MAGMA
IN TEACHING AND RESEARCH
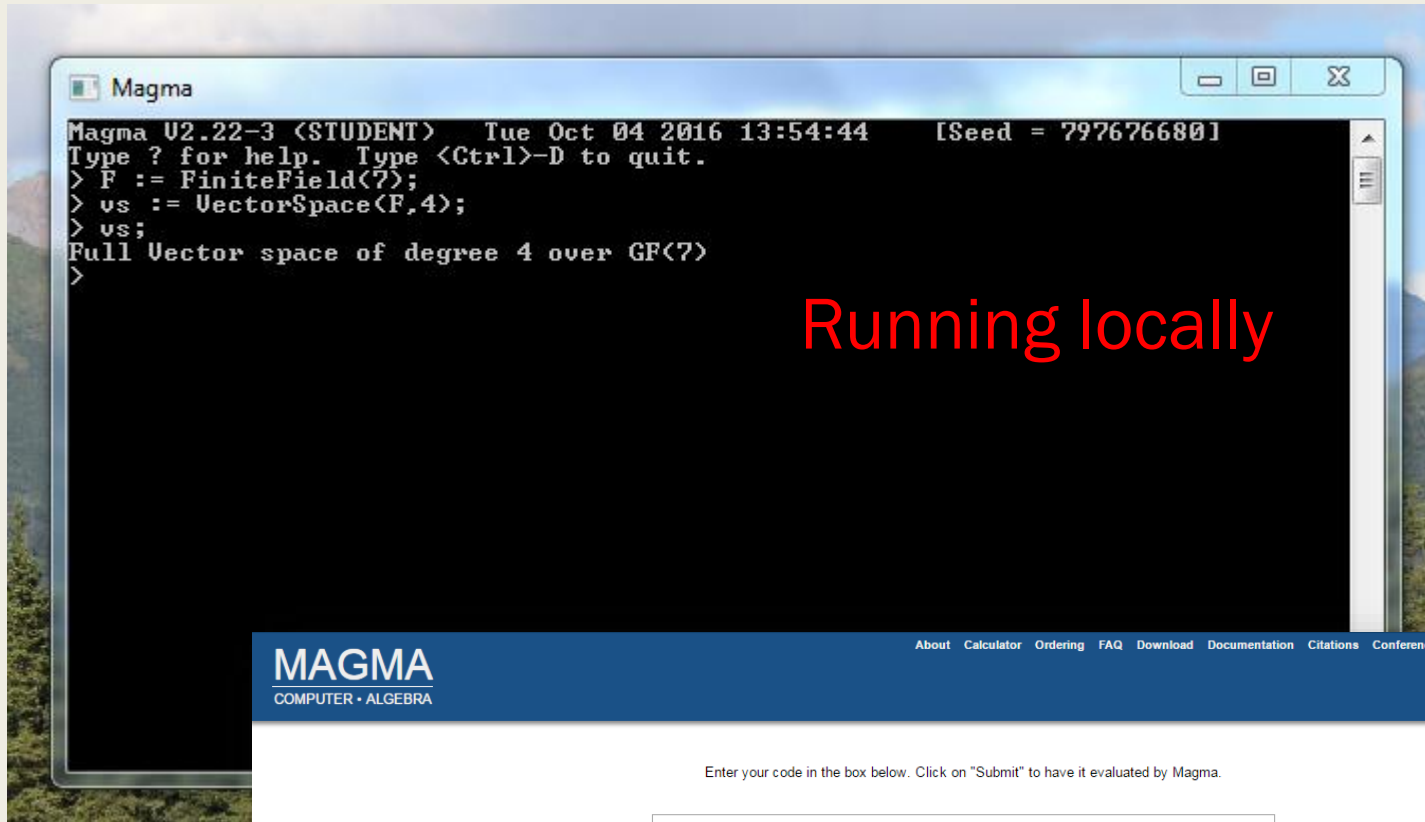
a computational group theory package

Workshop for the MD DC VA Section of the MAA
Fall Meeting 2016

Outline of the workshop

- Start with some basics of the user interface

- Provide information on how to obtain Magma

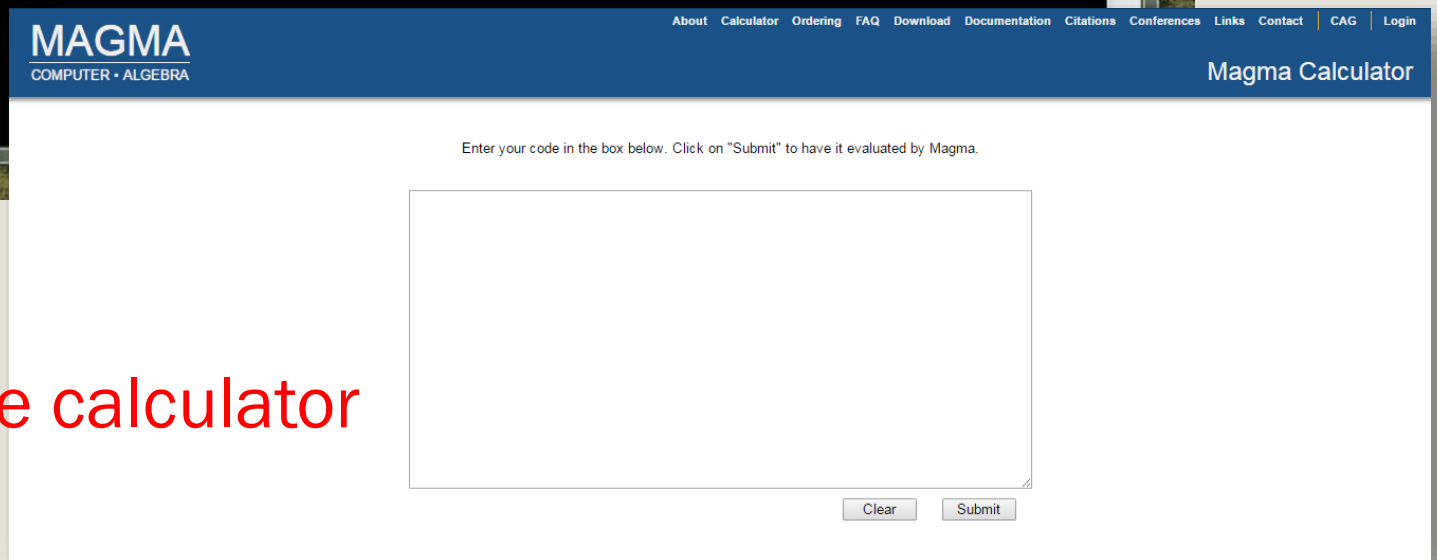- Turn you loose on some activities to get you familiar with the capabilities of Magma

BASIC USER INTERFACE

Running locally

Online calculator

Magma V2.22-3 (STUDENT)   Tue Oct 04 2016 13:54:44   [Seed = 797676680]
Type ? for help. Type <Ctrl>-D to quit.
> F := FiniteField(7);
> vs := VectorSpace(F,4);
> vs;
Full Vector space of degree 4 over GF(7)
>

MAGMA
COMPUTER · ALGEBRA

About Calculator Ordering FAQ Download Documentation Citations Conferences Links Contact CAG Login

Magma Calculator

Enter your code in the box below. Click on "Submit" to have it evaluated by Magma.

Clear   Submit

ENTERING COMPUTATIONS

Entering basic commands

- Simple assignment

    ```
    x := expression;
    ```

- Indexed assignment

    ```
    x[expr1] := expression;
    ```

- Generator assignment

    ```
    E<x₁> := expression;
    ```

Entering basic commands

■ Simple assignment

```
> x := 13;
> y := x^2-2;
> x, y;
13  167
```

■ Indexed assignment

```
> s := [ [1], [1, 2], [1, 2, 3] ];
> s;
[
        [ 1 ],
        [ 1, 2 ],
        [ 1, 2, 3 ]
]
> s[2, 2] := -1;
> s;
[
        [ 1 ],
        [ 1, -1 ],
        [ 1, 2, 3 ]
]
```

Entering basic commands

- Generator assignment

```
> P<[X]> := PolynomialRing(RationalField(), 5);
> P;
Polynomial ring of rank 5 over Rational Field
Lexicographical Order
Variables: X[1], X[2], X[3], X[4], X[5]
> X;
[
    X[1],
    X[2],
    X[3],
    X[4],
    X[5]
]
```

Computing

```
>
> F := GF(2);
> C := HammingCode(F,3);
> C;
[7, 4, 3] "Hamming code (r = 3)" Linear Code over GF(2)
Generator matrix:
[1 0 0 0 1 1 0]
[0 1 0 0 0 1 1]
[0 0 1 0 1 1 1]
[0 0 0 1 1 0 1]
> AutomorphismGroup(C);
Permutation group acting on a set of cardinality 7
Order = 168 = 2^3 * 3 * 7
    (1, 2)(3, 5, 6, 7)
    (2, 5, 3)(4, 6, 7)
    (3, 6)(5, 7)
    (3, 5)(6, 7)
> MinimumWeight(C);
3
>
```

Computing

```
>
>
>
> S4 := SymmetricGroup(4);
> e := S4!(1,2);
> f := S4!(1,3);
> S4sub := sub<S4 | e,f>;
> S4sub;
Permutation group S4sub acting on a set of cardinality 4
    (1, 2)
    (1, 3)
> Order(S4sub);
6
> IsAbelian(S4sub);
false
> IsCyclic(S4sub);
false
>
```

OBTAINING MAGMA

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CONTENTS

Institution version

While Magma is a non-commercial system, we are required to recover all costs arising from its distribution and supp processors and platforms, the preparation of user documentation, the prompt fixing of bugs, and the provision of a hig is organised on a subscription basis, whereby a site takes out a subscription to run Magma on one or more designate subscribing site is provided with all new releases, bug fixes, and general support while the subscription is current. At their subscription or continues to run the last version installed whilst their subscription was active.

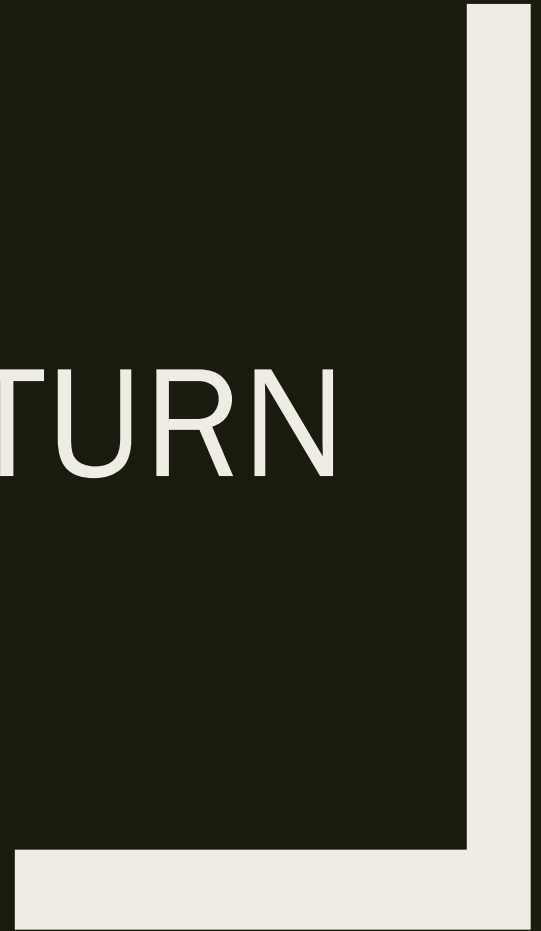The subscription cost depends upon the number of machines and the processor type. As a general indication, an edu

One desktop machine (maximum of 6 cores):	US$1440 (€1040)
Two to four desktop machines (maximum of 24 cores):	US$2160 (€1560)

http://magma.maths.usyd.edu.au/magma/ordering/

YOUR TURN

Series of short modules accessible on the web

www.keithmellinger.com -> mathematician -> Magma workshop

Basic Set Manipulation

Factoring Polynomials

Number Theory

Groups

Subgroups

Graph Theory

Coding Theory

The MAGMA Handbook

- Read through the examples.

- Try them yourself using the online calculator.

- Try other things, using the examples as a model.

- Solve the problems at the end of each module.