AMATH 301 Section A: Beginning Scientific Computing Midterm

Instructions

- Friday, November 4, 9:30-10:20 AM
- During the exam, students are permitted writing utensils, blank paper, and a copy of the exam.
- No study aids (cheat sheets, calculators, etc.) are allowed.
- Students should not have access to their mobile phone or any internet connected device.
- Answers must be justified to receive full credit (i.e., show your work).
- There are 4 questions.
- Time permitted: 50 minutes.

Name: _____ Student Number: _____

Syntax of some useful Matlab commands:

`save filename var format` stores the specified variable `var` in a file named `filename`. `format` may be `'-mat'` for a binary MAT-file format (default) or `'-ascii'` for 8-digit ASCII format.

`plot(X,Y,LineSpec,value)` plots vector `X` versus vector `Y`. `LineSpec` and `value` together specify the line type, marker symbol and color.

`abs(x)` returns the magnitude of `x`.

`norm(X,p)` and `cond(X,p)` give the p-norm and condition number of `X` respectively.

`X.'` returns the transpose of the 2D matrix `X`.

`inv(X)` returns the inverse of the square matrix `X`.

`sum(A,dim)`, `mean(A,dim)` and `prod(A,dim)` return the sum, average and product of the array elements of `A` along the dimension `dim`.

`diag(A)` returns the diagonal of the matrix `A` or creates a square matrix with the vector `A` on the diagonal.

`zeros(n1,...,nk)` returns an $n1$ x $\cdots$ x nk array of 0's.

`A\B` solves a linear system using Gaussian elimination.

`triu(X)` and `tril(X)` returns the upper and lower triangular parts of `X`, respectively.

`[L,U,P]=lu(A)` returns an upper triangular matrix in `U`, lower triangular matrix `L` with unit diagonal and permutation matrix `P` such that `L*U=P*A`.

`[V,D]=eig(A)` returns a matrix `V` whose columns are eigenvectors of `A` and a diagonal matrix `D` whose entries are the corresponding eigenvalues of `A`.

`p=polyfit(x,y,n)` finds the coefficients of a polynomial `p` of degree `n` that fits the data in a least squares sense. The result `p` is a row vector of length `n+1` containing the polynomial coefficients in descending powers.

`y=polyval(p,x)` returns the value of a polynomial `p` evaluated at `x`.

`yf=spline(x,y,xf)` uses a cubic Hermite spline interpolation to find `yf` at `xf` given `y` as a function of `x`.

Solving a linear equation $Ay = b$ iteratively:

- Break the matrix A into two parts such that $M + N = A$
- Iterate according to $My_{k+1} = b - Ny_k$
  - Also can be written as $y_{k+1} = M^{-1}b - M^{-1}Ny_k$
  - Initial guess y_0 must be provided
- Different iterative methods reflect different choices of M and N