

Week 9 - Homework

March 15, 2014

1. Given the spin state: $\frac{1}{\sqrt{2}}|+z\rangle + \frac{1}{\sqrt{2}}|-z\rangle$

If you do a measurement in the z basis.

What is the probability of getting $|+z\rangle$

2. Given the spin state: $\frac{1}{\sqrt{2}}|+z\rangle + \frac{1}{\sqrt{2}}|-z\rangle$

If you do the observation associated with the matrix $\begin{bmatrix} 0 & 1 \\ 1 & 0 \end{bmatrix}$

What is the probability of getting the $+1$ eigenvalue

3. Given the spin state: $-\frac{4}{5}|+x\rangle - \frac{3}{5}|-x\rangle$

If you do a measurement in the x basis.

What is the probability of getting $|+x\rangle$

4. Given the spin state: $\frac{3}{\sqrt{10}}|+y\rangle + \frac{1}{\sqrt{10}}|-y\rangle$

If you do the observation associated with the matrix $\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$

What is the probability of seeing the 1 eigenvalue

5. Given the spin state: $-\frac{5+4i}{\sqrt{51}}|+x\rangle + \frac{3+i}{\sqrt{51}}|-x\rangle$

If you do a measurement in the z basis.

What is the probability of getting $|-z\rangle$

6. Given the spin state: $-\frac{1+2i}{\sqrt{10}}|+z\rangle + \frac{1+2i}{\sqrt{10}}|-z\rangle$

If you do a measurement in the y basis.

What is the probability of getting $|-y\rangle$

7. Given the spin state: $\frac{3i}{\sqrt{35}}|+z\rangle - \frac{1+5i}{\sqrt{35}}|-z\rangle$

If you do the observation associated with the matrix $\begin{bmatrix} 1 & 0 \\ 0 & -1 \end{bmatrix}$

What is the probability of seeing the -1 eigenvalue

8. Given the spin state: $\frac{4+3i}{5\sqrt{2}}|+z\rangle - \frac{3+4i}{5\sqrt{2}}|-z\rangle$

If you do a measurement in the x basis.

What is the probability of getting $|-x\rangle$

Solutions

1. $\frac{1}{2}$ or 0.5

2. 1 or 1.0

3. $\frac{16}{25}$ or 0.64

4. $\frac{4}{5}$ or 0.8

5. $\frac{89}{102}$ or approximately 0.8725

6. $\frac{1}{2}$ or 0.5

7. $\frac{26}{35}$ or approximately 0.7429

8. $\frac{49}{50}$ or 0.98