



## RESOLUTION OF CONJECTURES RELATED TO LIGHTS OUT! AND CARTESIAN PRODUCTS\*

BRYAN CURTIS<sup>†</sup>, JONATHAN EARL<sup>†</sup>, DAVID LIVINGSTON<sup>†</sup>, AND BRYAN SHADER<sup>†</sup>

**Abstract.** Lights Out! is a game played on a  $5 \times 5$  grid of lights, or more generally on a graph. Pressing lights on the grid allows the player to turn off neighboring lights. The goal of the game is to start with a given initial configuration of lit lights and reach a state where all lights are out. Two conjectures posed in a recently published paper about Lights Out! on Cartesian products of graphs are resolved.

**Key words.** Matrix, Graph, Lights Out!, Sylvester equation.

**AMS subject classifications.** 05C50, 15A15, 15A03, 15B33.

---

\*Received by the editors on February 5, 2018. Accepted for publication on October 15, 2018. Handling Editor: Leslie Hogben. Corresponding Author: Bryan Curtis.

<sup>†</sup>Mathematics Department, University of Wyoming, Laramie, WY 82071 (bcurtis6@uwyo.edu, jearl5@uwyo.edu, dliving5@uwyo.edu, bshader@uwyo.edu).