Numerical Methods Library in Excel VBA

Module	**LUfbsub.bas**
Title	**Forward and back substitution for real systems.**
Description	LU factorisation of a square $n \times n$ matrix A is normally produces the lower-triangular matrix L, the upper triangular matrix (with diagonal elements set to 1) U and the permutation matrix P. such that $$PA = LU$$ And the permutation matrix is stored as an integer n-vector, which simply records the positions of the 1s in each column (or row) of the permutation matrix. An example of the LU factorisation algorithm is LUfac.bas and this subroutine can be used directly on its results. One of the most important reasons for LU factorisation is for the solution of linear systems of equations or matrix-vector systems of the form $$A\,\underline{x} = \underline{b}\,.$$ The factorisation allows us to write LU x = P b, which can be solved straightforwardly using forward and back substitution. The forward and back substitution method is implemented by LUfbsub.bas. The forward and back substitution is an $O(n^2)$ and the LU factorisation is $O(n^2)$; the forward and back substitution is computationally less intense than the LU factorisation and hence the strategy is that the LU factorisation, once computed, may be re-used for various vectors b..
Interface	Sub LUfbsub(a, n, perm, b) real a: on input the nxn matrix A, on output L and U integer n: the dimension of the matrix/vector integer perm: an n-vector, the column index of the permutation matrix P real b: the vector b Note the input matrix 'a' is such that the diagonal and upper-triangular elements is the 'U' matrix and the lower-triangular elements together with 1s on the diagonal is the matrix 'U'. On exit the b is overwritten by the solution 'x'.
Web source of code.	www.numerical-methods.com/ExcelVBA/LU.xlsm (key 'Developer' then 'Visual Basic' and then 'LUbfsub_module')

Web source of this guide	www.numerical-methods.com/Excel_VBA/LUfac_bas.htm
Web source of the algorithm	www.numerical-methods.com/lineq/LU Factorisation.htm
Dependent routines	NONE
Test problems	The Excel file contains spreadsheet test programs that demonstrate the forward and back substitution method of either a set of test matrix-vector systems of various dimensions or a chosen matrix/vector. www.numerical-methods.com/ExcelVBA/LU.xlsm The test problems are similar to those used in Matlab/Freemat/Octave Scilab www.numerical-methods.com/mfiles/LUfbsub_tests.htm and in FORTRAN www.numerical-methods.com/fortran/CLUTESTS_FOR.htm
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Similar codes that may be of interest	LUFBSUB, www.numerical-methods.com/fortran/LUFBSUB_FOR.htm , LUfbsub.bas, www.numerical-metods.com/Excel_VBA/LU.xlsm For the method in visual basic / VBA (Excel), but only for real systems.
Bibilography	Linear Systems and 2x2 Matrices www.numerical-methods.com/lineq/LU Factorisation.htm Tutorials on Fortran77 Numerical Methods