Quantum Error Correction

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Introduction

"To be an Error and to be Cast out is part of God's Design."

William Blake

- Noise as a longstanding problem in information processing systems
  - *e.g.*, classical computers, modems, CD players, etc.
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- Key idea: to protect a message against noise, *encode* the message by adding redundant information; even if some information is corrupted, redundancy allows us to *decode* and recover the original message

Project Framework

- Goals:
  - to implement various quantum error-correcting codes (3-qubit, 9-qubit, 7-qubit)
  - to analyze and compare their performances: *when are they effective?*
- Tools:
  - Python's Qiskit package
  - IBM's quantum machines

3-qubit codes

Classical inspiration: repetition codes and majority voting

The Shor code

7-qubit code