Quantum One-Time Pad Encryption using Quirk

Project Summary: In this project, I implemented a Quantum One-Time Pad (QOTP) encryption protocol using the Quirk quantum circuit simulator. The goal was to securely transmit a classical message by leveraging quantum superposition, entanglement, and measurement principles.

Key Features:

- **Quantum Key Generation**:
  Utilized Hadamard gates to place key qubits in superposition, creating random key bits.
- **Message Encoding with CNOT Gates**:
  Applied controlled NOT (CNOT) gates to encode a classical message using the generated key, ensuring encryption through quantum entanglement.
- **Message Decoding and Measurement**:
  Re-applied Hadamard gates to decode the key and measured all qubits to retrieve both the key and the message securely.
- **Security Insight**:
  Demonstrated how any attempt to intercept the quantum transmission disturbs the system, ensuring the detection of potential eavesdroppers.

Tools & Concepts Used:

- Quantum Gates: Hadamard (H), Pauli-X (X), CNOT
- Measurement Operations
- Quirk Quantum Circuit Simulator