California State University Northridge

College of Engineering and Computer Science
Mechanical Engineering Department

Mechanical Engineering 501A
Seminar in Engineering Analysis

Fall 2017 Number 15966 Instructor: Larry Caretto

September 27 Homework Problems

1. Find the inverse of the matrix **A** at the right using Gauss-Jordan elimination. Check your result by showing that $\mathbf{AA}^{-1} = \mathbf{I}$.

$$\mathbf{A} = \begin{bmatrix} 2 & 0 & -1 \\ 5 & 1 & 0 \\ 0 & 1 & 3 \end{bmatrix}$$

2. Find the inverse of the matrix **A** at the right using the cofactor formula for $\mathbf{B} = \mathbf{A}^{-1}$: $b_{ij} = C_{ji}/\det(\mathbf{A})$. Check your result by showing that $\mathbf{A}^{-1}\mathbf{A} = \mathbf{I}$.

$$\mathbf{A} = \begin{bmatrix} 2 & 0 & -1 \\ 5 & 1 & 0 \\ 0 & 1 & 3 \end{bmatrix}$$

3. Download the Excel workbook that you can find on the course web site at the following link: http://www.csun.edu/~lcaretto/me501a/Gaussian.xlsm . Follow the directions to use the Visual Basic code and data provided to obtain solutions to a set of 100 simultaneous linear equations. Obtain these results for each of 12 given right-hand sides. Compare the exact solutions provided in the workbook to five alternative solutions: obtain four solutions using the VBA functions Gaussian, GaussianDoubleNoPivot, GaussianSinglePivot, and GaussianSingleNoPivot; these different functions provide solutions using various combinations or single or double precision and pivoting or no pivoting. Obtain a fifth solution using the matrix inversion function of Excel, Minverse and compare that result to the exact solutions. For your solution comparisons use the root mean square (RMS) difference defined by the following equation, where, for the i^{th} variable, x_i:is the exact solution and y_i is the solution obtained by the appropriate Gaussian function.)

$$\boldsymbol{RMS\ Difference} = \sqrt{\frac{\sum_{i=1}^{N}(x_i - y_i)^2}{N}}$$