Problem Set 2

Due Date: March 25, 2015

Use double precision computations.

Write a subroutine (function) named jacobi implementing the Jacobi algorithm for the SVD of a real matrix. The singular values should be returned in decreasing order, and the order of the singular vectors should correspond to the order of singular values.

The calling sequence of the FORTRAN subroutine should be

$$jacobi(a, n, s, u, v) \tag{1}$$

The input parameters in the calling sequence are
a - the $n \times n$-matrix to be diagonalized, given as $n \times n$ array; will be destroyed by the subroutine
n - the dimensionality of the matrix

The output parameters are:
s - the spectrum of the matrix, in order of decreasing values (all should be non-negative), given as an array of length n
u - the left singular vectors of the matrix a, given as $n \times n$ array
v - the right singular vectors of the matrix a, given as $n \times n$ array

The calling sequence of the C function should be

$$void\ jacobi(double * a,\ int\ n,\ double * s,\ double * u,\ double * v) \tag{2}$$

The input parameters in the calling sequence are
a - the $n \times n$-matrix to be diagonalized, given as $n \times n$ array; will be destroyed by the subroutine. Please note that, unlike in the FORTRAN environment, the matrices are stored *by the row*, i.e. The elements of the matrix a should be ordered as follows:

$a_{1,1}$, $a_{1,2}$, ..., $a_{1,n}$, $a_{2,1}$, $a_{2,2}$, ..., $a_{2,n}$, ..., ...,$a_{n,1}$, $a_{n,2}$, ..., $a_{n,n}$.

n - the dimensionality of the matrix

The output parameters are:
s - the spectrum of the matrix a, in order of decreasing values (all should be non-negative), given as an array of length n
u - the left singular values of the matrix a, given as $n \times n$ array
v - the right singular values of the matrix a, given as $n \times n$ array