More Sample Prelim Questions

1 String Manipulation

(a) Implement the following function so that it performs as specified.

```python
def Q1(s):
    """ Returns True if the characters at the start and end of s are the same and occur nowhere else in s
    ""

    PreCondition: s is a string with length greater than or equal to 3.
    ""
```

(b) Imagine playing around with this script:

```python
s = raw_input('Enter a string that has length greater than or equal to 2: ')
t = s.replace(s[0], 'x')
u = t.replace('x', s[0])
print s, u
```

Sometimes it is the case that the printed values of `s` and `u` are the same and sometimes it is observed that they are different. Give a Boolean expression that is True if `u` and `s` have the same value and is False otherwise. Hint. Consider some small examples.
2 Random Walk

A random walk simulation produces a travel string comprised of the characters N, S, E, and W. The travel string encodes the hop directions associated with the robot’s journey from (0,0) to a purple boundary tile. Here is a display of an $n = 5$ “hopping arena” highlighting its four middle edge tiles:

(a) Assume that $x$ and $y$ are initialized with the $(x, y)$ coordinates of the robot’s location and that the value of $n$ is the size of the hopping arena. Give a Boolean expression that is True if the robot is on a middle edge tile and False otherwise.

(b) A hop is “predictable” if it is in the same direction as the previous hop. Here is a travel string that includes 3 predictable hops: ‘EWWNNWWN’. Complete the following function so that it performs as specified.

```python
def nPredictable(s):
    """ Returns an int that is the number of predictable hops in s.
    Precondition: s is a travel string.
    """
```
3 Short Answer

(a) Assign a value to $x$ so that the character ‘A’ is printed out:

\[
x = \underline{\text{____________________}}
\]

if $x\%2==0$ and $x\%3==1$:
    print 'A'

(b) Assign values to $x \text{ and } y$ so that the character ‘D’ is printed out:

\[
x = \underline{\text{____________________}}
\]

\[
y = \underline{\text{____________________}}
\]

if not ((0<=$x<=$3) and (0<=$y<=$3)):
    print 'A'
elif $y<=$1 \text{ or } y>=$2:
    print 'B'
elif $x<=$1 \text{ or } x>=$2:
    print 'C'
else:
    print 'D'

(c) What would be the output if the following code is executed?

\[
x = \text{float}(10/4)
\]
print $x$
(d) Suppose the functions in modules M1.py and M2.py are to be used by module M.py. Briefly explain why it is safer to implement M.py with

```python
import M1
import M2
```

than with

```python
from M1 import *
from M2 import *
```

(e) Indicate what the output would be if the following application script is run:

```python
def F(x,y):
    x = y
    y = x
    z = x+2*y
    print x,y,z
    return z

if __name__ == '__main__':
    x = 1
    y = 2
    print x,y
    x = F(y,x)
    print x,y
    if x<y:
        print 'A'
    else:
        print 'B'
```
4 Loops

(a) Consider the following script

```python
    t = 'x'
s = raw_input('Enter a string: ')
for c in s:
    t = t + c + t
```

Assuming that ‘ba’ is assigned to `s`, what is the final value of `t`? Show work.

(b) Write a script that is equivalent to the script in part (a) but which uses a while-loop instead of a for-loop.
5  A Graphics Procedure

Assume the availability of the following procedure:

```python
def DrawRow(x0,y0,s,n):
    """ Draws a horizontal row of n squares that are each s-by-s. The center of the leftmost square is (x0,y0).

    Precondition: x0, y0, and s are floats, n is a positive integer"
```

By making effective use of `DrawRow`, implement the following procedure so that it performs as specified

```python
def DrawPyramid(x0,y0,s,n):
    """ Draws a pyramid of s-by-s squares. The bottom row consists of n squares and the lower left corner of the leftmost square is at (x0,y0).
    There are n rows of squares and each row has one less square than the row beneath it. The centers of each row are vertically aligned.

    Precondition: x0, y0, and s are floats, n is a positive integer"
```

For your information, the call `DrawPyramid(-5.,-5.,2.,5)` would produce this figure:

![Image of a pyramid](image-url)
## Function Information

<table>
<thead>
<tr>
<th>Function</th>
<th>What It Does</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>len(s)</code></td>
<td>returns an <code>int</code> that is the length of string <code>s</code></td>
</tr>
<tr>
<td><code>s.count(t)</code></td>
<td>returns an <code>int</code> that is the number of occurrences of string <code>t</code> in string <code>s</code></td>
</tr>
<tr>
<td><code>s.find(t)</code></td>
<td>returns an <code>int</code> that is the index of the first occurrence of string <code>t</code> in the string <code>s</code>. Returns -1 if no occurrence.</td>
</tr>
<tr>
<td><code>s.replace(t1,t2)</code></td>
<td>returns a string that is obtained from <code>s</code> by replacing all occurrences of <code>t1</code> with <code>t2</code>.</td>
</tr>
<tr>
<td><code>floor(x)</code></td>
<td>returns a float whose value is the largest integer less than or equal to the value of <code>x</code>.</td>
</tr>
<tr>
<td><code>ceil(x)</code></td>
<td>returns a float whose value is the smallest integer greater than or equal to the value of <code>x</code>.</td>
</tr>
<tr>
<td><code>int(x)</code></td>
<td>If <code>x</code> has type <code>float</code>, converts its value into an <code>int</code>. If <code>x</code> is a string like '-123', converts it into an <code>int</code> like -123.</td>
</tr>
<tr>
<td><code>float(x)</code></td>
<td>If <code>x</code> has type <code>int</code>, converts its value into a <code>float</code>. If <code>x</code> is a string like '1.23', converts it into a <code>float</code> like 1.23.</td>
</tr>
<tr>
<td><code>str(x)</code></td>
<td>Converts the value of <code>x</code> into a string.</td>
</tr>
<tr>
<td><code>DrawRect(x,y,L,W)</code></td>
<td>Draws a rectangle with center <code>(x, y)</code>, horizontal dimension <code>L</code>, and vertical dimension <code>W</code>.</td>
</tr>
<tr>
<td><code>DrawDisk(x,y,r)</code></td>
<td>Draws a circle with center <code>(x, y)</code> and radius <code>r</code>.</td>
</tr>
<tr>
<td><code>DrawStar(x,y,r)</code></td>
<td>Draws a star with center <code>(x, y)</code> and radius <code>r</code>.</td>
</tr>
<tr>
<td><code>DrawLineSeg(x,y,L,d)</code></td>
<td>Draws a length <code>L</code> line segment that starts at <code>(x, y)</code> and makes counterclockwise angle of <code>d</code> degrees with the positive x-axis.</td>
</tr>
</tbody>
</table>