Computing (with) characters and representations

Frank Lübeck
Lehrstuhl D für Mathematik, RWTH Aachen
Aachen, Germany

AIM, Palo Alto, June 26, 2007

General systems for computations in group and representation theory, but also many other fields in algebra.

GAP
`http://www.gap-system.org`
strength in group and representation theory, easy to extend (> 70 GAP *packages*, e.g., `polycyclic`, `EDIM`, `Singular`, `cohomolo`, `HAP`, `QuaGroup`, ...),
GPL license, open code, no license fee

Magma
`http://magma.maths.usyd.edu.au/`
number theory, algebraic geometry, Groebner bases, ...
not so easy to extend (on your own), closed source, license fee

General systems for computations in group and representation theory, but also many other fields in algebra.

GAP

`http://www.gap-system.org`

strength in group and representation theory, easy to extend ($>$ 70 GAP *packages*, e.g., `polycyclic`, `EDIM`, `Singular`, `cohomolo`, `HAP`, `QuaGroup`, ...),
GPL license, open code, no license fee

Magma

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

number theory, algebraic geometry, Groebner bases, ...
not so easy to extend (on your own), closed source, license fee

General systems for computations in group and representation theory, but also many other fields in algebra.

GAP

`http://www.gap-system.org`

strength in group and representation theory, easy to extend (> 70 GAP *packages*, e.g., `polycyclic`, `EDIM`, `Singular`, `cohomolo`, `HAP`, `QuaGroup`, ...), GPL license, open code, no license fee

Magma

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

number theory, algebraic geometry, Groebner bases, ... not so easy to extend (on your own), closed source, license fee

General systems for computations in group and representation theory, but also many other fields in algebra.

GAP

`http://www.gap-system.org`
strength in group and representation theory, easy to extend ($>$ 70 GAP *packages*, e.g., `polycyclic`, `EDIM`, `Singular`, `cohomolo`, `HAP`, `QuaGroup`, ...),
GPL license, open code, no license fee

Magma

`http://magma.maths.usyd.edu.au/`
number theory, algebraic geometry, Groebner bases, ...
not so easy to extend (on your own), closed source, license fee

General systems for computations in group and representation theory, but also many other fields in algebra.

GAP

`http://www.gap-system.org`
strength in group and representation theory, easy to extend (> 70 GAP *packages*, e.g., `polycyclic`, `EDIM`, `Singular`, `cohomolo`, `HAP`, `QuaGroup`, ...),
GPL license, open code, no license fee

Magma

`http://magma.maths.usyd.edu.au/`
number theory, algebraic geometry, Groebner bases, ...
not so easy to extend (on your own), closed source, license fee

General systems for computations in group and representation theory, but also many other fields in algebra.

GAP

`http://www.gap-system.org`
strength in group and representation theory, easy to extend ($>$ 70 GAP *packages*, e.g., `polycyclic`, `EDIM`, `Singular`, `cohomolo`, `HAP`, `QuaGroup`, ...),
GPL license, open code, no license fee

Magma

`http://magma.maths.usyd.edu.au/`
number theory, algebraic geometry, Groebner bases, ...
not so easy to extend (on your own), closed source, license fee

General systems for computations in group and representation theory, but also many other fields in algebra.

GAP

`http://www.gap-system.org`
strength in group and representation theory, easy to extend ($>$ 70 GAP *packages*, e.g., `polycyclic`, `EDIM`, `Singular`, `cohomolo`, `HAP`, `QuaGroup`, ...),
GPL license, open code, no license fee

Magma

`http://magma.maths.usyd.edu.au/`
number theory, algebraic geometry, Groebner bases, ...
not so easy to extend (on your own), closed source, license fee

General systems for computations in group and representation theory, but also many other fields in algebra.

GAP

`http://www.gap-system.org`
strength in group and representation theory, easy to extend (> 70 GAP *packages*, e.g., `polycyclic`, `EDIM`, `Singular`, `cohomolo`, `HAP`, `QuaGroup`, ...),
GPL license, open code, no license fee

Magma

`http://magma.maths.usyd.edu.au/`
number theory, algebraic geometry, Groebner bases, ...
not so easy to extend (on your own), closed source, license fee

Ordinary character table for finite group G:
$C_1, C_2, \ldots, C_r$ labels for conjugacy classes,
$\chi_1, \chi_2, \ldots, \chi_r$ labels for irreducible characters,
$\chi_i(C_j)$ matrix of character values,
and *power maps* $f_p : C_i \mapsto C_k$ if $x^p \in C_k$ for $x \in C_i$

GAP package **CTblLib** (Th. Breuer): collection of tables available by name of group (ATLAS and many more, S_n, A_n, $\ldots$)

Dixon-Schneider algorithm: Given a (permutation) group G, this computes the character table. Works for $|G|$ a few thousands, but also some much bigger G. Available in GAP and Magma.

Ordinary character table for finite group G:
$C_1, C_2, \ldots, C_r$ labels for conjugacy classes,
$\chi_1, \chi_2, \ldots, \chi_r$ labels for irreducible characters,
$\chi_i(C_j)$ matrix of character values,
and *power maps* $f_p : C_i \mapsto C_k$ if $x^p \in C_k$ for $x \in C_i$

GAP package **CTblLib** (Th. Breuer): collection of tables available by name of group (ATLAS and many more, S_n, A_n, ...)

Dixon-Schneider algorithm: Given a (permutation) group G, this computes the character table. Works for $|G|$ a few thousands, but also some much bigger G. Available in GAP and Magma.

Ordinary character table for finite group G:
$C_1, C_2, \ldots, C_r$ labels for conjugacy classes,
$\chi_1, \chi_2, \ldots, \chi_r$ labels for irreducible characters,
$\chi_i(C_j)$ matrix of character values,
and *power maps* $f_p : C_i \mapsto C_k$ if $x^p \in C_k$ for $x \in C_i$

GAP package **CTblLib** (Th. Breuer): collection of tables available by name of group (ATLAS and many more, S_n, A_n, $\ldots$)

Dixon-Schneider algorithm: Given a (permutation) group G, this computes the character table. Works for $|G|$ a few thousands, but also some much bigger G. Available in GAP and Magma.

Example: Alternating group A_5 (from GAP)

```
A5     2  2  2  .  .  .
       3  1  .  1  .  .
       5  1  .  .  1  1

          1a 2a 3a 5a 5b
       2P 1a 1a 3a 5b 5a
       3P 1a 2a 1a 5b 5a
       5P 1a 2a 3a 1a 1a

X.1        1  1  1  1  1
X.2        3 -1  .  A *A
X.3        3 -1  . *A  A
X.4        4  .  1 -1 -1
X.5        5  1 -1  .  .

A = -E(5)-E(5)^4
  = (1-ER(5))/2 = -b5
```

with $\mathtt{A} = (1+\sqrt{5})/2$ und $*\mathtt{A} = (1-\sqrt{5})/2$

Example: Alternating group A_5 (from GAP)

```
A5   2  2  2  .  .  .
     3  1  .  1  .  .
     5  1  .  .  1  1

       1a 2a 3a 5a 5b
    2P 1a 1a 3a 5b 5a
    3P 1a 2a 1a 5b 5a
    5P 1a 2a 3a 1a 1a

X.1      1  1  1  1  1
X.2      3 -1  .  A *A
X.3      3 -1  . *A  A
X.4      4  .  1 -1 -1
X.5      5  1 -1  .  .

A = -E(5)-E(5)^4
  = (1-ER(5))/2 = -b5
```

with $\mathtt{A} = (1+\sqrt{5})/2$ und $*\mathtt{A} = (1-\sqrt{5})/2$

Computing with characters in GAP: linear combinations, tensor products, induction/restriction, scalar products, ...

Brauer character tables: large collection in CTblLib, no general algorithm except brute force for very small groups, ongoing *Modular Atlas Project* - needs sophisticated theoretical and computational techniques (MeatAxe, GAP, ...) (`http://www.math.rwth-aachen.de/~MOC/`)

Computing with characters in GAP: linear combinations, tensor products, induction/restriction, scalar products, ...

Brauer character tables: large collection in CTblLib, no general algorithm except brute force for very small groups, ongoing *Modular Atlas Project* - needs sophisticated theoretical and computational techniques (MeatAxe, GAP, ...) (http://www.math.rwth-aachen.de/~MOC/)

Computing with characters in GAP: linear combinations, tensor products, induction/restriction, scalar products, ...

Brauer character tables: large collection in CTblLib, no general algorithm except brute force for very small groups, ongoing *Modular Atlas Project* - needs sophisticated theoretical and computational techniques (MeatAxe, GAP, ...) (`http://www.math.rwth-aachen.de/~MOC/`)

Computing with characters in GAP: linear combinations, tensor products, induction/restriction, scalar products, ...

Brauer character tables: large collection in CTblLib, no general algorithm except brute force for very small groups, ongoing *Modular Atlas Project* - needs sophisticated theoretical and computational techniques (MeatAxe, GAP, ...) (`http://www.math.rwth-aachen.de/~MOC/`)

Representations of finite groups

Libraries of groups (GAP, Magma): groups by name in *natural* permutation or matrix representation (e.g., $SL(n,q)$, S_n), small groups (order < 2000, $|G|$ has some structure).

WWW-ATLAS of representations (Rob Wilson et.al.), available in GAP via the **AtlasRep** package (Th. Breuer et.al.)

Tools to construct more representations: (GAP) tensoring, reduction mod p, induction, MeatAxe, ...

Representations of finite groups

Libraries of groups (GAP, Magma): groups by name in *natural* permutation or matrix representation (e.g., $SL(n, q)$, S_n), small groups (order < 2000, $|G|$ has some structure).

WWW-ATLAS of representations (Rob Wilson et.al.), available in GAP via the **AtlasRep** package (Th. Breuer et.al.)

Tools to construct more representations: (GAP) tensoring, reduction mod p, induction, MeatAxe, ...

Representations of finite groups

Libraries of groups (GAP, Magma): groups by name in *natural* permutation or matrix representation (e.g., $SL(n, q)$, S_n), small groups (order < 2000, $|G|$ has some structure).

WWW-ATLAS of representations (Rob Wilson et.al.), available in GAP via the **AtlasRep** package (Th. Breuer et.al.)

Tools to construct more representations: (GAP) tensoring, reduction mod p, induction, MeatAxe, ...

Representations of finite groups

Libraries of groups (GAP, Magma): groups by name in *natural* permutation or matrix representation (e.g., $SL(n, q)$, S_n), small groups (order < 2000, $|G|$ has some structure).

WWW-ATLAS of representations (Rob Wilson et.al.), available in GAP via the **AtlasRep** package (Th. Breuer et.al.)

Tools to construct more representations: (GAP) tensoring, reduction mod p, induction, MeatAxe, ...

Recognition of finite groups

Opposite question: Given a faithful permutation/matrix (or ...) representation of a finite group G (by images of generators), what is G? ($|G| = ?$, composition series, $G < H$ and $x \in H$ is $x \in G$, ...)

Permutation groups: Many good theoretical and practical algorithms.

Matrix and/or black box groups: Ongoing theoretical and implementation work (*Matrix Recognition Project*), ask Ákos Seress for more details.

Finitely presented groups: try to avoid these, mainly tools but not algorithms. (But some specific presentations can be very good, e.g., power commutator presentations of solvable groups.)

Recognition of finite groups

Opposite question: Given a faithful permutation/matrix (or ...) representation of a finite group G (by images of generators), what is G? ($|G| = ?$, composition series, $G < H$ and $x \in H$ is $x \in G$, ...)

Permutation groups: Many good theoretical and practical algorithms.

Matrix and/or black box groups: Ongoing theoretical and implementation work (*Matrix Recognition Project*), ask Ákos Seress for more details.

Finitely presented groups: try to avoid these, mainly tools but not algorithms. (But some specific presentations can be very good, e.g., power commutator presentations of solvable groups.)

Recognition of finite groups

Opposite question: Given a faithful permutation/matrix (or ...) representation of a finite group G (by images of generators), what is G? ($|G| = ?$, composition series, $G < H$ and $x \in H$ is $x \in G$, ...)

Permutation groups: Many good theoretical and practical algorithms.

Matrix and/or black box groups: Ongoing theoretical and implementation work (*Matrix Recognition Project*), ask Ákos Seress for more details.

Finitely presented groups: try to avoid these, mainly tools but not algorithms. (But some specific presentations can be very good, e.g., power commutator presentations of solvable groups.)

Recognition of finite groups

Opposite question: Given a faithful permutation/matrix (or …) representation of a finite group G (by images of generators), what is G? ($|G| = ?$, composition series, $G < H$ and $x \in H$ is $x \in G$, …)

Permutation groups: Many good theoretical and practical algorithms.

Matrix and/or black box groups: Ongoing theoretical and implementation work (*Matrix Recognition Project*), ask Ákos Seress for more details.

Finitely presented groups: try to avoid these, mainly tools but not algorithms. (But some specific presentations can be very good, e.g., power commutator presentations of solvable groups.)

Recognition of finite groups

Opposite question: Given a faithful permutation/matrix (or ...) representation of a finite group G (by images of generators), what is G? ($|G| = ?$, composition series, $G < H$ and $x \in H$ is $x \in G$, ...)

Permutation groups: Many good theoretical and practical algorithms.

Matrix and/or black box groups: Ongoing theoretical and implementation work (*Matrix Recognition Project*), ask Ákos Seress for more details.

Finitely presented groups: try to avoid these, mainly tools but not algorithms. (But some specific presentations can be very good, e.g., power commutator presentations of solvable groups.)

Generic character tables of groups of Lie type

***Series* of groups of Lie type:** e.g., $\{SL_2(q)|q\}$, $\{PGU_5(q)|q\}$, $\{E_8(q)|q\}$

***Generic* character tables** for such series:

Generic character tables of groups of Lie type

***Series* of groups of Lie type:** e.g., $\{SL_2(q)|q\}$, $\{PGU_5(q)|q\}$, $\{E_8(q)|q\}$

***Generic* character tables** for such series:

Generic character tables of groups of Lie type

***Series* of groups of Lie type:** e.g., $\{SL_2(q)|q\}$, $\{PGU_5(q)|q\}$, $\{E_8(q)|q\}$

***Generic* character tables** for such series:

Generic character table of $SL_2(q)$ for $q \equiv 0 \mod 2$

$SL_2(q)$	C_1	C_2	$C_3(a)$	$C_4(a)$
χ_1	1	1	1	1
χ_2	q	0	1	-1
$\chi_3(n)$	$q+1$	1	$\zeta_1^{an}+\zeta_1^{-an}$	0
$\chi_4(n)$	$q-1$	-1	0	$-\xi_1^{an}-\xi_1^{-an}$

$\zeta_1 := \exp(\frac{2\pi\sqrt{-1}}{q-1})$, $\quad \xi_1 := \exp(\frac{2\pi\sqrt{-1}}{q+1})$

Parameter ranges:

$\chi_3(n)$:	$n = 1, \ldots, q-2$	($\frac{1}{2}(q-2)$ characters)
$\chi_4(n)$:	$n = 1, \ldots, q$	($\frac{1}{2}q$ characters)
$C_3(a)$:	$a = 1, \ldots, q-2$	($\frac{1}{2}(q-2)$ classes)
$C_4(a)$:	$a = 1, \ldots, q$	($\frac{1}{2}q$ classes)

There is a bit more complicated table for $q \equiv 1 \mod 2$.

(By the way: $A_5 \cong SL_2(4)$)

Generic character table of $SL_2(q)$ for $q \equiv 0 \bmod 2$

$SL_2(q)$	C_1	C_2	$C_3(a)$	$C_4(a)$
χ_1	1	1	1	1
χ_2	q	0	1	-1
$\chi_3(n)$	$q+1$	1	$\zeta_1^{an} + \zeta_1^{-an}$	0
$\chi_4(n)$	$q-1$	-1	0	$-\xi_1^{an} - \xi_1^{-an}$

$\zeta_1 := \exp(\frac{2\pi\sqrt{-1}}{q-1})$, $\xi_1 := \exp(\frac{2\pi\sqrt{-1}}{q+1})$

Parameter ranges:

$\chi_3(n)$: $n = 1, \ldots, q-2$ ($\frac{1}{2}(q-2)$ characters)
$\chi_4(n)$: $n = 1, \ldots, q$ ($\frac{1}{2}q$ characters)
$C_3(a)$: $a = 1, \ldots, q-2$ ($\frac{1}{2}(q-2)$ classes)
$C_4(a)$: $a = 1, \ldots, q$ ($\frac{1}{2}q$ classes)

There is a bit more complicated table for $q \equiv 1 \bmod 2$.

(By the way: $A_5 \cong SL_2(4)$)

Generic character table of $SL_2(q)$ for $q \equiv 0 \bmod 2$

$SL_2(q)$	C_1	C_2	$C_3(a)$	$C_4(a)$
χ_1	1	1	1	1
χ_2	q	0	1	-1
$\chi_3(n)$	$q+1$	1	$\zeta_1^{an} + \zeta_1^{-an}$	0
$\chi_4(n)$	$q-1$	-1	0	$-\xi_1^{an} - \xi_1^{-an}$

$\zeta_1 := \exp(\frac{2\pi\sqrt{-1}}{q-1})$, $\xi_1 := \exp(\frac{2\pi\sqrt{-1}}{q+1})$

Parameter ranges:

$\chi_3(n)$:	$n = 1, \ldots, q-2$	($\frac{1}{2}(q-2)$ characters)
$\chi_4(n)$:	$n = 1, \ldots, q$	($\frac{1}{2}q$ characters)
$C_3(a)$:	$a = 1, \ldots, q-2$	($\frac{1}{2}(q-2)$ classes)
$C_4(a)$:	$a = 1, \ldots, q$	($\frac{1}{2}q$ classes)

There is a bit more complicated table for $q \equiv 1 \bmod 2$.

(By the way: $A_5 \cong SL_2(4)$)

Generic character table of $SL_2(q)$ for $q \equiv 0 \bmod 2$

$SL_2(q)$	C_1	C_2	$C_3(a)$	$C_4(a)$
χ_1	1	1	1	1
χ_2	q	0	1	-1
$\chi_3(n)$	$q+1$	1	$\zeta_1^{an} + \zeta_1^{-an}$	0
$\chi_4(n)$	$q-1$	-1	0	$-\xi_1^{an} - \xi_1^{-an}$

$\zeta_1 := \exp(\frac{2\pi\sqrt{-1}}{q-1}), \qquad \xi_1 := \exp(\frac{2\pi\sqrt{-1}}{q+1})$

Parameter ranges:

$\chi_3(n)$:	$n = 1, \ldots, q-2$	($\frac{1}{2}(q-2)$ characters)
$\chi_4(n)$:	$n = 1, \ldots, q$	($\frac{1}{2}q$ characters)
$C_3(a)$:	$a = 1, \ldots, q-2$	($\frac{1}{2}(q-2)$ classes)
$C_4(a)$:	$a = 1, \ldots, q$	($\frac{1}{2}q$ classes)

There is a bit more complicated table for $q \equiv 1 \bmod 2$.

(By the way: $A_5 \cong SL_2(4)$)

CHEVIE

(M.Geck, G.Hiß, F.L., G.Malle, J.Michel, G.Pfeiffer),
`http://www.math.rwth-aachen.de/~CHEVIE`

Maple-part: Contains the known generic character tables and programs to compute with them (e.g., scalar products, structure constants - generically without specializing *q*).

F.L.: various non-published GAP3/GAP4/Maple programs to compute parts of generic character tables, based on Deligne-Lusztig theory, character sheaves, combinatorics, data collections, algorithmic reductions. See my homepage for some data, e.g., numbers of conjugacy classes, character degrees and more. There are still theoretical gaps for an algorithm to compute generic character tables systematically.

CHEVIE

(M.Geck, G.Hiß, F.L., G.Malle, J.Michel, G.Pfeiffer),
`http://www.math.rwth-aachen.de/~CHEVIE`

Maple-part: Contains the known generic character tables and programs to compute with them (e.g., scalar products, structure constants - generically without specializing *q*).

F.L.: various non-published GAP3/GAP4/Maple programs to compute parts of generic character tables, based on Deligne-Lusztig theory, character sheaves, combinatorics, data collections, algorithmic reductions. See my homepage for some data, e.g., numbers of conjugacy classes, character degrees and more. There are still theoretical gaps for an algorithm to compute generic character tables systematically.

CHEVIE

(M.Geck, G.Hiß, F.L., G.Malle, J.Michel, G.Pfeiffer),
`http://www.math.rwth-aachen.de/~CHEVIE`

Maple-part: Contains the known generic character tables and programs to compute with them (e.g., scalar products, structure constants - generically without specializing q).

F.L.: various non-published GAP3/GAP4/Maple programs to compute parts of generic character tables, based on Deligne-Lusztig theory, character sheaves, combinatorics, data collections, algorithmic reductions. See my homepage for some data, e.g., numbers of conjugacy classes, character degrees and more. There are still theoretical gaps for an algorithm to compute generic character tables systematically.

Generic Brauer tables?

As Bhama Srinivan told us, Brauer- and Deligne-Lusztig theory are somehow compatible. For example, known decomposition matrices in non-defining characteristic l depend only on the order of q modulo l. One could think of generic decomposition matrices and Brauer tables, but this is not yet done.

And in defining characteristic?

For most applications use the characters in the sense of weight multiplicities (for the algebraic group), not Brauer characters for any finite subgroup.

My webpage contains many characters of small degree representations for all simple types of rank smaller 11.

Generic Brauer tables?

As Bhama Srinivan told us, Brauer- and Deligne-Lusztig theory are somehow compatible. For example, known decomposition matrices in non-defining characteristic l depend only on the order of q modulo l. One could think of generic decomposition matrices and Brauer tables, but this is not yet done.

And in defining characteristic?

For most applications use the characters in the sense of weight multiplicities (for the algebraic group), not Brauer characters for any finite subgroup.

My webpage contains many characters of small degree representations for all simple types of rank smaller 11.

Generic Brauer tables?

As Bhama Srinivan told us, Brauer- and Deligne-Lusztig theory are somehow compatible. For example, known decomposition matrices in non-defining characteristic l depend only on the order of q modulo l. One could think of generic decomposition matrices and Brauer tables, but this is not yet done.

And in defining characteristic?

For most applications use the characters in the sense of weight multiplicities (for the algebraic group), not Brauer characters for any finite subgroup.

My webpage contains many characters of small degree representations for all simple types of rank smaller 11.

Generic Brauer tables?

As Bhama Srinivan told us, Brauer- and Deligne-Lusztig theory are somehow compatible. For example, known decomposition matrices in non-defining characteristic l depend only on the order of q modulo l. One could think of generic decomposition matrices and Brauer tables, but this is not yet done.

And in defining characteristic?

For most applications use the characters in the sense of weight multiplicities (for the algebraic group), not Brauer characters for any finite subgroup.

My webpage contains many characters of small degree representations for all simple types of rank smaller 11.

Generic Brauer tables?

As Bhama Srinivan told us, Brauer- and Deligne-Lusztig theory are somehow compatible. For example, known decomposition matrices in non-defining characteristic l depend only on the order of q modulo l. One could think of generic decomposition matrices and Brauer tables, but this is not yet done.

And in defining characteristic?

For most applications use the characters in the sense of weight multiplicities (for the algebraic group), not Brauer characters for any finite subgroup.
My webpage contains many characters of small degree representations for all simple types of rank smaller 11.

Representations in defining characteristic

GAP and Magma contain code by Willem de Graaf for computing irreducible representations of the simple Lie algebras over $\mathbb{C}$ for given highest weight. This can be used to compute Weyl modules in characteristic p.

I have used parts of my computations for the characters to construct generating vectors for the radical of the Weyl module, so getting the simple quotients. This should work for cases where the result fits into the computer memory.

Representations in defining characteristic

GAP and Magma contain code by Willem de Graaf for computing irreducible representations of the simple Lie algebras over $\mathbb{C}$ for given highest weight. This can be used to compute Weyl modules in characteristic p.

I have used parts of my computations for the characters to construct generating vectors for the radical of the Weyl module, so getting the simple quotients. This should work for cases where the result fits into the computer memory.

Representations in defining characteristic

GAP and Magma contain code by Willem de Graaf for computing irreducible representations of the simple Lie algebras over $\mathbb{C}$ for given highest weight. This can be used to compute Weyl modules in characteristic p.
I have used parts of my computations for the characters to construct generating vectors for the radical of the Weyl module, so getting the simple quotients. This should work for cases where the result fits into the computer memory.

CHEVIE–GAP3 package

A package for computing with (finite) reflections groups and their root systems, root data, braid groups, Iwahori-Hecke algebras.
Some more keywords: Coxeter groups and finite complex reflection groups, root systems, character tables with labels as used in the literature, reflection subgroups, cosets of Coxeter groups, induce/restrict matrices, character tables of Iwahori-Hecke algebras, translations between bases (T_w, C_w, D_w, ...) of Iwahori-Hecke algebras.

CHEVIE–GAP3 package

A package for computing with (finite) reflections groups and their root systems, root data, braid groups, Iwahori-Hecke algebras.
Some more keywords: Coxeter groups and finite complex reflection groups, root systems, character tables with labels as used in the literature, reflection subgroups, cosets of Coxeter groups, induce/restrict matrices, character tables of Iwahori-Hecke algebras, translations between bases (T_w, C_w, D_w, ...) of Iwahori-Hecke algebras.