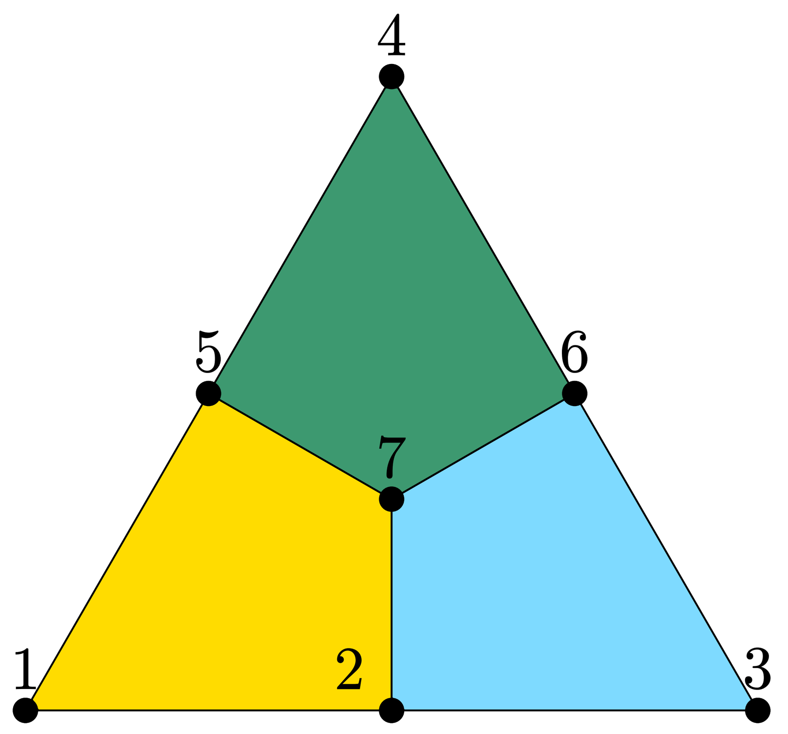
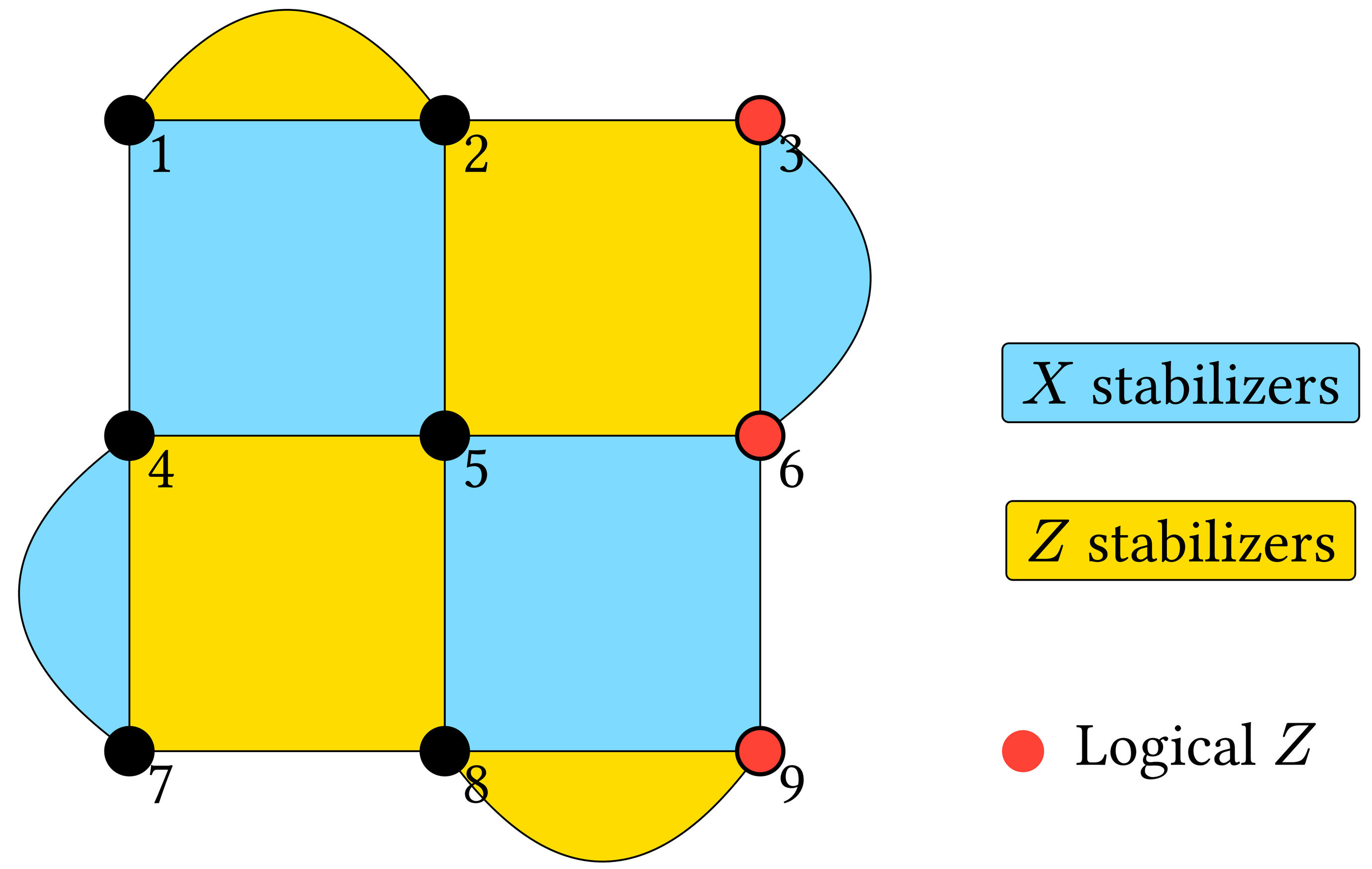
Zhongyi's Cheatsheet, 2025/03

Codes





Pauli

$$X = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}, \quad Y = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}, \quad Z = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$$

$$\begin{aligned} XY &= iZ, & YZ &= iX, & ZX &= iY \\ YX &= -iZ, & ZY &= -iX, & XZ &= -iY \end{aligned}$$

$$\begin{aligned} [X, Y] &= 2iZ, & [Y, Z] &= 2iX, & [Z, X] &= 2iY \\ [Y, X] &= -2iZ, & [Z, Y] &= -2iX, & [X, Z] &= -2iY \end{aligned}$$

Quantum channels

A quantum channel: $\varphi \in T(X, Y)$

Kraus representation:

$$\varphi(\rho) = \sum_i E_i \rho E_i^\dagger \text{ (CP)}, \quad \sum_i E_i^\dagger E_i = I \text{ (TP)}$$

Choi isomorphism: $J : T(X, Y) \to L(Y \otimes X)$

$$J(\varphi) = \sum_{i,j} \varphi(|i\rangle\langle j|) \otimes |i\rangle\langle j|$$

Definition representation: $\varphi(\rho) = \mathrm{Tr}_{E(U\rho U^\dagger)}$

Vectorization: $K(\varphi)\mathrm{vec}(\rho) = \mathrm{vec}(\varphi(\rho))$