15. **Miguel A. Abanades, Francisco Botana, Zoltan Kovacs, Tomas Recio and Csilla Solyom-Gecse**

Automatic Discovery in GeoGebra: First Steps

Automatic discovery of geometric facts is a manifold concept. Basically, it refers to methods for finding complementary hypotheses for a conjectured statement to become true. Say, one conjectures that the projections of a free point P, on the sides of a given triangle, are collinear; then we would like to automatically find out that this is true iff P lies on the outer circle of the triangle. As this example shows, automatic discovery includes a generalized, implicit locus computation (the locus of P). On the other hand, automatic derivation of formulas (say, finding the relation between the radii of the inner and the outer circle of a triangle and the distance between their centers, ie. Euler's theorem) can be considered as a sort of automatic discovery in which we consider a trivial thesis and we look for new hypotheses, just involving the variables describing the two radii and centers' distance.

In our talk we will present our current work on developing tools for the automatic discovery and derivation of elementary geometry statements, based on the implementation of computational algebraic geometry methods onto the dynamic geometry program GeoGebra. It is, in our opinion, the first time such tools will be available on a widely disseminated dynamic geometry program, allowing it to automatically (and wisely!) guide a student through an inductive exploration process on a geometric context.

The emphasis in our "Justifying (in) Math" presentation will be placed on two issues: 1) the contradictory, unexpected, results in some simple cases, requiring the implementation of a subtle protocol in our discovery algorithm, 2) the diverse mathematical and educational challenges posed by this -apparently straightforward- application of some well known algorithms onto the GeoGebra framework.

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