PHY622/Assignment 03

Date: February 22, 2018

Note: Solve the following problems. The submission of assignment is NOT required. You are encouraged to discuss with each other and/or contact the instructor if you have any difficulty in solving the problems.

Problem 1. Problem 2.21 (on page 78) of *Mathematical Physics*, Sadri Hassani.

Problem 2. Show that:

(a) Eigenvalues of Hermitian operator are real.

(b) Eigenvalues of Unitary operator are phases.

(c) Eigenvalues of Hermitian Projection operator are 0 or 1.

Problem 3. Find the spectral decomposition of each of the Pauli's matrices.

Problem 4. For $R\,H\,R^{-1} = D$ where H is hermitian matrix and D is diagonal matrix, show that R is always a unitary matrix.

Problem 5. Using the spectral decomposition of A,

$$A = \sum_{i=1}^{r} \lambda_i \mathbf{P}_i$$

show that an expandable function of A in power series can be written as

$$f(A) = \sum_{i=1}^{r} f(\lambda_i) \mathbf{P}_i$$

Problem 6. Problem 4.11 (on page 139) of *Mathematical Physics*, Sadri Hassani.

Problem 7. Problem 4.19 (on page 139) of *Mathematical Physics*, Sadri Hassani. [Hint: To solve (c) and (d), you may use the results of Problem 5 and 6 given in the above.]