Math 451

Project 4

Data Fitting - Due Monday April 10th @ 11:59pm

1) M-Files. Create the following three functions ...

a) c = interpolant(dx,dy) that will return the coefficients of the polynomial interpolant for the data points dx,dy. Use your linearsolver function to solve for the coefficients within interpolant.

b) y = lagrange(x,dx,dy) which is the evaluation of the lagrange form of the polynomial interpolant where x is a vector of values and dx,dy are the data points for the polynomial interpolant.

c) c = datafit(dx,dy,n) which will return the n coefficients of the least squares polynomial of n - terms for the data points dx,dy. Use your linearsolver function to solve for the coefficients withing datafit.

2) Example Data One.

Create example data by using taking 5 linearly distributed points of sin(x) between 0 and 3. Verify that your lagrange function and interpolant function produce the same polynomial interpolant. Create a single figure that plots the data, all the least squares fit polynomials of 1 term to 4 terms, and the polynomial interpolant.

3) Example Data Two.

Create example data similar to Example Data One except add randomness from -0.1 to 0.1 to each of the y values. Then create a single figure that plots the data, all the least squares fit polynomials of 1 term to 4 terms, and the polynomial interpolant.

4) Real Data.

hourly

Search online for the temperature data for Wichita. Get the daily min and max temperatures for the week of January 8, 2017 through January 14, 2017 along with when they occured. Create a single figure that plots the 14 data points, all the least squares fit polynomials of 2, 4, 6 ... to 12 terms, and the polynomial interpolant. Which polynomial do you feel is the best approximate function for the data? For that polynomial what does it predict the temperature was on Jan 10th at 6pm? Is it close to the answer? What does it predict the temperature was on Jan 16th at 6pm? Is it close to the answer?

...

Proj. 5

Calc toolbox

Contents.m & comments to explain functions in the directory

mysin	mysec
mycos	mycsc
mytan	mycot
myexp	myln

simpint, trapint (adapt. quad)

definitegral(f, a, b, type)

indef integral(c)

coef vector of a poly

derivative(c, f, a)

$$f'(a) = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$$

linearsolver

gauss backsolve

interpolant

lagrange

datafit

ODE's

equation

⇓

expression = expression

has variables, ops, functions and derivatives

algebraic eqn

$x^2 + \sin x \boxed{=} 3y + x^3$

$$y' + xy + 3 = y'' - y' + 2yx^3$$

(solve) when is this true?

↳ find a function $y = f(x)$ that makes the eqn true.

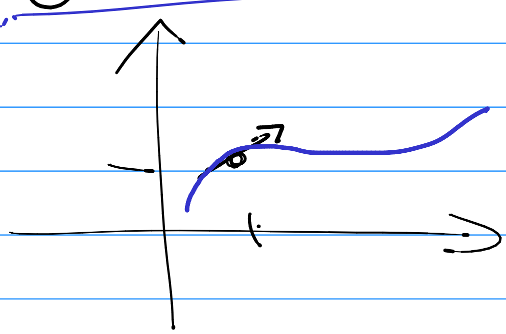
ex $\quad \boxed{y'' + y = 0}$

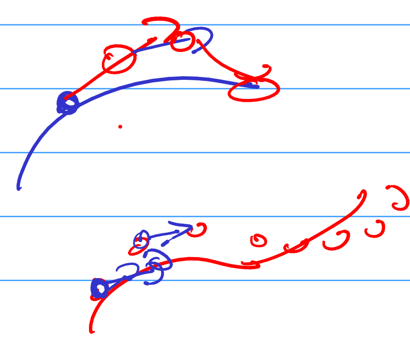
$\boxed{y_1 = \sin x} \qquad y' = \cos x \qquad y'' = -\sin x$

$$(-\sin x) + (\sin x) = 0 \quad \checkmark$$

$\boxed{y_2 = \cos x} \rightarrow$ gen soln $\boxed{y = a\sin x + b\cos x}$

$$\boxed{y' = f(x, y)}$$





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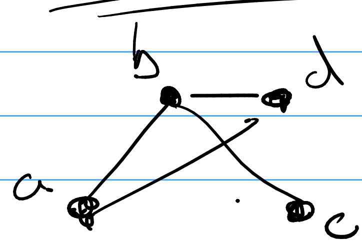
(15) Graph theory



$$M_G = \begin{array}{c|cccc} & a & b & c & d \\ \hline a & 0 & 1 & 0 & 1 \\ b & 1 & 0 & 1 & 1 \\ c & 0 & 1 & 0 & 0 \\ d & 1 & 1 & 0 & 0 \end{array}$$

People to Groups

$$M_{PG} = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \\ P_4 \end{array} \begin{array}{c} \begin{array}{cc} G_1 & G_2 \end{array} \\ \begin{bmatrix} 1 & 0 \\ 1 & 1 \\ 0 & 1 \\ 0 & 1 \end{bmatrix} \end{array}$$

$$M_{PG} \cdot M_{PG}' = \underset{4 \times 2}{\begin{bmatrix} 1 & 0 \\ 1 & 1 \\ 0 & 1 \\ 0 & 1 \end{bmatrix}} \underset{2 \times 4}{\begin{bmatrix} 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 \end{bmatrix}} = \begin{array}{c} \\ P_1 \\ P_2 \\ P_3 \\ P_4 \end{array} \begin{array}{c} P_1 \; P_2 \; P_3 \; P_4 \\ \underset{4 \times 4}{\begin{bmatrix} & & & \\ & & & \\ & & & \\ & & & \end{bmatrix}} \end{array}$$

$$= \begin{bmatrix} 1 & 1 & 0 & 0 \\ 1 & 2 & 1 & 1 \\ 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 \end{bmatrix}$$