Presentation of the CoCoA library

The CoCoA Team: J.Abbott, A.Bigatti, M.Caboara and L.Robbiano

One of the products of the long running CoCoA project specialised in Computations in Commutative Algebra is a freely available interactive system offering good implementations of many algorithms in that area. This program (currently CoCoA version 4.3) has been, and still is, highly successful; indeed it has grown far beyond what was foreseen when its foundations were laid.
The CoCoA library is an important new phase in the project:
it
is a C++ library offering facilities for computational commutative algebra, and is a major component of the CoCoA 5 project.
The design of the library aims to offer the following:

(1) good run-time performance (in terms of both speed and space)
(2) ease of use through a structured design and clear documentation
(3) ready accessibility to non-programmers (*e.g.* via a server, or as an interactive system)
(4) reliability and longevity of the code by being open source

In the demo we shall exhibit access to the facilities of the CoCoA library from an interactive CoCoA 4.3 session using a rudimentary OpenMath-like protocol. Since CoCoA 4.3 is more restrictive than the CoCoA library some of the features of the library will be demonstrated using standalone C++ programs. To emphasise the cleanliness of the library design we shall also show the source code of some small programs which use the CoCoA library.

The particular computational features of the CoCoA library which we shall show include:

∗ computation of Gröbner bases with floating point coefficients
∗ computation of Gröbner bases in a multi-graded ring with user defined ordering

Besides the capabilities in the demonstration the CoCoA library offers, or will shortly offer, these features:

∗ rings and their homomorphisms are first class objects
∗ special operations for univariate polynomials
∗ modules, matrices and module homomorphisms
∗ computation in (non-commutative!) Weyl algebras

Acknowledgement: all underlying high precision arithmetic is calculated using the GMP library (http://www.swox.com/).