PHYS 3701 - Assignment #3
Due Friday February 13, 2015

1. a) Show $\left[\hat{A}+\hat{B},\hat{C}\right]=\left[\hat{A},\hat{C}\right]+\left[\hat{B},\hat{C}\right]$.

   b) Show $\left[\hat{A}\hat{B},\hat{C}\right]=\hat{A}\left[\hat{B},\hat{C}\right]+\left[\hat{A},\hat{C}\right]\hat{B}$.

   c) Show that $\left(\hat{A}\hat{B}\right)^{\dagger}=\hat{B}^{\dagger}\hat{A}^{\dagger}$. Note that the small 't' here is supposed to be a dagger and represent Hermitian conjugation.

   d) If $\left[\hat{B},\hat{C}\right]=\hat{A}$ and $\left[\hat{A},\hat{C}\right]=\hat{B}$ show $\sigma_{AB}\sigma_{C}\geq\frac{1}{2}\left\langle\hat{A}^{2}+\hat{B}^{2}\right\rangle$.

   e) Simplify $\left[\hat{x}^{2},\hat{p}^{2}\right]$.

2. Scherrer Chapter 5 # 6. We will discuss this in class in the context of the time-energy uncertainty principle.

3. Show that Hermitian operators have real eigenvalues. Show that eigenvectors of a Hermitian operator with unique eigenvalues are orthogonal. Use Dirac notation for this problem.

4. Show that the position, momentum, and Hamiltonian operators are Hermitian. (see Chapter 5 and question 5.7).