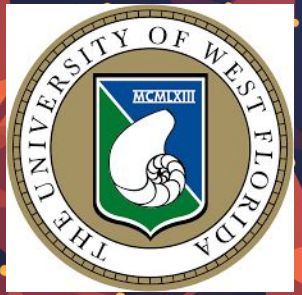
https://github.com/nps6-uwf/MethodsOfPolynomialInterpolation

Methods of Polynomial Interpolation

By: Nick Sebasco



Overview of Research

Chebyshev Nodes

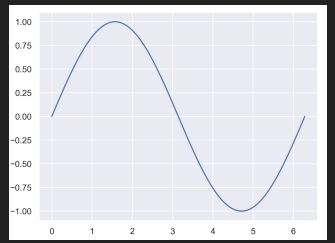
$$f(x) = Sin(x), x \in [0, 2\pi]$$

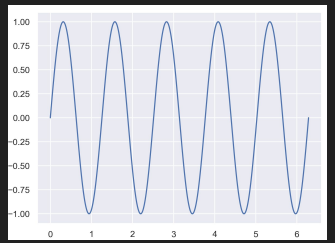
$$g(x) = Sin(5x), x \in [0, 2\pi]$$

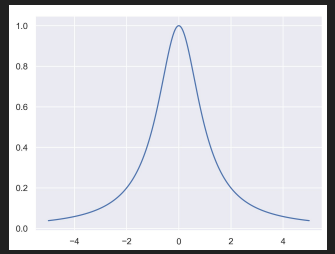
$$h(x) = \frac{1}{1+x^2}, x \in [-5, 5]$$

Direct
Lagrange
Hermite

n Equal Spaced Nodes







Importance and Applications of Polynomial Interpolation

1. Create lookup tables for logarithms.
2. Typography
3. Secret sharing & cryptography
4. Numerical Quadrature
5. Replace computationally expensive function with simple polynomial
6. Computer Graphics
7. Engineering

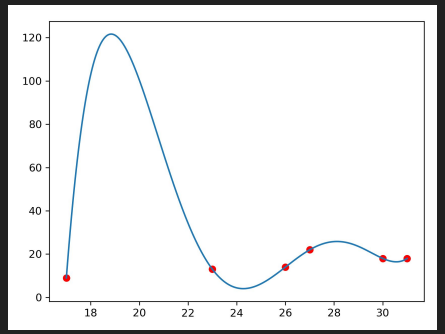
x	log(x)
2	0.693
2.5	?
3	1.099

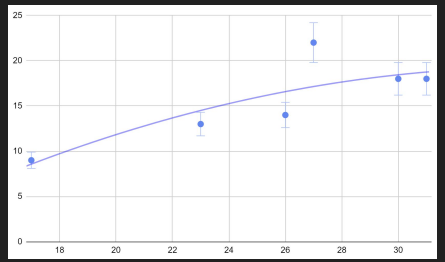
Approximation Polynomial Theory

Polynomial Interpolation, what is it?

Interpolation vs. Extrapolation

Weierstrass Approximation Theory





Numerical Methods

The Direct Method

Solve the Vandermonde Matrix for polynomial coefficients.

Lagrange

polynomial of lowest degree that assumes at each value x corresponding value y, so that the functions coincide at each point.

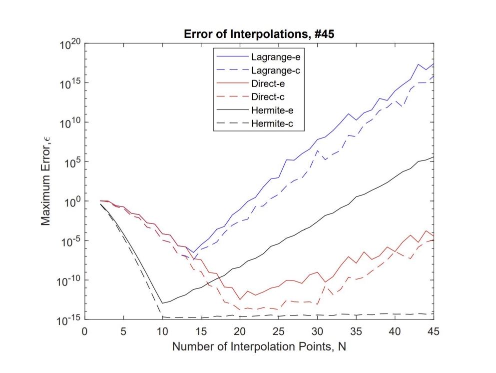
Hermite

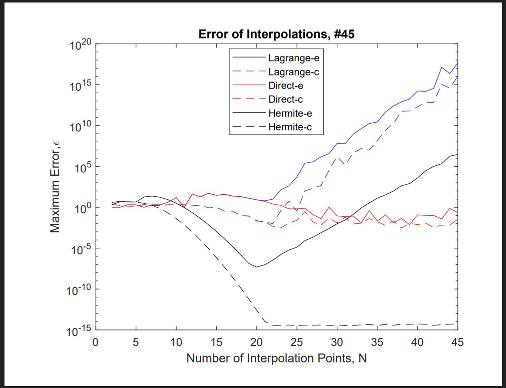
Extends the idea of Lagrange interpolation by adding derivative information

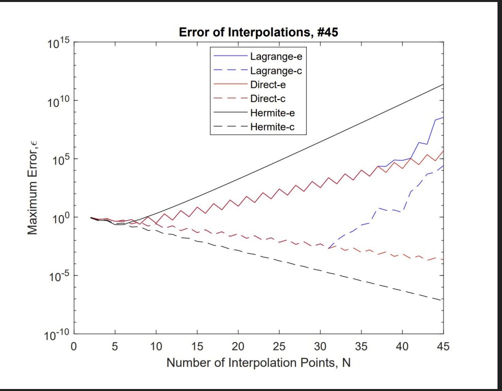
Demonstration of Code

https://github.com/nps6-uwf/MethodsOfPolynomialInterpolation

Numerical Experiments







Conclusions

Difference in Error for n=5 Sin(x) vs. Sin(5x)

Overall Best performance

Impact of Chebyshev Nodes

CPU Times

Future Research

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