Quiz 5: Quantum Information Processing Protocols

Question 1. Consider a quantum teleportation protocol where Alice sends a state ρ_S to Bob, with whom she shares a maximally entangled state $\rho_{AB} = |\Phi^+_{AB}\rangle\langle\Phi^+_{AB}|$. What is Bob's marginal state *before* Alice sends the classical information $x, z \in \{0, 1\}$?

(a) ρ,

(b) $\frac{1}{2}\mathbb{1}$,

(c) $X^x Z^z \rho Z^z X^x$.

Question 2. Which of the following quantum channels are recoverable?

(a) $M_A \mapsto V M_A V^\dagger$, where $V\colon A \to B$ is an isometry.

(b) $M_{AB} \mapsto \mathrm{tr}_B[M_{AB}]$.

(c) $M_A \mapsto (1-p)M_A + \frac{p}{\dim(\mathcal{H}_A)} \mathrm{tr}[M_A]\mathbb{1}_A$, where $p \in (0, 1)$.