Evolution Algebras, Cayley graphs and Local Derivations

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Abstract: The main objects of this project are evolution algebras associated with graphs. They were introduced by J. P. Tian in 2008 as an algebraic way to mimic the self-reproduction of alleles in non-Mendelian genetics. Much research effort has been devoted to exploring the connections between this abstract object and concepts of other fields, such as graph theory, Markov chains, groups, dynamical systems, among others.

The main goal of this project is to explore relationships between the structure of the graph and the existence (or not) of invariant properties of the associated evolution algebras, with a focus on two objects: Cayley graphs and local derivations.

We would like to understand the interaction between these objects by studying questions such as: What are the properties of the evolution algebras associated to the Cayley graphs of a finitely generated group? How does G act on the automorphism group of each algebra? Is it possible to describe the local derivations of an evolution algebra associated to a graph T using the properties of T? Which local derivations are derivations? This project will require knowledge of graph theory, group theory and linear algebra.