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Exploring Perfect State Transfer Through Quantum Random Walks AUSTEN COUVERTIER, Worcester Polytech Inst, SWARNADEEP MAJUMDER, Worcester Polytechnic Inst — The field of quantum information (QI) theory is relevant to the goal of quantum computers. A mathematical model to understand QI is a graph. In graph theory, classical problems are described by graphs known as decision trees. To study problem-solving on these graphs, we utilized random quantum walks (RQW). This graph evolution is analogous to random walks (RW), which describe the time to get from an initial node to an answer node. To move from one node to another is complex in quantum mechanics (QM). Unlike classical RWs, where the evolution ends at one node 100% of the time, the quantum system ends in a superposition of nodes. Thus, we cannot guarantee the answer found by quantum computation is correct. To avoid quantum error, we studied graphs for the feature of perfect state transfer (PST). PST is when the time-evolution of a quantum state guarantees the system will be in one state with complete certainty. We translated graphs into a discrete QM system by using the adjacency matrix. This translates connections of nodes to a Hamiltonian of allowed transitions. We applied this to graphs that included: platonic solids, cell graphs, cycle graphs and hypercubes. Our results could prove useful to the future of QI by allowing classically hard decision trees to be solved.

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