PHZ 3113 – PROBLEM SET 3

1) **Text Problem 1.9 –** note that two matrices anticommute if BA=-AB. Evaluation of the expression in the last part is facilitated by first showing that the matrices A and C anticommute.

2) Prove the following statements:

a) Any matrix that is the commutator of two other matrices has zero trace; i.e., if C=[A,B], then Trace(C)=0.

b) If A is a *diagonal* matrix with no two elements equal to each other and if A commutes with a second matrix B, then the matrix B must also be a diagonal matrix.

3) Find the inverse of the 3 X 3 matrix whose rows are 3 2 1 (row1) , 2 2 1 (row2), and 1 1 4 (row 3).

4) Prove the following statements:

a) If a matrix C is defined by the relation $C=S^{\dagger}S$, where S is any non-null matrix and $S^{\dagger}$ is its Hermitian conjugate, then the trace of C will be greater than zero.

b) If A and B are any two Hermitian matrices, then the matrices C=AB+BA and D=*i*(AB-BA) are also Hermitian matrices.

5) **Text Problem 1.14 –** to determine whether each set of equations has a non-zero solution, you will need to evaluate the determinant of the coefficient matrix.

6) **Text Problem 1.16 –** to determine whether the set of equations has a unique solution, you will need to evaluate the determinant of the coefficient matrix. Note that the problem specifies that a *matrix* method (*not* Gaussian elimination) is to be used to obtain the solution.

7) **Text Problem 1.7 –** In part d of this problem, it is useful to multiply the equation defining A on the left by 1+S and then to consider the transpose of the resulting equation using the fact that $S^T=-S$.

8) **Text Problem 1.18 –** recall that for a unique solution to a set of inhomogeneous linear equations, the determinant of the coefficient matrix must be non-zero. You should find that the determinant is zero for *two* values of the parameter α. You need to consider these two values separately. For one value, there is no solution at all; for the other there is an infinity of solutions. For the second case, you should be able to express two of the unknown quantities in terms of the third.