

**Physics 7501 (Quantum Mechanics I):  
Homework Set No. 1**

**Due date: Tuesday, September 1, 2015, 5:00pm  
in PRB M2025 (Abhishek Mohapatra's office)**

**Total point value of set: 100 points**

**Problem 1 (10 pts.):** Exercise 1.1.1 (Shankar p.2)

**Problem 2 (5 pts.):** Exercise 1.1.3 (Shankar p.4)

**Problem 3 (10 pts.):** Orthonormalize the vectors  $|I\rangle \leftrightarrow (0, 3, 4)$ ,  $|II\rangle \leftrightarrow (2, 0, 0)$ ,  $|III\rangle \leftrightarrow (0, -1, 3)$ , using the Gram-Schmidt procedure and starting with  $|I\rangle$ .

**Problem 4 (10 pts.):** Exercise 1.3.4 (Shankar p.17, proof of triangle inequality)

**Problem 5 (15 pts.):** Exercise 1.4.1 (Shankar p.18)

**Problem 6 (10 pts.):** Exercise 1.4.2 (Shankar p.18)

**Problem 7 (10 pts.):** Exercise 1.6.1 (Shankar p.22)

Describe the action of this operator as a rotation about some axis and specify the axis in terms of a normalized unit vector constructed from the states  $|1\rangle$ ,  $|2\rangle$ ,  $|3\rangle$  and give the value of the rotation angle.

**Problem 8 (15 pts.):** Exercise 1.8.3 (Shankar p.41)

**Problem 9 (5 pts.):** Exercise 1.8.6 (Shankar p.42)

**Problem 10 (10 pts.):** Exercise 1.8.8 (Shankar p.43) [Note: in part (2) it should read  $M^i M^j = -M^j M^i$ ]