Memory.

Michael Ben-Or David Ponarovsky

August 7, 2025

0.1 Definitions.

0.2 Idea.

$$\begin{array}{ccccc} \text{Given - } \rho & \longrightarrow & \text{Decoding} & \longrightarrow & p\text{-depololraized} \\ \downarrow & & \downarrow & & \downarrow \\ E_1 & & E_2 & & E_3 \end{array}$$

$$\mathbf{Pr}\left[\mathbf{Sup}E_2 = S\right] \leq \mathbf{Pr}\left[\text{any bit } v \in S_{c_1} \text{ sees majority of unstatisfied stabilizers }\right] \leq q^{\Delta|S|_{c_1}}$$

$$\begin{aligned} \mathbf{Pr}\left[\mathbf{Sup}E_3 = S\right] &= \sum_{S' \subset S} \mathbf{Pr}\left[E_2\mathbf{Sup}S' \cap E_3/E_2\mathbf{Sup}S/S'\right] \\ &\leq \sum_{S' \subset S} q^{\Delta|S'_{c_1}|} p^{|S/S'_{c_1}|} \leq \sum_{S' \subset S} q^{\Delta|S'_{c_1}|} p^{|S_{c_1}|-|S'_{c_1}|} \\ &\leq \left(q^{\Delta} + p\right)^{|S_{c_1}|} \leq \begin{cases} \left(q^{\Delta} + p\right)^{\frac{1}{4}|S|} & \text{if } |S_{c_1}| \geq \frac{1}{4}|S| \\ \star & \text{else} \end{cases} \end{aligned}$$

Let $S^t = \mathbf{Sup}E$ at time t and denote by $\mathcal{P}_t$ the probability that $|S^t_{c_1}| > \frac{1}{4}|S_t|$.