

Numerical Analysis - Homework 4

Professor:

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Office Hours:

Check the class website for office hours: numericalanalysis.joannabieri.com

Homework Problems

You should attempt all these problems before class, but we will work on them in class with our groups.

- Exploring Taylor Remainder Error:
 1. Write down the Taylor Polynomial approximation for $f(x) = \sin(x)$ near the point $x = 0$. Make reasonable bounds on the error using the remainder term, you choose n .
 2. Imagine we will use the expansion in to approximate $f(.4)$. Write a program that lets you test different n and x values in your error bound formula. What n would we need to choose to get an error of no greater than (10^{-10}) ? NOTE: You can look at my code if you need help, but start to write your own code if possible.
 3. Graph the desired Taylor Polynomial approximation with the appropriate number of terms and calculate the “true” error, because you can find the exact value.
 4. What if we expanded our range of x -values so that $x = 1$ keeping the approximation about $x = 0$? How does this effect your error? How many terms would you need to keep the error tolerance at (10^{-10}) ? Does this make sense to you? Why?

- Repeat steps 1-3 above for the function

$$f(x) = e^{-x^2}$$

- Repeat steps 1-3 for the function

$$f(x) = \frac{\sin(x)}{x}$$

- Problems 2, 13 from chapter 1.2

Hand In Code and Check In

Due Sunday Sept 10th - Homeworks 3 and 4

- PDF document - your weekly narrative:
 1. What is one piece of Numerical Analysis knowledge that you are proud of gaining this week?
 2. What is one piece of Numerical Analysis knowledge that you struggled with most this week?
 3. What is one area where you are reaching beyond the class comment to continue to challenge yourself?
 4. In what specific ways have you contributed to your group during class periods?
 5. What goals do you have for yourself in the next week of class?
- A link to your CoLab code with the homework problems. Your CoLab notebook should also contain markdown cells that describe your solutions.

Extra If you are interested in how the program `polyeval` works, read chapter 1.3 in the book about polynomial evaluation from a programmers perspective.

SUPER CHALLENGE: Can you write the Example Program 1.3.1 in Python?