CS1110 Lab 5 (Mar 3-4, 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 10-11). 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 A4 due date (Mar 5). 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`, `simpleGraphicsE.py`, `ShowRand.py`, `ShowBF.py`, `Paintbal.py`, and `UpDown.py`. Put them all in the same folder, say `Lab5`. In the command shell, navigate the file system so that this folder is THE CURRENT WORKING DIRECTORY.

2 Random Simulations

2.1 `random.randint` and `random.uniform`

The following script produces 4 lines of output:

```
# ShowRand.py
from random import randint as randi
from random import uniform as randu

N = 100000
count=0
for k in range(N):
    x = randu(0,100)
    if 10<=x<=30 or 40<=x<=7:
        count +=1
print float(count)/float(N)

count=0
for k in range(N):
    x = randu(0,100)
    if 10<=x<=50 and   20<=x<=60:
        count +=1
print float(count)/float(N)

count=0
for k in range(N):
    x = randi(1,20)
    if x%2==1:
        count +=1
print float(count)/float(N)

count=0
for k in range(N):
    x = randi(1,20)
    if 13<=x<15:
        count +=1
print float(count)/float(N)
```
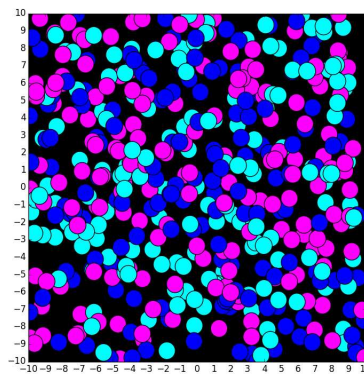
Fill in the following table:

		I Think it's This	Python Says	Notes
1	`First Output Line`			
2	`Second Output Line`			
3	`Third Output Line`			
4	`Fourth Output Line`			

2.2 Paintball

Run the module `Paintball.py` and observe that it randomly places 500 color disks in the figure window:

How could you modify the computation of x and y so that no paintball is "cut off" by the edge of the figure window?

As it stands, the color is Magenta with probability 1/3, Cyan with probability 1/3, and blue with probability 1/3. How could you change

```
rc = randi(1,3)
if rc%3==0:
    c = MAGENTA
elif rc%3==1:
    c = CYAN
else:
    c = BLUE
```

so that we draw a Magenta disk with probability 1/2, a Cyan disk with probability 1/3, and a blue disk with probability 1/6? Hint: `randi(1,6)`.
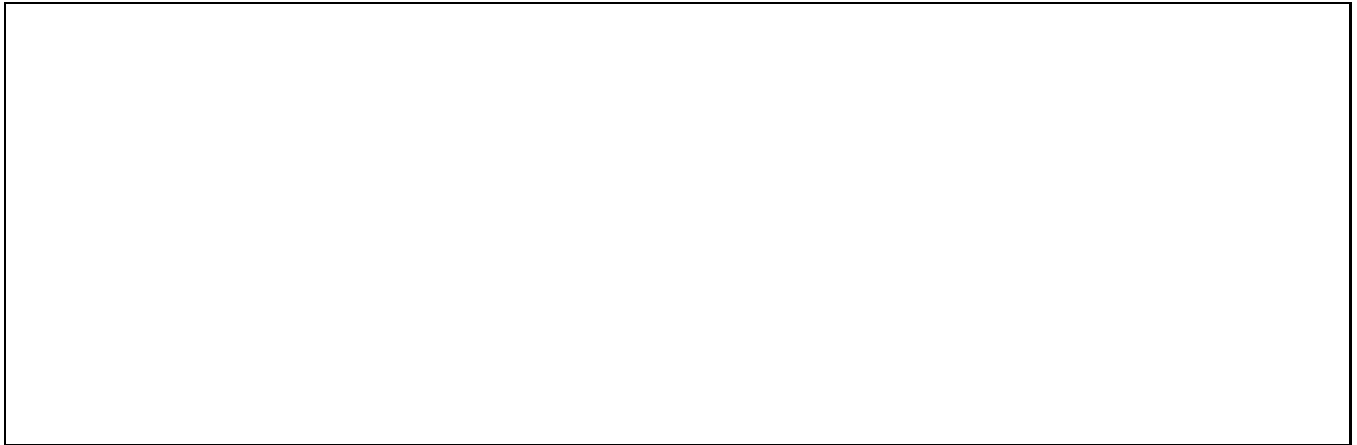
3 While Loop

3.1 Converting a For-Loop to a While-Loop

Look at the module `Asteroid.py` and notice that there is a for-loop in the Application Script. Change it to an equivalent `While`-loop. Indicate what the while loop and initializations look like here:
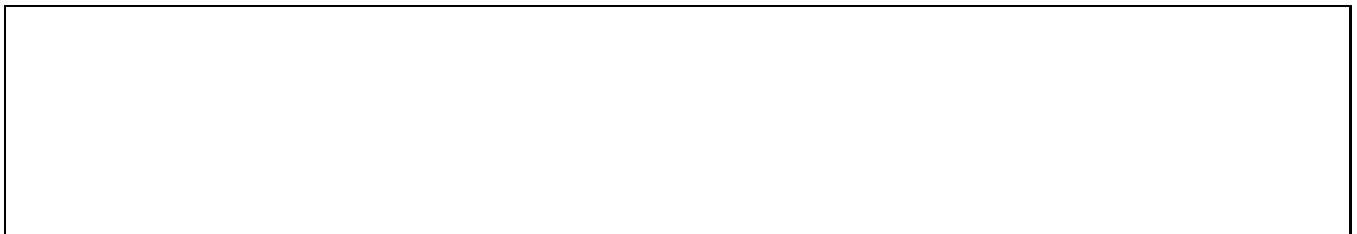
3.2 Up-Down

Consider the module `UpDown.py`:

```
""" Generates the Up/Down sequence.
If m is even, the next m is m/2
If m is odd, the next m is 3m+1
"""

n = input('Enter a positive integer: ')
m = n
steps=0
while m>1:
    if m%2 == 0:
        # m is even
        m = m/2
    else:
        # m is odd
        m = 3*m+1
    steps+=1
    print steps,m
```

Describe how you would augment this code so that after the loop is over, the largest value that `m` takes on during the iteration is printed out.

Modify the while loop condition so that the iteration terminates if `steps ==100` is `True`.

4 Boolean-Valued Functions

Consider the following module:

```
# ShowBF.py

from random import uniform as randu
import math

def B(x):
    """ Returns True if x is strictly closer to an even integer than to
    an odd integer and False otherwise

    PreC: x is a positive float

    """
    L = int(math.floor(x))
    R = int(math.ceil(x))
    z = True
    return z

if __name__ == '__main__':
    for k in range(10):
        x = randu(10,99)
        if B(x):
            print x,'yes'
        else:
            print x,'no'
```

Replace the "`True`" in the `z = True` line with a boolean expression so that the implementation of `B(x)` is correct. Write the expression here:

Hint. `L <= x <= R` is true and `L` and `R` are integers. Either `L` is odd and `R` is even or `L` is even and `R` is odd.