Problem 1

Consider a two-level system governed by the Hamiltonian $H = \frac{\omega_0}{2}\sigma_z$ and coupled to an external environment described by the two Lindblad operators $L_- = \sqrt{\gamma_-}\sigma_-$ and $L_+ = \sqrt{\gamma_+}\sigma_+$.

- Find the steady state and possibly the effective temperature as a function of the given parameters.
- Determine the corresponding Kraus operators

Problem 2

Quantum state preparation: Show that free bosons on a lattice subject to a Lindblad dynamics of the type $L_{ij} = (a_i^\dagger + a_j^\dagger)(a_i - a_j)$ lead the system, in the long time limit, to a pure BEC condensate. If and additional hopping Hamiltonian is added, does the steady state change? If yes, how? [i, j indicate lattice sites on a cubic lattice]