Matrix Helper v 1.1

Performing Various Matrix Operations

SHEBA SOFTPHUR

By Hussam Dandashli
Purdue University
W. Lafayette, IN
dandashl@mn.ecn.purdue.edu

INTRODUCTION

Matrix Helper is an application to help with basic matrix operations like inverting, row-reducing, solving a system of linear equations and more...

The application utilizes several features including:

* dynamic memory allocation, allowing the user to enter a large matrix depending on the amount of RAM allocated to the application.

* Improved solver for a system of equations using Gauss-Jordan method with full pivoting to handle ill-conditioned matrices.

* Ability to read/write large matrices that the application would not be able to display in the application's window.

* Display matrix in main and console windows, so the user can copy the numbers as text right out of the visible part of the console window.

* Straight-forward user interface.

Version 1.1 fixes a small bug that caused the determinant to be zero if some of the diagonal numbers were very small. Other additions include three options to view numbers, e.g. 3.20e-2 or 0.032 or 0.032000.
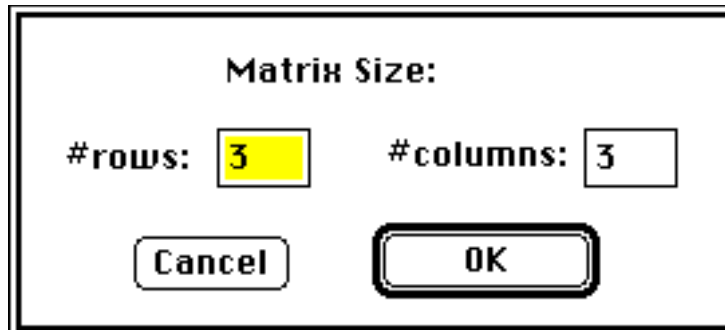
TUTORIAL

Double-click on the application's icon to start it.
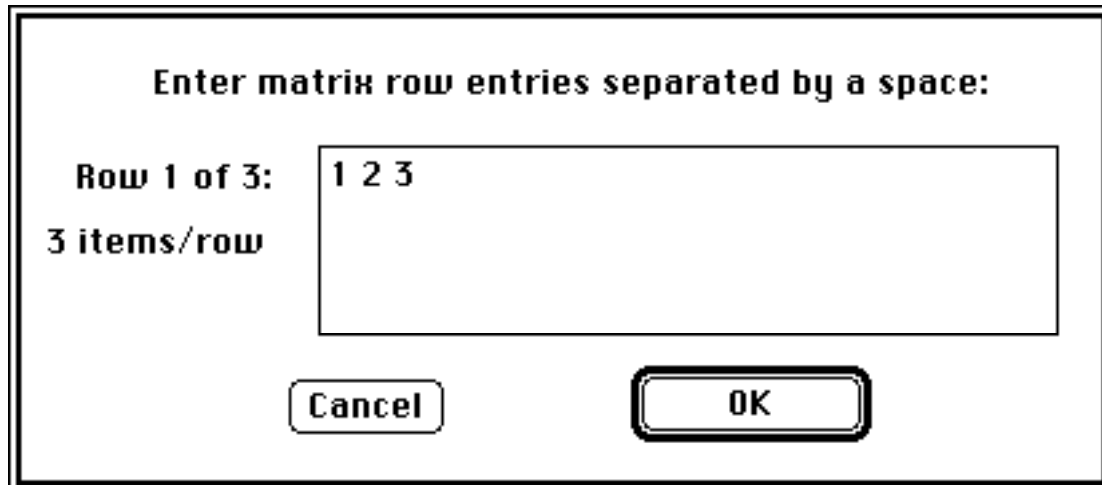

Matrix Helper 1.0

The main window and the console will be displayed awaiting further action.

The application has a 3x3 default A and B matrices that the user can change with the "Setup..." menu item from either "Matrix A or B" menus.

Figure 1: Responding to "Setup..." menu option

Figure 2: Entering matrix numbers

Select "Display" menu item from Matrix A menu, the default [A] will be displayed. To change that matrix select "Setup..." and you will be prompted to enter the dimensions of the desired matrix. After completing that step you will be prompted to enter the row entries of that matrix. These entries should be numbers separated by a space ( ), a semicolon (;), or a tab (   ).

Repeat the procedure for the number of rows desired. The application will read the matrix and display it in the application and the console windows.

Note that the advantage of the console window is that numbers could be copied as text directly to the clipboard, where as the copy function in the File menu copies the contents as a picture to the clipboard.

$$[A] = \begin{vmatrix} -1.00e+00 & +1.00e+00 & +2.00e+00 \\ +3.00e+00 & -1.00e+00 & +1.00e+00 \\ -1.00e+00 & +3.00e+00 & +4.00e+00 \end{vmatrix} * \{X\} = \{U\} \begin{vmatrix} +2.00e+00 \\ +6.00e+00 \\ +4.00e+00 \end{vmatrix}$$

-- Solving for {X} -->

$$\{X\} = \begin{vmatrix} +1.00e+00 \\ -1.00e+00 \\ +2.00e+00 \end{vmatrix}$$

Perform the desired operation on the matrix. The user has the option of saving the result back into matrix A or in B to perform other operations.

For example: invert matrix A, go to menu "Matrix B" and save the result as matrix B. Then you can verify that multiplying a matrix by its inverse will give you the identity matrix.

As the matrices become larger, the time it take the application to perform certain math intensive operations will get longer. The version utilizing the FPU will generally run a lot faster and be more efficient.

MENU OPTIONS

Apple Menu:

About...   Display logo and credits.
Help...   On-line simple manual.

File Menu:

Open Matrix File...   Read an external file containing a matrix.
Save Matrix...   Has three options: Save matrix [A], [B], or the current result of an operation performed. Matrix will be saved in an external file with ".in" ending.
Read a TEXT File...   View any TEXT file in the console window. Helpful in reading the contents of an input/output file for example.
Copy...   Copy a selected window content to clipboard.
Invert Screen   Change the background color between Black and White.
Set Numbers Display Specify number of digits after the decimal (2, 3, or 6)
Quit   Exit application.

Matrix A/B Menu (The same applies for both menus A and B)**:**

Setup...   Enter the dimensions and the entries of a new A/B matrix.
Display   Draw the matrix on-screen.
Transpose   Show the transpose of the matrix (A/B).
Row-Reduce   Row-reduce the matrix into an upper-triangular matrix.
Invert   Find the inverse of a square matrix.
Rank   Find the rank of a matrix (number of non-zero rows).
[A] + [B]   Add the two matrices (have to be the same size).
[A] * [B]   Multiply two matrices of the proper size (m x **N** and **N** x p).
Scalar Multiply   Multiply matrix by a scalar.
Put Result in[?]   Set matrix A/B to contain the result of the current operation.

<u>Vector V Menu:</u> (to be used in solving a system of linear equations)

Setup...   Enter the dimensions and the entries of a new vector V.
Display   Draw the vector on-screen.
Scalar Multiply   Multiply vector by a scalar.

<u>Solve Menu: </u>

[A or B]{X} = {V} Solve that system of equations.