

Accepted Manuscript

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PII: S0024-3795(17)30338-5

DOI: <http://dx.doi.org/10.1016/j.laa.2017.05.038>

Reference: LAA 14186

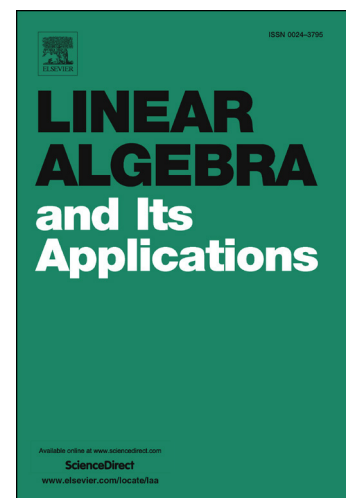
To appear in: *Linear Algebra and its Applications*

Received date: 3 August 2016

Accepted date: 19 May 2017

Please cite this article in press as: S. Bang, J. Koolen, Distance-regular graphs of diameter 3 having eigenvalue -1 , *Linear Algebra Appl.* (2017), <http://dx.doi.org/10.1016/j.laa.2017.05.038>

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Distance-regular graphs of diameter 3 having eigenvalue -1

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May 22, 2017

Abstract

For a distance-regular graph of diameter three Γ , the statement that distance-3 graph Γ_3 of Γ is strongly regular is equivalent to that Γ has eigenvalue -1 . There are many distance-regular graphs of diameter 3 having eigenvalue -1 , such as the folded 7-cube, generalized hexagons of order (s, s) and antipodal nonbipartite distance-regular graphs of diameter 3. In this paper, we show that for a fixed positive integer α (β , respectively), there are only finitely many distance-regular graphs of diameter 3 having eigenvalue -1 and $a_3 = \alpha$ ($\frac{b_1}{c_2} = \beta$ and $a_3 \neq 0$, respectively). Such distance-regular graphs for small numbers $\alpha = 1, 2$ or $\beta = 3$ with $a_3 \neq 0$ are classified. We show that there are no distance-regular graphs with intersection array $\{44, 35, 3; 1, 5, 42\}$. Moreover, we classify the distance-regular graphs with diameter 3 and smallest eigenvalue greater than -3 .

MSC: 05C50;05C12;05E30

Keywords: Distance-regular graph;Smallest eigenvalue;Strongly-regular graph

1 Introduction

For Γ a distance-regular graph of diameter 3, the statement that distance-3 graph Γ_3 of Γ is a strongly regular graph is equivalent to that Γ has eigenvalue -1 (see [2, Proposition 4.2.17]). There are many distance-regular graphs of diameter 3 having eigenvalue -1 , such as the folded 7-cube, generalized hexagons of order (s, s) and antipodal nonbipartite distance-regular graphs of diameter 3. In this paper we study distance-regular graphs of diameter 3 having eigenvalue -1 . In Theorem 1.1 (Theorem 1.2, respectively), we show that for a fixed positive integer α (β , respectively), there

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