New proofs of the Kochen-Specker theorem for a system of three qubits MORDECAI WAEGELL, P.K. ARAVIND, Worcester Polytechnic Institute — In 1995 Kernaghan and Peres gave a transparent state-independent "parity proof" of the Kochen-Specker theorem by using a system of three qubits. They did this by using the observables of the 3-qubit system to construct a set of 40 rays in a real 8-dimensional space that formed 25 bases, and then picked out a subset of the bases that gave a parity proof. They showed that there are 320 different (but unitarily equivalent) versions of their proof in this 40-ray set. We extend their result in a number of ways. Firstly, we show that this 40-ray set contains five new types of parity proofs in addition to the one found by Kernaghan and Peres, and that the total number of versions of all six types of proofs under the symmetries of the system is $2^{11} = 2048$. Secondly, we point out the existence of a large number of state-independent KS proofs in the 3-qubit system that are structurally different from the Kernaghan-Peres proof, and we explore their features. The geometry of mutually unbiased bases (MUBs) in the 3-qubit system, which played a crucial role in the discovery of these new proofs, will be discussed.

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Date submitted: 05 Dec 2011   Electronic form version 1.4