University of Jyväskylä - Course TIEJ6003
intro2QC Summer2024: ex2

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Exercise 2.1: averaged measurements

Suppose we have qubit in the state $|0\rangle$, and we measure the observable X (Pauli's σ_x!).
What is the average value of X?
What is the standard deviation of X?

Exercise 2.2: Hadamard identities

Prove the following identities for the Hadamard gate H:

$$HZH = X; \quad HTH = R_x(\pi/4).$$

Exercise 2.3: Hadamard via rotations

Express the Hadamard gate H as a product of R_x and R_z rotations,

$$H = R_z(\pi/2)R_x(\pi/2)R_z(\pi/2)$$

up to a global phase of $e^{-i\pi/2}$.

Exercise 2.4: XY manipulations

Show that $XYX = -Y$ and use it to prove that $XR_y(\theta)X = R_y(-\theta)$.

Exercise 2.5: X_1Z_2

Show that the average value of the observable X_1Z_2 for a 2-qubit system measured in the state $(|00\rangle + |11\rangle)/\sqrt{2}$ is zero.