

# Graceful Labeling meets Hamming Distance

Francesca Cantor<sup>1</sup>, Ashka Dalal<sup>2,\*</sup>, Sahojar Kahn<sup>3</sup>, Morgan Nasir<sup>4</sup>

<sup>1</sup>*Department of Mathematics and Statistics, Swarthmore College, Swarthmore, PA 19081, [fcantor1@swarthmore.edu](mailto:fcantor1@swarthmore.edu);*

<sup>2</sup>*Department of Mathematics, Rose-Hulman Institute of Technology, Terre Haute, IN 47803, [dalalas@rose-hulman.edu](mailto:dalalas@rose-hulman.edu);*

<sup>3</sup>*Department of Mathematics, University at Buffalo, Buffalo, NY 14260, [sahojark@buffalo.edu](mailto:sahojark@buffalo.edu);*

<sup>4</sup>*Department of Mathematics and Statistics, Williams College, Williamstown, MA 01267, [m1n2@williams.edu](mailto:m1n2@williams.edu)*

In 1967, Alexander Rosa introduced a graph labeling called graceful labeling. In our research we expand on this by introducing  $\eta$ -labeling. In an  $\eta$ -labeling, we assign binary strings as labels to the vertices and we induce an edge label as the Hamming distance between incident vertex labels such that all labels are distinct. We explore the relationship between graceful labeling and  $\eta$ -labeling, graphs that may have  $\eta$ -labelings, and counting the number of possible  $\eta$ -labelings for a given path.