Homework 2 Revision1

Due: October 30, 2020 **Points:** 100

Question 2 has been revised to not require recursion, as we will not have covered it.

In the examples, input is shown in red, output in black, and the character "↵" means "return" or "enter".

1. (*30 points*) Write a function to determine whether a year, given as input, is a leap year. A year is a leap year if it is evenly divisible by 4, unless it is evenly divisible by 100 and not 400. So 2000 was a leap year, but 2100 and 2200 will not be. Then write a program that asks the user to enter a year and uses the function you wrote to determine whether the year is a leap year. The program then prints the result.
   Your program must give an error message and exit if the user enters anything other than a positive integer.
   Here is sample output. Each is from a separate run of the program.

```
Year> 2020↵
2020 is a leap year

Year> 2000↵
2000 is a leap year

Year> 1900↵
1900 is not a leap year

Year> hello↵
You must enter the year as a positive integer

Year> -12↵
You must enter the year as a positive integer
```

   To turn in: Please turn in the program in the file *leap.py*.

2. (*40 points*) A string is said to be *abcdearian* if the letters in it, regardless of case, are in dictionary order. So, for example, "almost" and "effort" are abcdearian, and "willow" and "computer" are not.
   (a) Write a ~~*recursive*~~ function called `isabcde(s)` that returns True if `s` contains a string that is abcdearian, and False otherwise. The function must ignore any non-letter characters in `s`, and treat all alphabetic characters as lower case. ~~Note the function *must* be recursive, and so must call itself.~~
   (b) Write a program that reads a string and uses the function to determine whether the string is abcdearian. The program is to loop until the user types an end of file (control-D), or another exception occurs.
   Here is sample output:

```
The string? heLlo↵
heLlo is not abcdearian
The string? aLmost↵
aLmost is abcdearian
The string? w3i$l0l!ow↵
w3i$l0l!ow is not abcdearian
The string? e3f$f0o!rt↵
e3f$f0o!rt is abcdearian
The string? cOmpuTer↵
cOmpuTer is not abcdearian
The string? ABcDE↵
ABcDE is abcdearian
The string? control-D
```

   To turn in: Please turn in the function and the program in the file *abcde.py*.

3. (*30 points*) Write a program that prompts the user for a list of numbers, one per line. When the user enters "done", print the maximum, minimum, and mean (average) of the numbers entered.If the user enters anything other than a number and "done", give an error message.
Your program must give an error message and exit if the user enters anything other than an integer.
Here is sample output. Each is from a separate run of the program.

```
Enter number> 13␣
Enter number> 12␣
Enter number> 11␣
Enter number> 10␣
Enter number> 9␣
Enter number> xyzzy␣
Not a number
Enter number> done␣
The maximum is 13
The mean is 11.00
The minimum is 9
```

```
Enter number> -75␣
Enter number> -135␣
Enter number> 32␣
Enter number> 127␣
Enter number> 21␣
Enter number> 138␣
Enter number> 56␣
Enter number> done␣
The maximum is 138
The mean is 23.43
The minimum is -135
```

To turn in: Please turn in the program in the file *nums.py*.

Extra Credit

E1. (*30 points*) Take the program you wrote for problem 3. In addition to what that prints, have it print out the variance of the numbers entered.
Hint: You do not have to save all the numbers entered to do this. You can use the formula

$$\frac{1}{n}\left(\sum_{i=1}^{n} x_i^2\right) - \mu^2$$

where n is the number of numbers entered and μ is their mean (average).
Here is sample output. Each is from a separate run of the program.

```
Enter number> 13␣
Enter number> 12␣
Enter number> 11␣
Enter number> 10␣
Enter number> 9␣
Enter number> done␣
The maximum is 13
The mean is 11.00
The minimum is 9
The variance is 2.00
```

```
Enter number> -75␣
Enter number> -135␣
```

```
Enter number> 32␣
Enter number> 127␣
Enter number> 21␣
Enter number> 138␣
Enter number> x␣
Not a number
Enter number> 56␣
Enter number> done␣
The maximum is 138
The mean is 23.43
The minimum is -135
The variance is 8540.24
```