1. Alice has the first qubit of the two qubit system with wave function $|\Phi_+\rangle = \frac{1}{\sqrt{2}}(|00\rangle + |11\rangle)$. Now suppose that Alice applies $X$ to her qubit. What is the new two qubit wave function? Is this state orthogonal to $|\Phi_+\rangle$?

What if Alice had applied $Z$ to her qubit, what is the new two qubit wave function? Is this state orthogonal to $|\Phi_+\rangle$?

2. Suppose we have $n$ qubits with the wave function $|\phi_x\rangle = \frac{1}{\sqrt{2^n}} \sum_{y=0}^{2^n-1} (-1)^{y \cdot x}|y\rangle$. What is the new $n$ qubit wave function if we apply the $n$ qubit unitary $Z^\otimes n$ to this state?