Homework #7 - SOLUTIONS

The following programs are due at the beginning of class on Tuesday, November 5. You can submit your programs online via NYU Classes. Please submit a separate .py file for each program, and put your name and the problem/assignment number in a comment at the top of the program.

1. Modify your guessing game program from homework #5 (problem #3) so that it randomly picks a whole number between 1 and 100 and then asks the user to guess this number (with hints like "Higher!" and "Lower!")

```python
# SOLUTIONS: Homework 7 – Problem 1
import random

secret_number = random.randint(1, 100)
count = 1
guess = int(input("I’m thinking of a number between 1 and 100. Can you guess what it is? "))

while guess != secret_number:
    count += 1
    if guess < secret_number:
        print("Higher!")
        guess = int(input("What number am I thinking of? "))
    elif guess > secret_number:
        print("Lower!")
        guess = int(input("What number am I thinking of? "))

if count > 1:
    print("You guessed it! And it only took you", count, "tries. ")
else:
    print("You guessed it! And it only took you", count, "try.")
```

2. The average value in the following data set is 5.

```
3, 6, 7, 5, 4
```

When statisticians want to measure how much variation there is from the average, they use a statistic called the standard deviation. To calculate the standard deviation, first compute
the difference of each data point from the average and square each result.

\[
(3 - 5)^2 = (-2)^2 = 4 \\
(6 - 5)^2 = (-1)^2 = 1 \\
(7 - 5)^2 = 2^2 = 4 \\
(5 - 5)^2 = 0^2 = 0 \\
(4 - 5)^2 = (-1)^2 = 1
\]

Next, add up each of these numbers, divide by the total number of data points minus one, and take the square root of the result:

\[
\sqrt{\frac{4 + 1 + 4 + 0 + 1}{5 - 1}} = \sqrt{\frac{10}{4}} \approx 1.58
\]

The standard deviation is this number, 1.58. This is a tedious calculation even when you only have five data points! Write a function calculate_standard_deviation that takes a list of numbers as an argument and returns the standard deviation. Use your function to write a program that calculates the standard deviation for the data set

\[3, 6, 7, 5, 4, 2, 2, 1, 10, 9, 4, 6, 4, 5, 2, 7, 8, 3, 9, 3\]

# SOLUTIONS: Homework 7 – Problem 2
from math import sqrt

def calculate_mean(list_of_numbers):
    total = 0
    count = 0
    for num in list_of_numbers:
        total += num
        count += 1
    return total/count

def calculate_standard_deviation(list_of_numbers):
    total = 0
    count = 0
    mean = calculate_mean(list_of_numbers)
    for num in list_of_numbers:
        total += (num - mean)**2
        count += 1
    variance = total/(count - 1)
    return sqrt(variance)

sample = [3, 6, 7, 5, 4, 2, 2, 1, 10, 9, 4, 6, 4, 5, 2, 7, 8, 3, 9, 3]
stddev = calculate_standard_deviation(sample)
stddev = format(stddev, ',.4f')
print("The standard deviation is ", stddev, ",", sep='')
# ALTERNATE SOLUTION: Homework 7 – Problem 2

This solution is more polished (but more complicated.) It gets the list of numbers from the user, and avoids the special case where you would accidentally divide by 0.

```python
from math import sqrt

def get_sample():
    list_of_numbers = []
    num =
    print("This program calculates the standard deviation of a sample.")
    print("Please enter the data in your sample, one number at a time, and enter 'done' when you're done.")
    while num != 'done':
        num = input("The next number is ? ")
        if num != 'done':
            num = int(num)
            list_of_numbers += [num]
    return list_of_numbers

def calculate_mean(list_of_numbers):
    total = 0
    count = 0
    for num in list_of_numbers:
        total += num
        count += 1
    if count != 0: #This if statement is to avoid dividing by 0.
        return total/count

def calculate_standard_deviation(list_of_numbers):
    total = 0
    count = 0
    mean = calculate_mean(list_of_numbers)
    for num in list_of_numbers:
        total += (num - mean)**2
        count += 1
    if count != 1: #This if statement is to avoid dividing by 0.
        variance = total/(count - 1)
        return sqrt(variance)
    else:
        return 0

sample = get_sample()
stdev = calculate_standard_deviation(sample)
stdev = format(stdev, ',.4f')
print("The standard deviation is ", stdev, ".", sep='')
```
3. Assume that a file containing a sequence of names (as strings) is titled names.txt and exists on the computer’s hard disk. Write a program that displays each name in the file and the total number of names stored in the file.

```python
# SOLUTIONS: Homework 7 - Problem 3
infile = open('names.txt', 'r')

count = 0
line = infile.readline()
while line != ' ':
    print(line, end='')
    count += 1
    line = infile.readline()
infile.close()
print("There were a total of", count, "name(s).")
```

4. Write a program that writes a sequence of random numbers to a file. Each number should be between 1 and 100, and the program should let the user specify how many random numbers the file will hold.

```python
# SOLUTIONS: Homework 7 - Problem 4
from random import randint

outfile = open('random_numbers.txt', 'w')

print("This program writes numbers between 1 and 100 to a file random_numbers.txt")
um = int(input("How many random numbers do you want written to the file? "))
for x in range(num):
    random_number = randint(1, 100)
    random_number = str(random_number) + 'n'
    outfile.write(random_number)
outfile.close()
```