Physics 200-06
Assignment 6

1) A particle is found by measurement to have the the value +2 for the physical attribute represented by the matrix $\begin{pmatrix} 1 & 1 \\ 1 & 1 \end{pmatrix}$. What is the probability that if the physical attribute represented by the $\begin{pmatrix} 1 & 1 \\ 1 & 0 \end{pmatrix}$ matrix is measured, its value is found to be the largest value of this attribute.

2) A particle is found by measurement to have the value of +1 for the attribute represented by $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$. Then the attribute $\begin{pmatrix} 2 & 0 \\ 0 & 0 \end{pmatrix}$ is measured and found to have value +2. What is the probability that if $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$ is remeasured, its value is found to be $-1$?

3) The probability that it will rain today is .4 and tomorrow it is .6.
i)What is the probability that it will not rain today?
ii)What is the probability that it will rain both today and tomorrow?
iii) If it rains today, the amount of rain will be 12mm. What is the average rainfall predicted for today?

4) The following is a table of the number of times, in a throwing of a dice 1000 times, that the faces with the various numbers of spots comes up with the various values. What are the probabilities that two of the same dice will come up with their spots totalling 12? Totalling 7? (Assume, contrary to fact, that the probabilities are accurately reflected by their frequencies).

| Spots | #times |
|---|---|
| 1 | 155 |
| 2 | 158 |
| 3 | 175 |
| 4 | 170 |
| 5 | 180 |
| 6 | 162 |

(1)

5) i)Show that any 2x2 Hermitean matrix which is not a multiple of the identity matrix has two distinct eigenvalues.

ii) Show that the non-Hermitean matrix $\begin{pmatrix} 0 & 1 \\ 0 & 0 \end{pmatrix}$ has only one eigenvector (up to multiplications by a constant) and one eigenvalue.

6)

$$|\phi\rangle = \begin{pmatrix} 1 \\ 1+2i \end{pmatrix} \tag{2}$$

$$|\psi\rangle = \begin{pmatrix} 3+4i \\ 5i \end{pmatrix} \tag{3}$$

What are the normalized vectors corresponding to these two vectors? What is $\langle\phi||\psi\rangle$ and $\langle\psi||\phi\rangle$?

Given that the state of the system is $|\psi\rangle$ what is the probability of measuring some attributes whose eigenvector is $|\phi\rangle$?