1 String Methods

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

```python
def Q1(s):
    """ Returns True if the first half of s is exactly same as the second half of s.
    PreCondition: s is a non-empty string with even length.
    """
```

(b) What can you say about a string $s$ if the boolean expression $s.count(s[0]) == len(s)-1$ is True? Assume that $s$ has length 2 or greater.

(c) Give an example of a string $s$ for which the boolean expression $s.find('xx') > find('x') >= 0$ is True.

2 Loops

(a) Consider the following script:

```python
N = input('Enter a positive integer: ')
s1=0
s2=0
for k in range(1,N+1):
    if k%2==0
        s1 = s1+k
    else:
        s2 = s2+k
print s2-s1
```

What is the output if the value of $N$ is 4? What is the output if the value of $N$ is 99?

(b) Consider the following script:

```python
k = 0
while k<=100:
    print k
    k=k+5
```

Write an equivalent script that makes effective use of a for-loop.

(c) Describe in English what the following function returns:

```python
def F(s):
    """ PreCondition: s is a non empty string
    """
    t = '' # Empty string
    for c in s:
        if s.count(c)==1:
            t = t+c
    return t
```
3 Random Walk

Consider the random walk simulation in Assignment 4. Recall that the 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 $n = 5$ playpen:

(a) Suppose $t$ is a length-4 string that encodes the robot’s next four hop directions. If after these four hops the robot ends up where it started, then we say that $t$ is a “cycle” string. Here are some examples: ’NESW’, ’EEWW’, ’NSSN’. Complete the following function so that it performs as specified:

```python
def isCycle(s):
    """ Returns True if s is a cycle string and False otherwise.
    PreCondition: s is a length-4 string made up of the characters N, E, S, and W.
    """
```

(b) Complete the following function so that it performs as specified.

```python
def nLoops(s):
    """ Returns the number of cycle strings in s[:(len(s)-1)]
    PreCondition: s is a travel string.
    """
```
4 Short Answer

(a) Assign a value to $x$ so that the following code prints ‘‘A’’:

```python
x = ________________________
if x == x-(x/d)*d+7:
    print 'A'
```

(b) Assume that $x$, $y$, and $z$ are initialized integers. Can the Boolean expression $(x*y)/z \neq x*(y/z)$ ever be True? Explain.

(c) Indicate the output if the following application script is run:

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

if __name__ == '__main__':
    x = 1
    y = 10
    u = 0
    print x,y,u
    y = F(y,x)+F(2*x,y)
    print x,y,u
```

(d) A function can have local variables and parameters. Explain using as an example the function $F$ in part (c).
5 A Graphics Computation

By adding code in between the two comments, produce a script that draws the figure below

```python
x = -5
y = 0
r = 2
alfa = .75
DrawDisk(x,y,r)

for k in range(7):
    ##################################################
    DrawDisk(x,y,r)
    ##################################################
    DrawDisk(x,y,r)

Assume (a) all the circles have their centers on the x-axis, (b) the radius of a given circle is .75 times the radius of the circle to its left, (c) the circles are tangent to each other, and (d) the leftmost circle has radius 2 and center (-5,0)
def ThreeDigit(n):
    """Returns a length-three string that encodes the integer n.

    Leading zeros are included if necessary, e.g., '000', '001', '012'.

    Precondition: n is an integer that satisfies 0<=n<=999.
    """
<table>
<thead>
<tr>
<th>Function</th>
<th>What It Does</th>
</tr>
</thead>
<tbody>
<tr>
<td>len(s)</td>
<td>returns an int that is the length of string s</td>
</tr>
<tr>
<td>s.count(t)</td>
<td>returns an int that is the number of occurrences of string t in string s</td>
</tr>
<tr>
<td>s.find(t)</td>
<td>returns an int that is the index of the first occurrence of string t in the string s. Returns -1 if no occurrence.</td>
</tr>
<tr>
<td>s.replace(t1,t2)</td>
<td>returns a string that is obtained from s by replacing all occurrences of t1 with t2.</td>
</tr>
<tr>
<td>floor(x)</td>
<td>returns a float whose value is the largest integer less than or equal to the value of x.</td>
</tr>
<tr>
<td>ceil(x)</td>
<td>returns a float whose value is the smallest integer greater than or equal to the value of x</td>
</tr>
<tr>
<td>int(x)</td>
<td>If x has type float, converts its value into an int.</td>
</tr>
<tr>
<td></td>
<td>If x is a string like '-123', converts it into an int like -123</td>
</tr>
<tr>
<td>float(x)</td>
<td>If x has type int, converts its value into a float.</td>
</tr>
<tr>
<td></td>
<td>If x is a string like '1.23', converts it into a float like 1.23.</td>
</tr>
<tr>
<td>str(x)</td>
<td>Converts the value of x into a string.</td>
</tr>
<tr>
<td>DrawRect(x,y,L,W)</td>
<td>Draws a rectangle with center (x, y), horizontal dimension L, and vertical dimension W.</td>
</tr>
<tr>
<td>DrawDisk(x,y,r)</td>
<td>Draws a circle with center (x, y) and radius r.</td>
</tr>
<tr>
<td>DrawStar(x,y,r)</td>
<td>Draws a star with center (x, y) and radius r.</td>
</tr>
<tr>
<td>DrawLineSeg(x,y,L,d)</td>
<td>Draws a length L line segment that starts at (x, y) and makes counterclockwise angle of d degrees with the positive x-axis.</td>
</tr>
</tbody>
</table>