

smallantimagmas

**A fork of smallgrp package for small
antiassociative magmas**

0.2.9

28 August 2024

Kamil Zabielski

Kamil Zabielski

Address: Department of Theoretical Computer Science
Białystok University of Technology
Wiejska 45A
15-325 Białystok
Poland

Copyright

© 2024 by Kamil Zabielski

`smallantimagmas` package is free software; you can redistribute it and/or modify it under the terms of the [GNU General Public License](#) as published by the Free Software Foundation; either version 2 of the License, or (at your option) any later version.

Acknowledgements

We appreciate very much all past and future comments, suggestions and contributions to this package and its documentation provided by **GAP** users and developers.

Contents

1	smallantimagmas automatic generated documentation	4
1.1	smallantimagmas automatic generated documentation of properties	4
1.2	smallantimagmas automatic generated documentation of attributes	5
1.3	smallantimagmas automatic generated documentation of global functions	7
1.4	smallantimagmas automatic generated documentation of methods	11
Index		12

Chapter 1

smallantimagmas automatic generated documentation

1.1 smallantimagmas automatic generated documentation of properties

1.1.1 IsAntiassociative (for IsMagma)

▷ `IsAntiassociative(M)` (property)

Returns: true or false

identifies whether magma M is antiassociative.

Example

```
gap> IsAntiassociative(OneSmallGroup(16));  
false  
gap> IsAntiassociative(OneSmallAntimagma(2));  
true  
gap> IsAntiassociative(OneSmallAntimagma(3));  
true
```

1.1.2 IsLeftCyclic (for IsMagma)

▷ `IsLeftCyclic(M)` (property)

Returns: true or false

if magma is left cyclic m .

1.1.3 IsRightCyclic (for IsMagma)

▷ `IsRightCyclic(M)` (property)

Returns: true or false

if magma is left cyclic m .

1.1.4 IsLeftCancellative (for IsMagma)

▷ `IsLeftCancellative(M)` (property)

Returns: true or false

if magma is left cancellative m .

Example

```
gap> M := SmallAntimagma(2, 1);
<magma with 2 generators>
gap> Display( MultiplicationTable(M) );
[ [ 2, 1 ],
  [ 2, 1 ] ]
gap> IsRightCancellative(M);
false
gap> IsLeftCancellative(M);
true
gap> List(AllSmallAntimagmas(2), M -> IsLeftCancellative(M));
[ true, false ]
```

1.1.5 IsRightCancellative (for IsMagma)

▷ IsRightCancellative(M) (property)

Returns: true or false
if magma is right cancellative m .

Example

```
gap> List(AllSmallAntimagmas(2), M -> IsRightCancellative(M));
[ false, true ]
```

1.1.6 IsCancellative (for IsMagma)

▷ IsCancellative(M) (property)

Returns: true or false
if magma is cancellative m .

Example

```
gap> List(AllSmallAntimagmas(2), M -> IsCancellative(M));
[ false, false ]
```

1.2 smallantimagmas automatic generated documentation of attributes

1.2.1 AssociativityIndex (for IsMagma)

▷ AssociativityIndex(M) (attribute)

identifies associativity index of M .

Example

```
gap> OneSmallAntimagma(2);
<magma with 2 generators>
gap> AssociativityIndex(OneSmallAntimagma(2));
0
gap> OneSmallGroup(4);
<pc group of size 4 with 2 generators>
gap> AssociativityIndex(OneSmallGroup(4));
64
gap> AssociativityIndex(OneSmallGroup(4)) = 4 ^ 3;
true
```

1.2.2 DiagonalOfMultiplicationTable (for IsMagma)

▷ `DiagonalOfMultiplicationTable(M)` (attribute)

computes diagonal of multiplication table of M .

Example

```
gap> List(AllSmallAntimagmas(3), M -> DiagonalOfMultiplicationTable((M)));
[ [ 2, 1, 1 ], [ 2, 1, 1 ],
  [ 2, 3, 2 ], [ 2, 1, 1 ],
  [ 2, 1, 1 ], [ 2, 1, 2 ],
  [ 2, 3, 2 ], [ 2, 1, 2 ],
  [ 2, 3, 1 ], [ 2, 3, 1 ]
]
```

1.2.3 CommutativityIndex (for IsMagma)

▷ `CommutativityIndex(M)` (attribute)

identifies commutativity index of M .

Example

1.2.4 AnticommutativityIndex (for IsMagma)

▷ `AnticommutativityIndex(M)` (attribute)

calculates anticommutativity index of M .

Example

1.2.5 SquaresIndex (for IsMagma)

▷ `SquaresIndex(M)` (attribute)

computes squares index of M so the order of $\{m^2 | m \in \}$.

Example

```
gap> List(AllSmallAntimagmas(2), M -> List(M, m -> m * m) );
[ [ m2, m1 ], [ m2, m1 ] ]
gap> List(AllSmallAntimagmas(2), M -> SquaresIndex(M ));
[ 2, 2 ]
gap> List(AllSmallAntimagmas(3), M -> SquaresIndex(M ));
[ 2, 2, 2, 2, 2, 2, 2, 2, 3, 3 ]
```

1.2.6 IdSmallAntimagma (for IsMagma)

▷ `IdSmallAntimagma(M)` (attribute)

identifies class of antiassociative magma M .

Example

```
gap> IsAntiassociative(OneSmallGroup(16));
false
gap> IsAntiassociative(OneSmallAntimagma(2));
true
gap> IsAntiassociative(OneSmallAntimagma(3));
true
```

1.2.7 LeftOrder (for IsExtLElement)

▷ LeftOrder($[m]$) (attribute)

returns a left order of element m .

1.2.8 RightOrder (for IsExtRElement)

▷ RightOrder($[m]$) (attribute)

returns a right order of element m .

1.2.9 LeftOrdersOfElements (for IsMagma)

▷ LeftOrdersOfElements($[m]$) (attribute)

returns a left order of element m .

1.2.10 RightOrdersOfElements (for IsMagma)

▷ RightOrdersOfElements($[m]$) (attribute)

returns a left order of element m .

1.3 smallantimagnas automatic generated documentation of global functions**1.3.1 AllSubmagmas**

▷ AllSubmagmas(M) (function)

builds a collection of non-isomorphic submagmas of M .

Example

```
gap> AllSmallAntimagnas(2);
[ <magma with 2 generators>, <magma with 2 generators> ]
gap> List(AllSmallAntimagnas(2), M -> AllSubmagmas(M));
[ [ <magma with 1 generator> ], [ <magma with 1 generator> ] ]
```

1.3.2 MagmaIsomorphismInvariantsMatch

▷ MagmaIsomorphismInvariantsMatch(M) (function)

computes isomorphism invariants of M .

1.3.3 IsMagmaIsomorphic

▷ IsMagmaIsomorphic(M, N) (function)

identifies whether magmas M, N are isomorphic.

Example

```
gap> M := SmallAntimagma(2, 1);
<magma with 2 generators>
gap> N := SmallAntimagma(2, 2);
<magma with 2 generators>
gap> T := MagmaByMultiplicationTable([ [2, 1], [2, 1] ]);
<magma with 2 generators>
gap> IsMagmaIsomorphic(M, M);
true
gap> IsMagmaIsomorphic(M, T);
true
gap> IsMagmaIsomorphic(M, N);
false
```

1.3.4 IsMagmaAntiisomorphic

▷ IsMagmaAntiisomorphic($[M, N]$) (function)

identifies whether magmas M, N are antiisomorphic.

Example

```
gap> N := SmallAntimagma(2, 1);
<magma with 2 generators>
gap> M := SmallAntimagma(2, 1);
<magma with 2 generators>
gap> N := SmallAntimagma(2, 2);
<magma with 2 generators>
gap> IsMagmaAntiisomorphic(M, M);
false
gap> IsMagmaAntiisomorphic(M, N);
true
gap> IsMagmaAntiisomorphic(M, TransposedMagma(M));
true
```

1.3.5 TransposedMagma

▷ TransposedMagma($[M]$) (function)

generates transposed magma M .

Example

```

gap> M := SmallAntimagma(2, 1);
<magma with 2 generators>
gap> IsMagmaAntiisomorphic(M, TransposedMagma(M));
true
gap> IsMagmaIsomorphic(M, TransposedMagma(TransposedMagma(M)));
true
gap> M := SmallAntimagma(2, 1);
<magma with 2 generators>
gap> Display(MultiplicationTable(M));
[ [ 2, 1 ],
  [ 2, 1 ] ]
gap> Display(MultiplicationTable(TransposedMagma(M)));
[ [ 2, 2 ],
  [ 1, 1 ] ]

```

1.3.6 LeftPower

▷ LeftPower($[m, k]$) (function)

returns a left k -power of element m .

1.3.7 RightPower

▷ RightPower($[m, k]$) (function)

returns a right k -power of element m .

1.3.8 AllSmallAntimagmas

▷ AllSmallAntimagmas(n) (function)

returns all antiassociative magmas of specified size n (a number)

Example

```

gap> AllSmallAntimagmas(2);
[ <magma with 2 generators>, <magma with 2 generators> ]
gap> AllSmallAntimagmas(3);
[
  <magma with 3 generators>, <magma with 3 generators>, <magma with 3 generators>,
  <magma with 3 generators>, <magma with 3 generators>, <magma with 3 generators>,
  <magma with 3 generators>, <magma with 3 generators>,
  <magma with 3 generators>, <magma with 3 generators>
]

```

1.3.9 NrSmallAntimagmas

▷ NrSmallAntimagmas(n) (function)

counts number of antiassociative magmas of specified size n (a number).

Example

```
gap> NrSmallAntimagnas(2);
2
gap> NrSmallAntimagnas(3);
10
gap> NrSmallAntimagnas(4);
17780
```

1.3.10 SmallAntimagma

▷ `SmallAntimagma(n, i)` (function)

returns antiassociative magma of id $[n, i]$.

Example

```
gap> SmallAntimagma(2, 1);
<magma with 2 generators>
gap> SmallAntimagma(4, 5);
<magma with 4 generators>
```

1.3.11 OneSmallAntimagma

▷ `OneSmallAntimagma(n)` (function)

returns a random antiassociative magma of size n .

Example

```
gap> OneSmallAntimagma(2);
<magma with 2 generators>

gap> OneSmallAntimagma(3);
<magma with 3 generators>
```

1.3.12 ReallyAllSmallAntimagnas

▷ `ReallyAllSmallAntimagnas(n)` (function)

returns really-all antiassociative magmas, isomorphic, of specified size n (a number)

Example

```
gap> ReallyAllSmallAntimagnas(2);
[ <magma with 2 generators>, <magma with 2 generators> ]
```

1.3.13 ReallyNrSmallAntimagnas

▷ `ReallyNrSmallAntimagnas(n)` (function)

counts number of antiassociative magmas of specified size n (a number)

Example

```
gap> ReallyNrSmallAntimagnas(3);
52
```

1.3.14 AntimagmaGeneratorPossibleDiagonals

▷ AntimagmaGeneratorPossibleDiagonals(n) (function)

returns all possible diagonals of multiplication table for $[n]$ -antimagma.

Example

```
gap> AntimagmaGeneratorPossibleDiagonals(2);
[ [ 2, 1 ] ]
gap> AntimagmaGeneratorPossibleDiagonals(3);
[
  [ 2, 1, 1 ], [ 2, 1, 2 ], [ 2, 3, 1 ], [ 2, 3, 2 ],
  [ 3, 1, 1 ], [ 3, 1, 2 ], [ 3, 3, 1 ], [ 3, 3, 2 ]
]
```

1.3.15 AntimagmaGeneratorFilterNonIsomorphicMagmas

▷ AntimagmaGeneratorFilterNonIsomorphicMagmas(Ms) (function)

filters non-isomorphic magmas m .

1.4 smallantimagmas automatic generated documentation of methods

1.4.1 MagmaIsomorphism (for IsMagma, IsMagma)

▷ MagmaIsomorphism(M , N) (operation)

computes an isomorphism between magmas M , N .

Example

```
gap> M := SmallAntimagma(2, 1);
<magma with 2 generators>
gap> N := MagmaByMultiplicationTable([ [2, 1], [2, 1] ]);
<magma with 2 generators>
gap> MagmaIsomorphism(M, N);
<mapping: Domain([ m1, m2 ]) -> Domain([ m1, m2 ]) >
```

1.4.2 MagmaAntiisomorphism (for IsMagma, IsMagma)

▷ MagmaAntiisomorphism(M , N) (operation)

creates an antiisomorphism between magmas M , N .

Example

```
gap> M := SmallAntimagma(2, 1);
<magma with 2 generators>
gap> N := SmallAntimagma(2, 2);
<magma with 2 generators>
gap> MagmaAntiisomorphism(M, N);
<mapping: Domain([ m1, m2 ]) -> Domain([ m1, m2 ]) >
```

Index

AllSmallAntimagma, 9
AllSubmagmas, 7
AnticommutativityIndex
 for IsMagma, 6
AntimagmaGeneratorFilterNonIsomorphic-
 Magma, 11
AntimagmaGeneratorPossibleDiagonals, 11
AssociativityIndex
 for IsMagma, 5

CommutativityIndex
 for IsMagma, 6

DiagonalOfMultiplicationTable
 for IsMagma, 6

IdSmallAntimagma
 for IsMagma, 6
IsAntiassociative
 for IsMagma, 4
IsCancellative
 for IsMagma, 5
IsLeftCancellative
 for IsMagma, 4
IsLeftCyclic
 for IsMagma, 4
IsMagmaAntiisomorphic, 8
IsMagmaIsomorphic, 8
IsRightCancellative
 for IsMagma, 5
IsRightCyclic
 for IsMagma, 4

LeftOrder
 for IsExtLElement, 7
LeftOrdersOfElements
 for IsMagma, 7
LeftPower, 9
License, 2

MagmaAntiisomorphism
 for IsMagma, IsMagma, 11
MagmaIsomorphism
 for IsMagma, IsMagma, 11
MagmaIsomorphismInvariantsMatch, 8
NrSmallAntimagma, 9
OneSmallAntimagma, 10
ReallyAllSmallAntimagma, 10
ReallyNrSmallAntimagma, 10
RightOrder
 for IsExtRElement, 7
RightOrdersOfElements
 for IsMagma, 7
RightPower, 9

SmallAntimagma, 10
SquaresIndex
 for IsMagma, 6

TransposedMagma, 8