Fachbereich Mathematik — Winter Semester 2007/08, Set 5

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Computer Algebra

Due date: Tuesday, 04/12/2007, 10h00

Exercise 17: Check (by hand) whether $f = xz^3 - 2y^2$ belongs to the ideal $I = \langle xy - y, 2x^2 + yz, y - z \rangle_R$ for

a. $R = \mathbb{Q}[x, y, z]$, respectively

b. $R = \mathbb{Q}[x, y, z]_{\langle x,y,z \rangle}$.

Exercise 18: Write a SINGULAR procedure `standardbasis` which takes as input a list consisting of polynomials $f_1, \ldots, f_k$ and returns a standard basis of the ideal generated by $f_1, \ldots, f_k$.

Remark: Use the polynomial division with remainder PIDMora and build in the product criterion in order to speed up the computations.

Exercise 19: Change your procedure `standardbasis` in such a way that it takes an optional parameter. If the optional paramerter is the `string` *"minimal"* it returns a minimal standard basis, if the optional parameter is the `string` *"reduced"* it returns a reduced standard basis, and if the optional parameter is missing, it just returns some standard basis as before.

Hint, if you define the head of the procedure `standardbasis` as `proc standardbasis (ideal G, list #)`, then `#` is an optional parameter of type list and with `size(#)==0` you can test whether it is there or not, while with #[1] you can access its entry if it is there.

Exercise 20: Write a SINGULAR procedure `radicalmemebership` which takes as input a polynomial g and a list of polynomials $f_1, \ldots, f_k$, and which returns 1 if $g \in \sqrt{\langle f_1, \ldots, f_k \rangle}$, and 0 else.