HW2—Loops

10 points

Assignment: 1. Write a program that calculates "e" from an infinite series, as described below.
2. Write a similar program to calculate pi.
Put your name, HW#, and brief description at the top of each program. (Do this for all assignments from now on.)

Due: Friday 9/13, 5PM

Turn in: Submit the source files for your programs to Blackboard Vista.

Part 1. The constant "e" (the base of natural logarithms, approx. 2.718) can be calculated using the infinite series:

$$2e = \frac{1}{1} + \frac{2}{1} + \frac{3}{2} + \frac{4}{6} + \frac{5}{24} + \frac{6}{120} \ldots \quad \text{which can also be written as} \quad e = \frac{1}{2}\sum_{k=0}^{\infty} \frac{k+1}{k!}$$

Write a program that calculates "e" using this series. Let k range up to about 25 for starter, we'll adjust later. Inside of each iteration (each trip through the loop): find the value of the next term given k, find the sum so far of these terms, and print the value of "e" (1/2 of your sum) that you've computed so far.

The *first few* lines of output should look like this:

```
Approximations of e:
0.5
1.5
2.25
2.5833333333
2.6875
```

Look up the correct value of "e" somewhere to see if your final approximation is correct. Adjust your maximum value of k so that the correct answer is reached on the final step (no repetition of the final answer).

Hint: You can use `math.factorial(k)` to find `k!`. Also: If your answer is incorrect, one possibility is a problem with int's vs float's in your calculations. Make sure the division uses floats.

Part 2. Pi can be calculated using this infinite series:

$$\pi = 4(\frac{1}{1} + \frac{-1}{3} + \frac{1}{5} + \frac{-1}{7} + \frac{1}{9} + ...)$$

Write a Python program to calculate pi using this series. *Warning*: this series converges much more slowly than the "e" series does! You probably won't be able to find pi to more than a few digits of precision, so let's stop after about 500 terms and see how close we get. You should at least get 3.14, or maybe 3.139, but probably not much more accuracy than that. Feel free to try more terms if you wish.

Hint: write this series as a summation, like I did for e above. Given k, find a formula for the denominator. To get the numerators, consider raising -1 to a power.