Implementing theorem proving in GeoGebra by using various methods

Francisco Botana, Zoltán Kovács, Tomás Recio, Simon Weitzhofer

GeoGebra is a widely known education software for teaching elementary geometry. Its intuitive, multilingual user interface is an important argument for most teachers who choose mathematics software for illustrating geometry, and using them to help the students in discovering mathematics.

Using GeoGebra as an input interface to decide geometric statements has already a wide interest in the mathematics education community. A recent approach is to use GeoGebra for defining geometric constructions and forwarding the construction data for further investigation to Sage, researched and programmed by Abánades and Botana in 2011. Another approach, suggested by Recio in 2002, to create some configurations by setting up free test points with carefully chosen coordinates, and bound the number of test cases depending on the degree of the statement polynomial and the number of variables.

Both methods will be introduced as a possible prover sub-engine for GeoGebra in the near future, and even other methods are also welcome to be tested by the GeoGebra developer community. The first method will be used via webservice technology, using Singular directly for making possible to solve advanced problems in commutative algebra and ideal theory with the fastest available algorithms and implementations. The second method will be programmed natively in GeoGebra in the Java language by using arbitrary precision rational arithmetic, but no symbolic calculations.