Introduction to quantum computing

What is qubit state?

Mathematical Representation of a Qubit State

A qubit's state is represented as a linear combination of two basis states (**|0⟩ and |1⟩**):

$$|\psi\rangle = \alpha|0\rangle + \beta|1\rangle$$

where:

- α and β are **complex numbers** representing probability amplitudes.
- $|\alpha|^2$ is the probability of measuring the qubit in state **|0⟩**.
- $|\beta|^2$ is the probability of measuring the qubit in state **|1⟩**.
- The total probability must sum to 1:

$$|\alpha|^2 + |\beta|^2 = 1$$

Key Properties of a Qubit State

Superposition

Collapse Upon Measurement

Bloch Sphere Representation