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Non-commutative association schemes of rank 6 with affine subschemes

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Abstract

When association schemes are viewed as a generalization of groups, it becomes natural to seek non-commutative examples. As with groups, non-commutative association schemes must have at least six elements, but unlike in group theory, there are numerous examples with exactly six elements. One method to try to classify such schemes is to attempt to construct extensions of schemes of rank 3, starting with those schemes of rank 3 which correspond to self-complementary strongly regular graphs with a vertex-transitive automorphism group. Recent work of Klin, Kriger, and Woldar provides new constructions for such graphs. In this paper, we investigate the possibility of constructing new non-commutative schemes with six elements from these graphs.

Mathematics Subject Classification (2010). Primary 05E30; Secondary 05C25, 20B25

Keywords: association scheme, classical affine scheme, amorphic scheme, fusion scheme, scheme extension, strongly regular graph, self-complementary graph, group

1 Introduction

The study of association schemes provides a sufficiently general setting to encompass group theory, and also to generalize fundamental concepts in graph theory, the theory of combinatorial designs, of incidence geometries, in particular Tits buildings, and more. Much of the study of association schemes has traditionally focused on commutative schemes.¹ Our interest here, on the other hand, is in non-commutative schemes. As in

¹We will explain later in this section what it means for a scheme to be commutative. Also all other scheme theoretic terms needed to comprehend these introductory comments will be introduced later within this section.

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