

AUMAT/AUPHY/AUCSC 340 – Numerical Methods

Winter 2019

Assignment 4

Submission deadline: Monday, 01 Apr 2019, 8:30am (via eClass)

- 1) Use the least-square method to fit a quadratic function to $f(x) = \sin(\pi x/2)$ on $[0,2]$. Do you obtain the same result as in the corresponding midterm problem?

- 2) Use the least-square method to determine the constant of the function

$$g(x) = e^{bx}$$

so that it “best matches” the function

$$f(x) = x^2 + 1.0$$

on $[0,1]$.

In your analysis, use Wolfram Alpha to compute the definite integral that you obtain following differentiation. Then, plot the result as a function of b in Matlab to find the root by zooming in. Include the plot (b in $[-2,2]$) in your assignment. Lastly, plot both functions in the same figure.

- 3) Use LU decomposition to write

$$A = LU$$

where

$$A = \begin{bmatrix} 1 & 2 & 4 \\ 3 & 8 & 14 \\ 2 & 6 & 13 \end{bmatrix}$$

Subsequently, determine the determinant of A , its inverse, and solve

$$Ax = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}.$$

Hint: Stick to page 10 of the Week 7 lecture notes to find L and U .

- 4) Apply the Jacobi method to solve

$$5x - 2y + 3z = -1$$

$$-3x + 9y + z = 2$$

$$2x - y - 7z = 3$$

For the initial guess, use $x_0 = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$ and do three iterations. Then, solve the problem in Matlab and compare results.