420-PRO-LCU Programming in Python - Exercise 3

These are practice questions *similar* to what you *might* see on a test. These will *not* be collected or graded, but I recommend trying these as practice.

1. Write a Python program to do the following:

   (a) Ask the user to enter a integer x.

   (b) If x is less than or equal to zero, print an error go to step (e).

   (c) If x is greater than zero, print the *triangular* number $y = \sum_{k=1}^{n} k$.

   (d) Return to step (a).

   (e) Print 'Finished'.

   Computing the triangular number for an integer typically involves a loop, but there is a more efficient way to compute it. Either approach is fine for this exercise.

2. Write a Python program to do the following:

   (a) Ask the user to enter a floating-point number x.

   (b) Find the *cube root* of x using bisection search (NOT using `x ** (1/3)`!!!)

   The cube root function is *monotonic* over its entire range, however, it will take a little extra code to make the correct choice for the initial search interval in order to get this to work for $-1 < x < 1$.

3. Amy's parents were too cheap to buy her a smart phone, so they got her an old-fashioned flip phone[1]. Instead of having a "proper" touchscreen keyboard, her phone just has a keypad like this:

1	2 abc	3 def
4 ghi	5 jkl	6 mno
7 pqrs	8 tuv	9 wxyz

   Typing a text message requires patience, as in order to type a particular letter you need to press the associated numeric key between 1 and 4 times. For example, to enter a 'k' Amy has to press 5 twice, to produce an 's' she has to press 7 four times.

   A problem arises with this scheme. If you want to type the word 'cab', you need to press 222 for the 'c', 2 for the 'a', and 22 for the 'b'. But if you just pressed 222222 in rapid succession, the phone might think you meant to type 'cc'. To avoid this ambiguity, you need to pause before attempting to type another letter that uses the same key, so the word 'cab' becomes 222-pause-2-pause-22. If the next letter is on a different key, there's no need to pause.

   Amy is trying to lobby her parents for a better phone, so she decides to write a program that will calculate how long it will take her to type a particular message. She assumes it takes one second to press a key, and two seconds for a pause, so the word 'cab' will require 10 seconds.

   Write a program to compute how long many seconds it takes to type a series of words. Each word will be entered in lower-case letters on a separate line, and program will exit when the line is blank (empty). After reading each word, your program should print the number of seconds required to type that word. A session with your program should look like this (the input is in red, the program's response is in black).

   ```
   a
   1
   map
   3
   feed
   14
   cell
   13
   ```

   Note that this program can be made about half as long by using a list to store the strings corresponding to the characters on each key.

[1] Adapted from a question in the Canadian Computing Competition

4. What would each of the following Python programs print?

(a)

```
x = 1
y = 1
while x < 6:
    y *= x
    x += 2
print(x, y)
```

(b)

```
c = [11, 21, 33, 42, 50, 26, 8]
i = 0
while i < len(c):
    if c[i] > 40:
        break
    i += 1
print(i, c[i], c[-i])
```

(c)

```
x = "Zero"
n = len(x)
i = 0
r = ''
while i < n - 1:
   j = i + 1
   while j < n:
      r += x[i] + x[j]
      j += 1
   i += 1
print(r)
```

---

5. Simplify the following Boolean expressions. Remove all of the explicit comparisons to `True` or `False`. Assume that all of the names represent Boolean values.

(a)

```
x = not (a == True and b == False) or c == True
```

(b)

```
y = (a != False or b != False) and (a == True or c != True)
```
