1. (10 points) Consider the 2-qubit \( \frac{1}{\sqrt{2}}(|00\rangle + |11\rangle) \). Suppose we first apply a rotation of \( \frac{\pi}{8} \) to the second qubit, and we next apply a rotation of \( -\frac{\pi}{8} \) to the first qubit. Give the resulting superposition of the 2-qubit in the form \( \frac{1}{\sqrt{2}}(\alpha_{00}|00\rangle + \alpha_{01}|01\rangle + \alpha_{10}|10\rangle + \alpha_{11}|11\rangle) \).
   (Also give the calculations leading to your solution.)