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Orbix, LightsOut, and Related Vertex Neighborhood Switching Phenomena.

"Orbix" and "LightsOut" are two examples of graph puzzles in which each vertex of a graph G is considered to be in one of two states (often called ON and OFF). The state of the graph G, $S(G)$, is a list of the states of the vertices of G. Both puzzles consider a vertex neighborhood switching operation that is applied to some $U \subseteq V(G)$ so that, for every $v \in U$, each vertex in the open (for Orbix) or closed (for LightsOut) neighborhood of v changes its state. Given a graph G in an initial state $S(G)$, the usual objective in both of the puzzles is to determine a neighborhood switch function (in effect, a subset U), if one exists, that will result in the state of graph G with all of its vertices in the OFF state. For a specified vertex neighborhood switch operation, a graph state $S_1(G)$ is said to be switch related to a state $S_2(G)$ if there exists an appropriate switch function that changes the state of G from $S_1(G)$ to $S_2(G)$. For most vertex neighborhood switch operations of interest, the switch relation is an equivalence relation. This paper examines recent results on vertex neighborhood switching operations on graphs, with emphasis on graph state equivalence classes induced by the corresponding switch relation. (Received February 26, 2007)