Math 105B Lab Report 1

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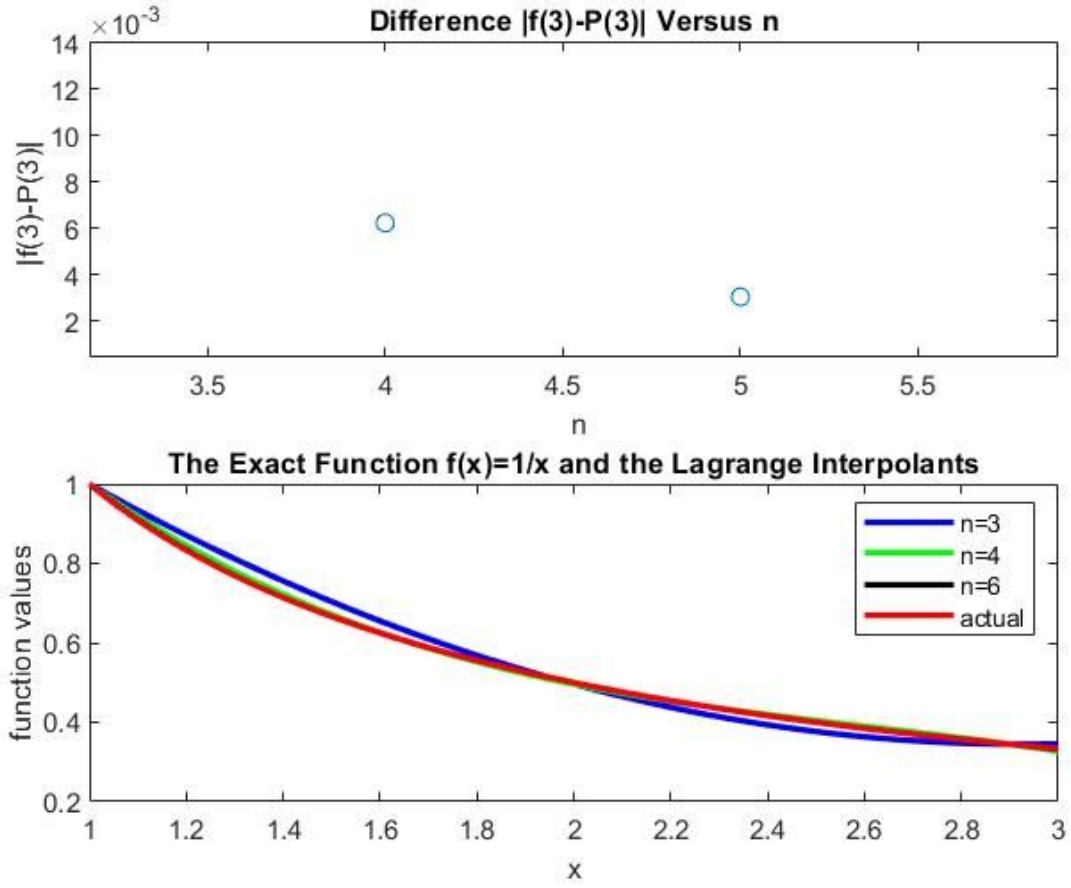
Purpose/Objective: In this lab I will first write a function outputting the Lagrange interpolating polynomial, based on the inputs of given x-coordinates, y-coordinates, and a point x of our interest. Then I will explore how the variable n affects the error between the Lagrange polynomial and the polynomial through multiple plots.

Introduction: For the Lagrange polynomial function, I will essentially follow the formula given and use a nested for loop to calculate product sums in each iteration and then add them up. Professor has given us a case where we have n=3 equally spaced coordinates and we are interested in x=3. I will compute using the Lagrange function and and subtract it from the real function value to obtain the difference. Professor also wants us to plot and observe the absolute difference as the variable n varies. Last but not least, we are expected to modify n again and plot the interpolants themselves on the graph, so that we could compare them to the original function of 1/x.

Procedure(Algorithm method): For coding the f_lagrange function, I initialize P(x) as 0 outside the loop so I can keep adding to it to become the summation of everything. Inside the loop, we set up a variable named product_sum for Ln,k(x), and its initial value is set to be 1 so it can be multiplied. After each iteration, it resets to 1. The rest of the coding is purely based on the formula. For the main assignment, the most essential thing is setting up the subplots. For part 3, I set up a list with the desired n values in it, and then loop through the list and store the absolute difference for each n value into a list. Finally, I plot the n values against the absolute difference and add labels to it. For part 4, it's mostly the same as part 3, except this time 100 different

values of x between 1 and 3 are being plugged into the lagrange function. I also use the command “hold on” to plot multiple interpolants and the actual function onto the same graph.

Graph:



Conclusion: The main takeaway from this lab is that as n increases, the absolute difference decreases. In a more meaningful way, it implies that the Lagrange interpolating polynomial becomes closer and closer to the actual function, as its degree n increases. So generally speaking, a Lagrange polynomial with a large degree yields better results.