxCCCxDxEeeee'
n = 0
old = '' # null string
for c in s:
    if c==old:
        n = n + 1
    old = c
print n
```

What is the output? (Use pencil and paper. Then confirm with the computer.)

4 Asteroid

The module `Asteroid.py` includes the following function

```
def dist(t):  
    """ Returns a float that is the distance between Earth and a Rogue  
    asteroid at time t (days)  
  
    PreC: t is a nonnegative float."""
```

and an Application Script that computes the smallest of the numbers `dist(L),dist(L+1),...,dist(R-1), dist(R)`:

```
L = input('Enter initial time (integer): ')  
R = input('Enter final time (integer): ')  
  
# At any stage of the search, d_min is the smallest value of dis(t)  
# found thus far and t_min is the time associated with that minimum.  
d_min = dist(L)  
t_min = L  
for t in range(L+1,R+1):  
    d_current = dist(t)  
    if d_current < d_min:  
        # A new minimum has been found.  
        d_min = d_current  
        t_min = t  
print t_min, d_min
```

1. How would you modify the Application Script so that it printed out the largest of the numbers `dist(L),...,dist(R)`?

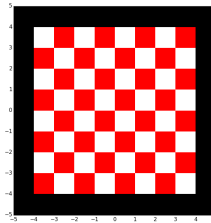
2. We say that a day is a *bad day* if the asteroid is closer to the earth than it was on the previous day. Consider time interval from day L up to and including day R . How would you modify the Application Script so that it prints out the number of those days that are bad?

5 Checkers.py

The module `Checkers.py` contains this function

```
def DrawRow(x0,y0,s,n,c1,c2):
    """ Draws a horizontal row of s-by-s squares. The
        center of the leftmost square is (x0,y0) and the
        first two leftmost squares have colors c1 and c2
        respectively.
    PreC: x0, y0, and s are floats, n is a positive integer, c1 and
        c2 are rgb arrays."""
```

and an Application Script that draws this:

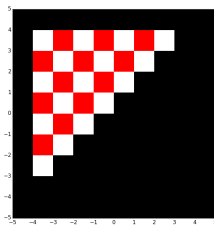


It works by calling `DrawRow` 8 times:

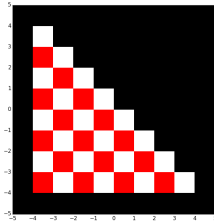
```
# The checkerboard is n-by-n and the squares are s-by-s
n = 8; s = 1
# The lower left square has center at (x0,y0)
x0 = -s*(n-1)/2.0; y0 = -s*(n-1)/2.0
# The checkerboard colors are c1 and c2
c1 = RED; c2 = WHITE
# y is the vertical coordinate of the next row to draw
y = y0
for k in range(n):
    # Draw the kth row
    if k%2==0:
        DrawRow(x0,y,s,n,c1,c2)
    else:
        DrawRow(x0,y,s,n,c2,c1)
    # The next row is up s units
    y = y+s
```

By making changes ONLY INSIDE the for-loop explain how to produce the following alternative designs.

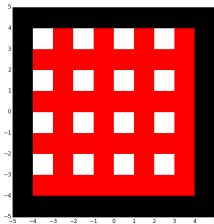
Describe changes inside the loop here:



Describe changes inside the loop here:



Describe changes inside the loop here:



6 Drawing Line Segments with DrawLineSeg

The module `simpleGraphicsE.py` includes this procedure:

```
def DrawLineSeg(a,b,L,theta,linecolor=BLACK):
    """ Draws a line segment with starting endpoint (a,b), length L,
    and heading theta (degrees).
```

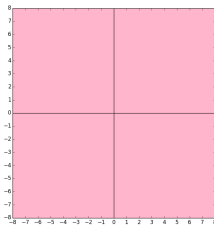
The line color can be one of the 13 built-in colors YELLOW, CYAN, MAGENTA, RED, GREEN, BLUE, WHITE, BLACK, PURPLE, LIGHTFGRAY, DARKGRAY, ORANGE, or PINK or an rgb array. The default value for linecolor is BLACK.

The drawn line segment has endpoints (a,b) and (a+cL,b+sL) where $c = \cos(\pi\theta/180)$ and $s = \sin(\pi\theta/180)$

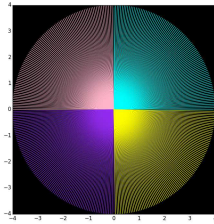
Preconditions: a,b, L and theta are float or int. L is positive and theta is given in degrees. linecolor is an rgb array and stroke is a positive float or int.

“Fill in the blanks” in the module `ShowLineSeg.py` so that it produces these three images:

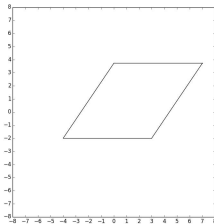
Describe the blanks you “filled in” here:



Describe the blanks you “filled in” here:



Describe the blanks you “filled in” here:



7 The Mechanics of a Function Call

Here is the module `FunctionTrace.py`. What output does it produce?

```
def f1(x,y):
    z = x
    x = y
    y = z
    print x,y,z
    return y

def f2(x,y):
    if x>y:
        z = f1(x,y)
    else:
        z = f1(y,2*x)
    return z

if __name__ == '__main__':
    x = 3;
    y = 2;
    z = f1(y,x)
    print x,y,z
    a = 10
    b = 20
    c = f2(a,b)
    print a,b,c
    c = f2(b,a)
    print a,b,c
```