Your Paper

You

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Abstract

Your abstract.

1 Introduction

We are given 4 problems all having to go with interpolation. The types of methods implemented are Laplace, Cubic interpolation, and natural cubic interpolation. The first question asked us to construct a Lagrange polynomial e*pow(2*x)*cos(3*x) with the given nodes x0=0, x1=0.3, x2=0.6, by hand. Question 2 is similar but using Lagrange in code with the given function pow(cos(2x))*10 and interpolating it to up to the 10th degree in between [-1,1] through a graph Question 3 using the same function from question 2 but instead we are using cubic spline and running the given nodes through 5,7,9,11 as well run it through [-1,1] in a graph Question 4 in question 4 we need to construct a natural cubic spline of a car speeding up through out given data points t= time and d= distance and the given point equal each other in order t=0,3,5,8,13 and d=0,225,383,623,993. and with this we wish to find a) what a distance of the car at t=10, b) what is the speed of the car at t=10 c) what would be the maximum speed of the car.

2 mathematics

Mathematics the base idea of our math is mapping a function of given known values in a function or interpolation. we are to Incorporated three interpolation methods Lagrange, Cubic and natural cubic. interpolation is the process of given know data values and estimating the unknown data values.

2.1 How to create Sections and Subsections

Lagrange interpolation a given polynomial and using the given formula

$$p(x) = f(x_0) * L_n,_0\,(x) + ... + f(x_n)L_n,_n\,(x) = \Sigma = 0, n * f(x_k)L_n,_k\,(x)$$

where, each k=0,1,...,n

$$L_n, k(x) = ((x - x_0)(x - x_1)...(x - x_{k-1})(x - x_{k+1}))...(x - x_n)) \div ((x_k - x_0)(x_k - x_1)...$$

$$(x_k - x_{k-1}))(x_{k-1} - x_{k+1})...(x_k - x_n)) = \Pi(x - x_i) \div (x_k - x_i)$$

Taking this formula we can when constructed a polynomial that can estimate the unknown values.

2.2 cubic spline

A cubic spline is a piecewise function of a third order polynomial and involving 4 constants. This function passes through a set of control points. the second derivative is commonly zero. Given this equation

$$S_i(x) = a_i^3 + b_i x^2 + c_i x + d_i$$

Taking that we can constructed a linear system to find our coefficients a,b,c,d and then break it down and constructed a spline to find our unknown values.

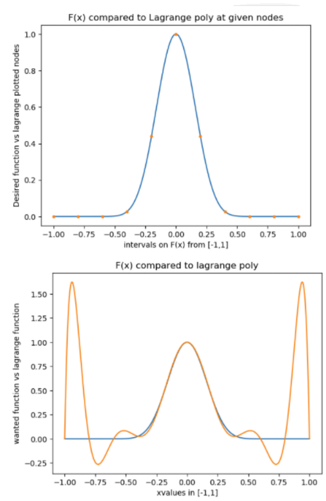

Figure 1: the finished result of our given function (cos(2x))**10 using Lagrange interpolation.

2.3 natural spline

A natural cubic spline is very similar to a cubic spline excepted for one key difference and that is the second order derivatives of the endpoints in S''(x)=0.

3 algorithm

3.1 Lagrange

Step 1 set packages to help with code numpy, scypi,mathplotlib. Step 2 define our given function Step 3-4 set bounds of the function from the x, y plots to number of nodes run through and to label our graphs. Step 5: set up the Lagrange function Step 6: run the code (end).

3.2 cubic

almost similar to Lagrange but instead on Step 6 where we set up a cubic function.

3.3 creating a cubic function

Step 1: import all packages need. Step 2: constructed given data in a array list. Step 3: create cubic spline then plot it. Step 4: create cubic derivative and plot it. Step 5: create new function and plot it. Step 6: then extracted the information wanted from the problem(end)

4 results

Question 1 results will be with the code as an attachment with the code. Question 2 results found on figure 1. Question 3 results found on figure 2 though it show 12 nodes passing through the other can be seen if you play with the function and the most accurate was 9 nodes. Question 4 results found on figure 3. Answer to question 4 follows a)778.479 ft, b) 75.82 ft/sec, c)80.266 ft/sec following code where used cs(10.0), dcs(10.0), max(dcs(tnew)).

5 conclusion

The interpolation method showed the important of being able to be given the data given and being able to uses this data to extract accurate information out of it. Lagrange shows the bases of how to do this but what is even more proficient with interpolation is cubic spline which take the weakness of

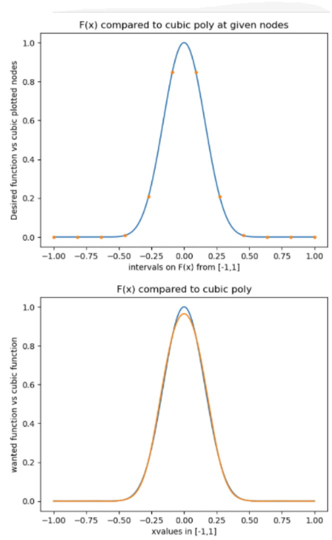

Figure 2: The result of our function (cos(2x))**10 using cubic spline.

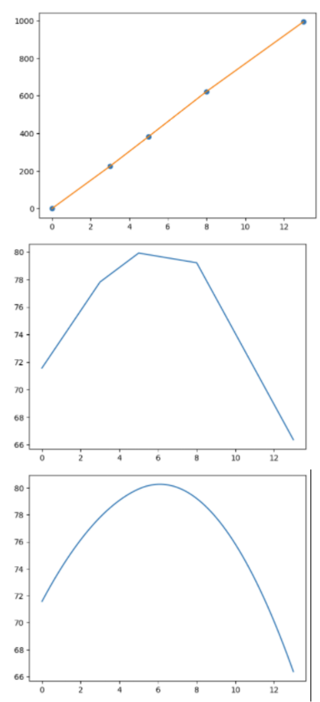

Figure 3: The results of the constructed cubic spline from question 4.

Lagrange and fixes them. Where you fluctuations in the end of the functions in cubic it is much more accurate though all this depends on the given function or data points. When we constructed our own cubic spline it really show cases how derivatives play a huge role in smoothing a function out and being able to analyze given data. All in all interpolation can be very good for organizing data to being able to present it in an organized way.