Understanding Quantumness And Testability.

D. Ponarovsky[1]

Master-Exam-Huji.

Faculty of Computer Science
Hebrew University of Jerusalem

Today.

- Brif Review of Coding.

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- Quantum Error Correction Codes.

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- Quantum Error Correction Codes.
- Good Classical Locally Testabile Codes and Good Qauntum LDPC.

Introduction.

The work assumes only a basic knowledge of linear algebra and combinatorics. So we believe that every computer science graduate will be able to enjoy reading it, understand the subject very well, and use it as a gateway for starting research in the field.

Coding.

Coding.

Can we come up with a code that tolerates $*$ bits flip?

Coding.

Definition

Let $n \in \mathbb{N}$ and $\rho, \delta \in (0,1)$. We say that C is a **binary linear code** with parameters $[n, \rho n, \delta n]$. If C is a subspace of $\mathbb{F}_2^n$, and the dimension of C is at least ρn. In addition, we call the vectors belong to C *codewords* and define the distance of C to be the minimal number of different bits between any codewords pair of C.

Coding.

Definition

A **family of codes** is an infinite series of codes. Additionally, suppose the rates and relative distances converge into constant values ρ, δ. In that case, we abuse the notation and call that family of codes a code with $[n, \rho n, \delta n]$ for fixed $\rho, \delta \in [0, 1)$, and infinite integers $n \in \mathbb{N}$.

Definition

We will say that a family of codes is a **good code** if its parameters converge into positive values.

Quantum Error Correction Codes.

Definition (CSS Code)

Let C_X, C_Z classical linear codes such that $C_Z^{\perp} \subset C_X$ define the $Q(C_X, C_Z)$ to be all the code words with following structure:

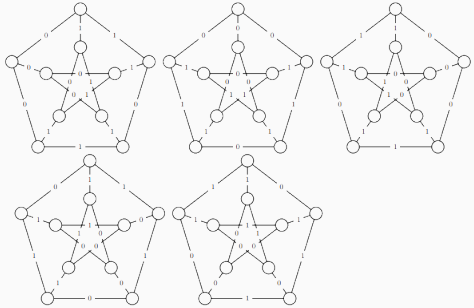
$$|\mathbf{x}\rangle := |x + C_Z^{\perp}\rangle = \frac{1}{\sqrt{C_Z^{\perp}}} \sum_{z \in C_Z^{\perp}} |x + z\rangle$$

Coding.

Coding.

BUS.

- A BUS is a communication pathway that transfers data between different components of a computer.



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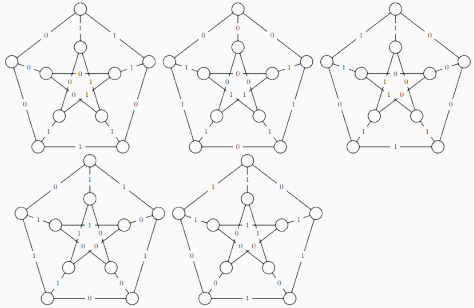
- A BUS is a communication pathway that transfers data between different components of a computer.
- Buses connect IO devices such as keyboards, monitors, and printers to the computer's central processing unit (CPU).



BUS.

- A BUS is a communication pathway that transfers data between different components of a computer.
- Buses connect IO devices such as keyboards, monitors, and printers to the computer's central processing unit (CPU).
- Buses provide a standardized way for different components to exchange data with each other, simplifying device connection and ensuring compatibility.