

Exam 1 Take Home

You must submit ALL m-files via email to pandrist@greenriver.edu by 11:59PM on Friday, February 6th. There must be a main script file named Exam1_*youremailaccount*.m and any function files you used in that script. A few problems below require you to write function files. Those must be named as specified in the problem and submitted as well.

Matlab Skills

1) Angle between two vectors

Write a function named *anglebetween.m* which accepts two 3-element vectors and returns the angle, in degrees, between them. To generate this function you may not use any Matlab built-in functions except `acosd`, which is the inverse cosine in degrees.

As a reminder:

$$\mathbf{A} \cdot \mathbf{B} = |\mathbf{A}||\mathbf{B}|\cos\theta$$

Where θ is the angle between the vectors.

2) Euclidean Norm

Write a function named *euclidnorm.m* which accepts a vector of ANY length and returns its Euclidean Norm. The Euclidean Norm has a nice Wikipedia page. You may not use any Matlab built-in functions.

Root Solving Methods

1) Bisection

Write a bisection method code which solves for a single root of a polynomial of your choosing! Then, graph the polynomial and the location of the root. Use a square marker for the root location.

2) Newton-Raphson

Write a Newton-Raphson code for the function $f(x) = x^3 - 2x^2 - 1$. Write the code twice, running with 2 different starting guesses.

- Choose a starting guess where the code returns an error or the method diverges
- Choose a starting guess where the method converges and a root is found

Solving $Ax = b$

1) LU and $A \backslash b$

On Canvas under Exam 1 you will find a file, "Data.mat". Load the variables on this file into your workspace by using the line "load Data.mat". The .mat file must be downloaded into your Matlab path. The matrix A is a coefficient matrix in an equation $Ax = b$, and the matrix B is a matrix whose columns are solution vectors b .

- a) Find the solution matrix X whose first column is the solution to $AX_{:,1} = B_{:,1}$, whose second column is the solution to $AX_{:,2} = B_{:,2}$, and so on, using the backslash command
- b) Find the same solution matrix X above but find it using the lu function in matlab and solving the appropriate equation: $LUx = B$ using the backslash command. No permutation matrix is necessary in this calculation

Eigenvalue problems

1) Finding Eigenvalues of A

Find the eigenvalues and corresponding eigenvectors of A from the previous problem using the eig command.

2) Matrix powers

Calculate A^{100} using the Matrices calculated from the previous problem