Problem I.3

Partial Sums

Due Date: 2/8/2019
Folder: `IntroToProgramming`
File Name: `PartialSum_LastName.py`

Learning Objectives

- Programming Skills ⋆ For loops
- Importing packages
- Using numpy arrays

Problem Background

Recall from Calculus 2 the idea of a sequence of partial sums,

$$s_n = \sum_{i=0}^{n} a_i.$$

This was used to discuss series convergence where we said if the sequence s_n converged, then the series $\sum_{i=0}^{\infty} a_i$ also converged. For this problem, we will compute the first N terms of the *sequence* of partial sums, and use these terms to guess as to whether the associated series converges or diverges. However, in order to get a good idea of the behavior of the series, we will use a large value for N. This massive computation can be simplified with the use of loops.

In addition, we will be storing the the terms of the sequence in a numpy array. There are some subtle differences between numpy arrays and python lists. Numpy arrays allow the use of linear algebra functions, which can be useful in many situations.

Programming Reminders

- Syntax for a `for` loop: `for ii in range(N):`

- Import `numpy` with `import numpy as np`

- Create a numpy array of zeros with `x = np.zeros((10))`

Program Criteria

Write a program that does the following:

- Create an input variable `N` for the total number of terms in the partial sum sequence.

- Generate the first N terms for the following partial sum sequences using a `for` loop, not a built-in function,

  ⋆ $s_n = \sum_{i=1}^{n} \dfrac{\ln(i^4 + i + 3)}{\sqrt{i} + 3}$

  ⋆ $t_n = \sum_{i=1}^{n} \dfrac{e^{i/100}}{i^{10}}$

  ⋆ A partial sum of your creation

- Print out the first 15 terms and the last 15 terms in each sequence, with an appropriate description.

Deliverables

Place the following in a folder named `IntroToProgramming` in your repository:

- A Python file `PartialSum_LastName.py` that satisfies the program criteria.

- A Latex document `PartialSum_LastName.pdf` with the following information:

  ⋆ Write down the partial sum terms that you created

  ⋆ State whether you think each series will converge or diverge and explain why.

  ⋆ If you think the series will converge, give an estimate of what it will converge to.

  ⋆ How many terms did you use to come to this conclusion? Why did you use that many?