QUANTUM STATES FOR TWO QUBIT SYSTEMS

Question 1

We define a state $|\psi\rangle=\alpha\,|00\rangle+\beta\,|01\rangle+\gamma\,|10\rangle+\delta\,|11\rangle$ to be a valid quantum state if $|\alpha|^2+|\beta|^2+|\gamma|^2+|\delta|^2=1$. Which of the following equations describe a valid quantum state?

(a) Example: $\frac{1}{2}\ket{00} + \frac{1}{2}\ket{01} + \frac{1}{2}\ket{10} + \frac{1}{2}\ket{11}$

$$\alpha = \frac{1}{2}, \beta = \frac{1}{2}, \gamma = \frac{1}{2}, \delta = \frac{1}{2}$$
$$\alpha^2 + \beta^2 + \gamma^2 + \delta^2 = (\frac{1}{2})^2 + (\frac{1}{2})^2 + (\frac{1}{2})^2 + (\frac{1}{2})^2 = 1$$

Since $\alpha^2+\beta^2+\gamma^2+\delta^2=$ 1, $|\psi\rangle$ is a valid quantum state.

(b)
$$|\psi\rangle = \frac{\sqrt{7}}{5}|00\rangle + \frac{\sqrt{7}}{\sqrt{5}}|01\rangle + \frac{3}{5}|10\rangle + \frac{\sqrt{2}}{5}|11\rangle$$

(c)	$ \psi\rangle$	=	$ 00\rangle$

(d)
$$|\psi\rangle = |00\rangle + |01\rangle + |10\rangle + |11\rangle$$

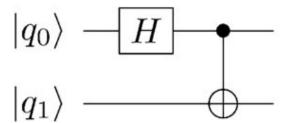
(e) $ \psi angle=rac{3}{5}\left 00 ight angle+rac{4}{5}\left 01 ight angle$	
MEASUREMENT	
Question 2	
For the following, quantum states, what would the qubits most likely collapse to?	
(a) Example: $\frac{1}{2}\ket{00}+\frac{1}{2}\ket{01}+\frac{1}{2}\ket{10}+\frac{1}{2}\ket{11}$	
This state is in an equal superposition of the four state $ 00\rangle, 01\rangle, 10\rangle, 11\rangle.$ Therefore, we can equally expect the state states to be: $FirstQubit:0, SecondQubit:0\\FirstQubit:0, SecondQubit:1\\FirstQubit:1, SecondQubit:0\\FirstQubit:1, SecondQubit:1$:S
(b) $ \psi\rangle = 00\rangle$	
(c) $ \psi\rangle = \frac{1}{\sqrt{2}} 0\rangle + \frac{1}{\sqrt{2}} 1\rangle$	

(d) $ \psi\rangle = \frac{1}{\sqrt{2}} 00\rangle + \frac{1}{\sqrt{2}} 11\rangle$
(e) For $ \psi\rangle=\frac{1}{\sqrt{2}} 00\rangle+\frac{1}{\sqrt{2}} 11\rangle$, if we measure the first qubit to result in 0, what can we say about the second qubit?
(f) For $ \psi\rangle=\frac{1}{\sqrt{2}} 01\rangle+\frac{1}{\sqrt{2}} 10\rangle$, if we measure the first qubit to result in 0, what can we say about the second qubit?
(g) For $ \psi\rangle=\frac{1}{\sqrt{2}} 00\rangle+\frac{1}{\sqrt{2}} 11\rangle$, if we measure the first qubit to result in 1, what can we say about the second qubit?
(h) For $ \psi\rangle=\frac{1}{\sqrt{2}} 00\rangle+\frac{1}{\sqrt{2}} 01\rangle$, if we measure the first qubit to result in 0, what can we say about the second qubit?

ENTANGLEMENT: BELL STATES

Question 3

Prepare bell states starting with the states $\ket{00}, \ket{01}, \ket{10}, \ket{11}$. What is the resulting state?



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