
Maximal violation of lifted Bell inequalities and its implications in self-testing

C. Jebarathinam¹, Jui-Chen Hung², and Yeong-Cherng Liang¹

¹Department of Physics and Center for Quantum Frontiers of Research & Technology (QFort), National Cheng Kung University, Tainan 701, Taiwan

²Department of Physics, National Cheng Kung University, Tainan 701, Taiwan

*jebarathinam@gmail.com

Abstract. In quantum information, lifting is a procedure employed to derive a Bell inequality applicable in a more complicated Bell scenario from an existing one. It is known that the procedure of lifting considered by Pironio [J. Math. Phys. A 46, 062112 (2005)] preserves the facet-defining property of a Bell inequality. Here, we perform a complementary investigation showing that the maximal value of a lifted Bell inequality is preserved for both the set of non-signaling correlations and quantum correlations. En route to showing these results, we also show that the optimal quantum state leading to the maximal violation of an outcome-lifted (party-lifted) Bell inequality is necessarily (essentially) the same as that for the original Bell inequality, thus showing that the self-testing property of a Bell inequality is partially preserved through the lifting procedure. The implication of these results on the usefulness of using lifted Bell-type inequality as a device-independent witness is also discussed.
