1035-05-380 **Elliot Andrew Paquette*** (elbaami@gmail.com), 1880 Sumac Ave, Boulder, CO 80304. *An Algebraic Approach to Characterizing Graph Invariants, with an Emphasis towards Computation.* Preliminary report.

A new approach to the analysis of graph invariants is presented. In particular, a basic result of Zhegalkin's in the 1920s is that any boolean function may be represented by a polynomial over $GF(2)$, and so graph decision problems may be represented by polynomials. However, graph decision problems are essentially always graph invariants (e.g. "Is a graph Eulerian?"), and so, only the polynomials which are invariant in some sense should be considered. This begs the entrance of the classical field of polynomial invariant theory, famously studied by Emmy Noether.

This is preliminary work, but there are a number of exciting results to present. This method allows for every graph to be realized as a function. For instance, by computing the polynomial generators for the ring of invariants, 46 graphs on 8 vertices are identified which completely capture all the possible complexity exhibited by the 12000 and some non-isomorphic graphs up to 8 vertices. In another instance, representations for classical questions such as "Is a graph hamiltonian?" are given in terms of graph functions. A number of conjectures and open problems have been posited. All of the work is accessible at an undergraduate level. (Received September 05, 2007)