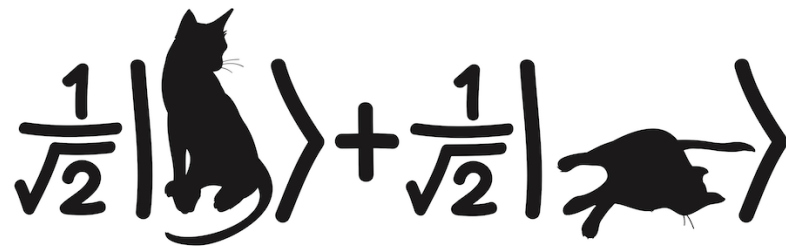


Quantum Mechanics & Quantum Computation

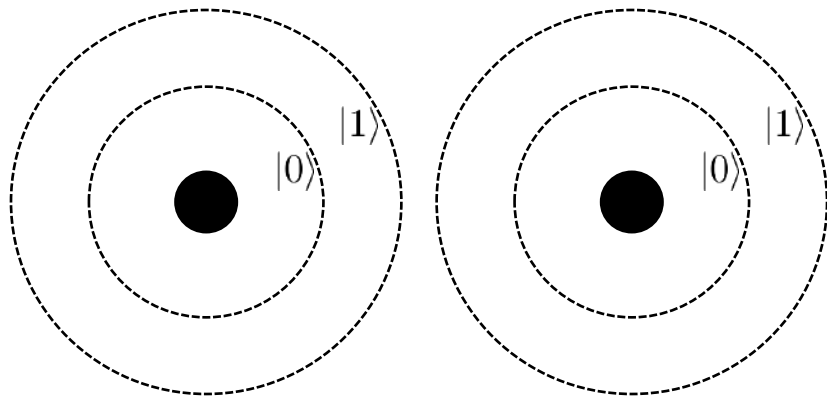
Umesh Vazirani, UC Berkeley



Lecture 3: Two Qubits & Entanglement

Two Qubits

Two Qubits

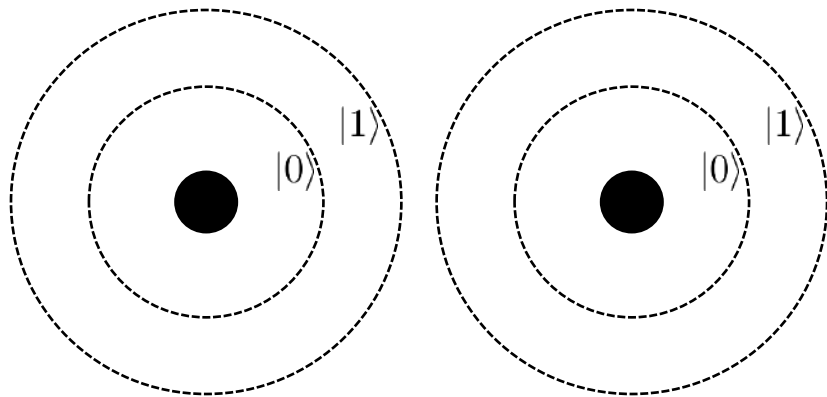


- Classically represent two bits of info:
 - 00, 01, 10, 11.
- Quantum state is a superposition over all four classical possibilities:

$$|\psi\rangle = \alpha_{00}|00\rangle + \alpha_{01}|01\rangle + \alpha_{10}|10\rangle + \alpha_{11}|11\rangle$$

$$|\alpha_{00}|^2 + |\alpha_{01}|^2 + |\alpha_{10}|^2 + |\alpha_{11}|^2 = 1$$

Measurement



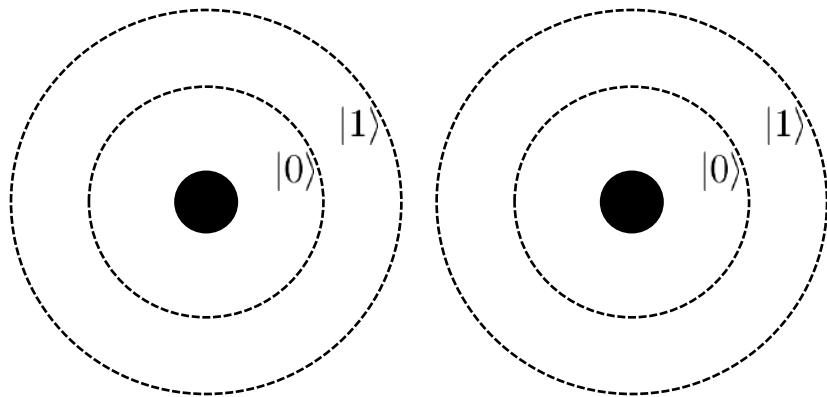
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Observe j with probability $|\alpha_j|^2$.
New state = $|j\rangle$.

Partial Measurement



- What is the result of measuring just the first qubit?

$$|\psi\rangle = \alpha_{00}|00\rangle + \alpha_{01}|01\rangle + \alpha_{10}|10\rangle + \alpha_{11}|11\rangle$$

$$|\alpha_{00}|^2 + |\alpha_{01}|^2 + |\alpha_{10}|^2 + |\alpha_{11}|^2 = 1$$