

# The Permutations Paper for non Algebraic Speakers.

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## Abstract

A guide for reading Becker, Lubotzky, and Mosheiff's paper for computer scientists. The goal is to help the reader by providing analogs and examples from the combinatorics field.

## 1 Motivation (Use Cases List).

We start by presenting several use cases that may be of interest to computer scientists.

1. Testing candidates for LTC/QLDPC codes. One of the resources needed for the available constructions is a square complex in which the encoding associates each bit with a face. We can obtain these structures by taking the Left-Right Cayley graph generated by a pair of generator sets  $A, B$ , such that  $[A, B] = 0$ .
2. Testing if a set of stabilizers forms a stabilizer code. Here the stabilizers are subsets of the Pauli group and they form a code only if they all commute.
3. Classical toy-version of QMA complete problem. It's known that decide if two quantum circuits over  $n$  qubits are  $1/poly$ -equivalent is QMA-complete problem. So, One question that could be interesting is to ask given prem'  $P = \prod p_i$  and  $Q = \prod q_i$  such that  $p_i$  ( $q_i$ ) act over a constant size of bits (assuming binary encoding), then ask whether  $P = Q$ .



## 2 Example.

First example, consider permutations  $f, g$  over  $n = 2m$  elements defined as follow:

$$f(i) = \begin{cases} \sigma & i < m \\ \sigma^{-1} & i \geq m \end{cases}$$
$$g(i) = \tau\sigma$$