

Assignment 7

1. This assignment involves module DENSEOP, which is described at <http://nce.ads.uga.edu/~ignacy/newprograms.html>. To use this module, compile files kind.f90 lapack90r.f90 denseop.f90 together with your application program. These files are available from the Linux machine at a location shown on board. An example of the use of this module is in file testdense.f90 in directory xx/course/test, where xx is shown on board. All programs can be compiled by the make command:

```
make
```

For make to work, write Makefile.

Examine contents of kind.f90 lapack90r.f90 denseop.f90.

Consider the following system of equations $Ax=b$:

$$\begin{bmatrix} 363018 \\ 304123 \\ 182314 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 150 \\ 181 \\ 106 \end{bmatrix}$$

Using dense matrix module DENSEOP and precision (r8):

- a) calculate Cholesky decomposition $A=LL'$ and check its correctness by matrix multiplication,
 - b) calculate eigenvalues and eigenvectors: $A=VDV$, and verify that $VV'=I$,
 - c) calculate the determinant of A
 - d) solve for x using both symmetric and general solvers; confirm the correctness of solutions by multiplication
 - e) Calculate the inverse of A and verify that $AA^{-1}=I$.
2. Repeat solving in different data formats: dense and half stored, single and double precision. To create a half stored matrix, convert a full-stored matrix.

Optional - hard

1. Write a hash matrix subroutine.
 - a) test with a few indices.
 - b) rework for different number of indices. Test with 8 digit Ids
 - c) rework to work with characters. Try 8 character IDs.