

Problem sheet 3: Non-local Games

Problem 1 (HW). Shared randomness. Suppose that there exists a classical strategy with shared randomness, winning a non-local game $\mathcal{G}$ with probability p_{win} . Prove that there is also a deterministic strategy winning $\mathcal{G}$ with probability at least p_{win} . *For simplicity you can assume that the shared randomness is just a discrete random variable with finite set of outcomes.*

Problem 2 (HW). Shared separables state. Suppose that there is a quantum strategy using a separable quantum state ρ_{AB} , winning a non-local game $\mathcal{G}$ with probability p_{win} . Prove that there also exists a randomized (and hence deterministic) strategy winning $\mathcal{G}$ with probability at least p_{win} .

Problem 3 (HW). Correlations beyond quantum theory. Find a non-signalling strategy that always wins the CHSH game. *There is no physical evidence for a theory supporting such correlations. So, do not worry about how to realize such a strategy, just describe the strategy as $p = (p(a, b|x, y)) \in [0, 1]^{O_A \times O_B \times I_A \times I_B}$.*