Introduction to Macaulay2

Diane Maclagan

Virtual Abram Gannibal Project, May 2020

Macaulay2 is a software system devoted to supporting research in algebraic geometry and commutative algebra, developed by Dan Grayson and Mike Stillman.

Other comparable systems include:

1. Singular
2. CoCoA http://cocoa.dima.unige.it

See also:

1. Sage
2. Magma

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www.macaulay2.com

Macaulay2

a software system for research in algebraic geometry

Search

the web site:

just the documentation (version 1.15):

just the documentation (version 1.14):

Home

macaulay2.com

Mirrors

www2.macaulay2.com

Getting Started

Macaulay2

Downloads | Getting Started | Documentation | Events

Macaulay2 is a software system devoted to supporting research in algebraic geometry and commutative algebra, whose creation has been funded by the National Science Foundation since 1992.

Macaulay2 includes core algorithms for computing Gröbner bases and graded or multi-graded free resolutions of modules over quotient rings of graded or multi-

Jobs

Events

Future events:

2020/05: Workshop, Cleveland State

2020/06: Workshop, Warwick

Publications

Selected links:

The Journal of Software for Algebra and Geometry

Computations in algebraic geometry with *Macaulay 2*, a book

Papers referring to *Macaulay2*

Papers referring to *Macaulay2* indexed by Zentralblatt

How to cite *Macaulay2*

Acknowledgments

To start `Macaulay2`, type

`M2`

in a terminal window, at the command line, or if you have installed it with emacs, press f12.

You should see something like:

```
Macaulay2, version 1.15 --loading configuration for
package ``FourTiTwo'' from file
/Users/maclagan/Library/Application
Support/Macaulay2/init-FourTiTwo.m2 --loading
configuration for package ``Topcom'' from file
/Users/maclagan/Library/Application
Support/Macaulay2/init-Topcom.m2 with packages:
ConwayPolynomials, Elimination, IntegralClosure,
InverseSystems, LLLBases, PrimaryDecomposition,
ReesAlgebra, TangentCone, Truncations

i1 :
```

```
i1 : 1+1

o1 = 2

i2 : R=QQ[x_0,x_1,x_2,x_3]

o2 = R

o2 : PolynomialRing


i3 : I=ideal(x_0*x_2-x_1^2,x_0*x_3-x_1*x_2,x_1*x_3-x_2^2)

                 2                                 2
o3 = ideal (- x  + x x , - x x  + x x , - x  + x x )
              1    0 2     1 2    0 3     2    1 3

o3 : Ideal of R
```

Let’s see that live!

We'll now go to break-out rooms for 15 minutes. In your room

1. Introduce yourself to everyone
2. Work through the commands we just covered yourself. They are in the file `M2examples.m2` on the webpage .
3. View the help for one of the commands: `viewHelp COMMANDNAME` (e.g., `viewHelp det`)

Questions?

Macaulay2 has a full programming language.
Useful commands:

1. `if...then`
2. Loops: `scan`, `apply`, `for`
3. Functions: `functionName = input -> ( content; return(answer));`

Let's see some live examples!

We will now return to the break-out rooms for most of the rest of the time.

Have a look at the list of exercises in the file `M2exercises.pdf` available on the webpage. There are hopefully more exercises here than you have time for now - choose according to your mathematical level and interest.

You can also find the slides for the presentation, and a file containing the commands I typed, on the webpage.