Term 1 Practice Questions

The University of British Columbia
Science One CS 2015-2016
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1. A student decides to extend the Random Walker code from Assignment 1 to a random walk in three dimensions instead of two. The code is meant to behave exactly the same as in the 2-d random walker: given a command-line argument N, the random walker should take N steps in a random direction, where each direction is equally likely. The student writes the following code:

```
import sys
import random

N = int(sys.argv[1])
n = random.random()

x = 0
y = 0
z = 0
count = 0
while count <= N:

    if n < 1/6:
        x = x + 1
    if n >= 1/6 and n < 2/6:
        x = x - 1
    if n >= 2/6 and n < 3/6:
        y = y + 1
    if n >= 3/6 and n < 4/6:
        y = y - 1
    if n >= 4/6 and n < 5/6:
        z = z + 1
    if n >= 5/6:
        z = z - 1

    print "("+str(x)+", "+str(y)+", "+str(z)+")"
    count = count + 1

print "squared distance = " + str(x*x + y*y + z*z)
```

When running the code, the following output is observed *every time* the program is run:

```
>> python RandomWalker3d.py 5
(0, 0, -1)
(0, 0, -2)
(0, 0, -3)
(0, 0, -4)
(0, 0, -5)
(0, 0, -6)
squared distance = 36
```

Help the student debug the program by identifying the bugs and explaining and how to fix them. Hint: the program contains three different bugs.

2. What is the output of the following code?

```
import numpy as np
N = 5
x = np.zeros(N)
n = 1
while n < N:
        x[n] = n*x[n-1] + 1
        n = n + 1
print x[N-1]
```

3. Write a function `countChar` that takes as its arguments two strings, `s` and `c`, and returns the number of times the character `c` occurs in the string `s`. We will assume that `c` is always a string of length 1 (a single character). Here are some sample calls to this function:

```
>> countChar("HELLO", "L")
2

>> countChar("hello", "m")
0

>> countChar("", "L")
0
```

Note: in Python you can access the ith character in a string `s` the same way you access the ith element of an array, namely using `s[i]`.