PHZ4151C, Fall 2019
Homework 5
Due Friday Nov 1st, 11.59PM

Instructions: Solve all four problems. Every problem is worth 10 points. Write your codes following the strategy discussed in the "Structure of the program and program design" video and the format used in the sample programs discussed in the class and lecture videos. Make sure that your code is clear, readable for users other than yourself, and properly commented. Once finished, include all your program files and figures into a zip file named after your last name and homework number (e.g. "Ullah_HW5.zip") and submit it through canvas. Submitting individual files for each problem or part of the problem will not be accepted and disregarded. There is no need to include big data files generated by your programs unless the data files are read by your programs (that is the program reads data from the file and uses that data). Email me any questions or concerns about the homework either through canvas or directly my email address.
Note: You are allowed to submit incomplete codes for partial credit.

Problem 1: We used the BLAS subroutine *dgemm* to perform the following matrix operation: $C = alpha*A*B + beta*C$ where all matrices are real. The complex version *chemm* of this subroutine performs the same operation on Hermitian matrices. Use *chemm* to multiply two 4 by 4 Hermitian matrices. Note that a Hermitian matrix A has complex elements and obeys $A^H = A$ where operator H is equivalent to complex-conjugate Transpose of a matrix. Have your program write the two matrices that you multiply as well as the resultant matrix.

Problem 2: Find and use a BLAS subroutine that performs the following operation $y = alpha*A^H*x$ where A is a matrix of all complex elements and x is a vector having complex elements. Have your program write A, x, and y.

Problem 3: In *EigV_Symetric_Lapack.f90*, we used subroutine *DSYEV* to compute the eigenvalues and eigenvectors of a 5 by 5 symmetric matrix. Use *DSYEV* to compute the eigenvalues and eigenvectors of a 8 by 8 matrix A. Verify that the eigenvalues are correct by checking that the inverse of $(A - \lambda*I)$ doesn't exist or determinant of $(A - \lambda*I) = 0$, where I is the identity matrix.

Problem 4: Use appropriate eigenproblem solver to find the eigenvalues and eigenvectors of the matrix

$$A = \begin{pmatrix} -1 & 5 & -2 \\ 4 & 2 & -8 \\ -5 & -6 & 1 \end{pmatrix}.$$

Have you program write all eigenvalues and eigenvectors.