

CS416 Spring 2007

Prof. Wright

Assignment #7

Due April 13, 2007

1. Compute by hand the LU factorization with row partial pivoting of the matrix

$$A = \begin{bmatrix} -1 & 4 & 0 & -1 \\ -1 & 0 & 4 & -1 \\ 4 & -1 & -1 & 0 \\ 0 & -1 & -1 & 4 \end{bmatrix}.$$

Use the form of calculation in which the 4×4 data structure originally containing A is gradually overwritten by the L and U factors, keeping track of the permutation sequence. Write out clearly the L , U , and P matrices that you obtain from this process.

2. Write a Matlab code `lupp.m` to form the LU factorization of an $n \times n$ matrix A with partial pivoting. Your code should overwrite the data structure of the input matrix with the L and U factors. It should also return the permutation matrix P , stored in coded form as a string of n integer values. (See stub on the web site.)
3. Write a Matlab code `lutri.m` to take the L and U factors from `lupp.m`, and the permutation matrix P , and return a solution to $Ax = b$ for a given b . (See stub on the web site.)
4. Use your codes to solve $Ax = b$ for the following matrix A and the two right-hand sides b . Print out the solution x and the permutation vector P in each case.

$$A = \begin{bmatrix} 2 & -1 & 4 & 9 & 2 \\ 1 & 0 & 3 & 9 & 7 \\ -5 & 0 & 1 & 3 & 5 \\ 4 & 3 & 2 & 2 & 7 \\ 3 & 0 & 0 & 0 & 9 \end{bmatrix}, \quad b = \begin{bmatrix} 2 \\ -1 \\ 3 \\ 8 \\ 4 \end{bmatrix}, \quad b = \begin{bmatrix} 4 \\ 0 \\ 5 \\ -2 \\ 1 \end{bmatrix}.$$

Hand in hard copies of your codes `as7.m`, `lupp.m`, `lutri.m`, and your output together with your written answers. Put your codes in a directory called `homework7`. From the parent directory of `homework7`, run the following command:

```
handin -c cs416-1 -a hwk7 -d homework7
```