FinInG: a share package for GAP

J. De Beule
(John Bamberg, Anton Betten, Philippe Cara, Michel Lavrauw, Max Neunhoeffer)

Department of Mathematics
Ghent University

Finite Geometries 2014
Irsee, September 19, 2014

GAP

- GAP: “Groups, Algorithms, Programming”: a system for computational discrete algebra.
- development of GAP started in late 90s in Aachen.
- GAP centers: Aachen, Braunschweig, Fort Collins and St. Andrews.

FinInG

- 1999: **pg**: predecessor of FinInG (JDB, Patrick Govaerts and Leo Storme).
- 2006: John Bamberg, Anton Betten, Philippe Cara, Michel Lavrauw, Max Neunhoeffer, Michael Pauley and Sven Reichard join.

Philosophy of FinInG

- Finite Incidence Geometry
- We want the user to be able to explore geometries and their substructures
- Integrated with with existing (group theoretical) functions of GAP
- Ease of use has priority above super performance

Philosophy of FinInG

- Finite Incidence Geometry
- We want the user to be able to explore geometries and their substructures
- Integrated with with existing (group theoretical) functions of GAP
- Ease of use has priority above super performance

Philosophy of FinInG

- Finite Incidence Geometry
- We want the user to be able to explore geometries and their substructures
- Integrated with with existing (group theoretical) functions of GAP
- Ease of use has priority above super performance

Philosophy of FinInG

- Finite Incidence Geometry
- We want the user to be able to explore geometries and their substructures
- Integrated with with existing (group theoretical) functions of GAP
- Ease of use has priority above super performance

Overview of FinInG

- Projective spaces, classical polar spaces, affine spaces, generalized polygons, coset geometries and diagrams.
- Algebraic varieties
- Integration of all the different parts: collineation groups and group actions, geometry morphisms, stabilizer groups of elements and sets of elements, efficient enumerators for elements, etc.
- manual of $\pm$ 250 pages (including 288 examples), $\pm$ 50 pages of additional technical documentation

Overview of FinInG

- Projective spaces, classical polar spaces, affine spaces, generalized polygons, coset geometries and diagrams.
- Algebraic varieties
- Integration of all the different parts: collineation groups and group actions, geometry morphisms, stabilizer groups of elements and sets of elements, efficient enumerators for elements, etc.
- manual of $\pm$ 250 pages (including 288 examples), $\pm$ 50 pages of additional technical documentation

Overview of FinInG

- Projective spaces, classical polar spaces, affine spaces, generalized polygons, coset geometries and diagrams.
- Algebraic varieties
- Integration of all the different parts: collineation groups and group actions, geometry morphisms, stabilizer groups of elements and sets of elements, efficient enumerators for elements, etc.
- manual of ± 250 pages (including 288 examples), ± 50 pages of additional technical documentation

Overview of FinInG

- Projective spaces, classical polar spaces, affine spaces, generalized polygons, coset geometries and diagrams.
- Algebraic varieties
- Integration of all the different parts: collineation groups and group actions, geometry morphisms, stabilizer groups of elements and sets of elements, efficient enumerators for elements, etc.
- manual of $\pm$ 250 pages (including 288 examples), $\pm$ 50 pages of additional technical documentation

Dependencies

- forms (John Bamberg and JDB)
- grape (Leonard Soicher)
- orb (Juergen Mueller, Max Neunhoeffer, Felix Noeske)
- genss (Max Neunhoeffer, Felix Noeske)
- cvec (Max Neunhoeffer)

These packages are automatically installed if you install the current version of GAP :-)

How to get

`http://cage.ugent.be/fining`

Tetrads of lines spanning $\mathrm{PG}(7,2)$

Monday 11.45, talk by Hans Havlicek

- Segre variety $S_{1,1,1}(2)$ in $\mathrm{PG}(7,2)$.
- Natural action of the group preserving the Segre variety gives five orbits $\mathcal{O}_1, \ldots, \mathcal{O}_5$ on the points of the ambient space.
- One of the questions addressed in the talk: what does the fifth orbit look like, and can it reconstruct the Segre variety?

Hemisystems of $\mathrm{Q}(6, q)$

Thursday 18.20, talk by Francesco Pavese

- There are two orbits of the group $G_2(q)$ on the planes of $\mathrm{Q}(6, q)$.
- The unique orbit of length $\frac{q^6-1}{q-1}$ is a q^2+q+1-regular system.

The exact cover problem in finite geometry

Thursday 10.25, talk by Anton Betten

- One of the topics was BLT sets.
- One of the questions addressed was to compute the stabilizer group of a particular BLT set and its structure.

Maximal partial spreads of $\mathrm{H}(5, q^2)$

JDB and Klaus Metsch

- Find an upper bound on the size of partial spreads of $\mathrm{H}(5, q^2)$.
- Can we find an answer for $q = 2$ using FinInG?