1 Exercise 1: Shor\(_9\) code protection against arbitrary single qubit error.

**Exercise 1.1** Let \( \mathcal{E}(\rho) = \sum_k E_k \rho E_k^\dagger \) be the error channel. Show that each error \( E_k \) can be written as
\[
E_k = e_1^k \mathbb{1} + e_X^k X + e_Y^k Y + e_Z^k Z.
\]
What constraints are there on the \( \{e_0^k\} \)?

**Exercise 1.2** Show that the Shor\(_9\) code protects against \( \mathcal{E} \), by showing that each error \( E_k \) can be protected individually (you may use the Knill-Laflamme theorem).

2 Exercise 2: Depolarizing channel on each qubit.

**Exercise 1.1** Calculate the logical error rate of the Shor\(_9\) code against the independent identically distributed depolarizing channel.

**Exercise 1.2 (BONUS)** Calculate the logical error rate of the Shor\(_n\) code against the independent identically distributed depolarizing channel.