

**Math 3620** Machine Problem 3: Due Tu. Sept. 28, 2020

- 1) Write a function `[L,U,p,sd] = mylu(A)` which performs Gauss-elimination with scaled partial pivoting to find an LU decomposition of (a permuted version of)  $A$  if one exists. If no pivot can be found, stop and set `sd = 0`. Otherwise, complete the algorithm to find the LU decomposition. In this case the output `p` should contain the permutation vector, and the output `sd` should be a flag (value 1 or -1) to indicate whether the permutation has changed the sign of the determinant.
- 2) Write a function `x = mysol(L,U,p,sd,b)` based on forward and backward substitution to find the solution of  $Ax = b$  assuming  $A$  is nonsingular. The input should be the right-hand side  $b$  and the output of `mylu`.
- 3) Write a driver program which
  - a) Reads in  $n$ ,  $A$ , and  $b$  from a file.
  - b) Calls on your function `mylu`
  - c) Prints `sd`, the permutation vector  $p$ , the matrices  $L$  and  $U$ , and the determinant of  $A$  as determined from  $U$ .
  - d) If the matrix is nonsingular, solve the linear system  $Ax = b$  by calling on `mysol`, then prints the value of  $x$  along with the max-norm of the residual  $b - Ax$ .
- 4) Run your code with the following data files which you can download from the web page:
  - a) `mp3.dat1`
  - b) `mp3.dat2`
- 5) Turn in a complete listing of your code along with the output for the four runs.