

# Package ‘sparta’

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**License** MIT + file LICENSE

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**BugReports** <https://github.com/mlindsk/sparta/issues>

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sparta-package      *sparta: Sparse Tables*

---

### Description

Fast Multiplication and Marginalization of Sparse Tables.

### Author(s)

**Maintainer:** Mads Lindskou <mads@math.aau.dk>

### See Also

Useful links:

- <https://github.com/mlindsk/sparta>
- Report bugs at <https://github.com/mlindsk/sparta/issues>

---

allowed\_class\_to\_sparta  
*Classes that can be converted to sparta*

---

### Description

A non-argument function, that outputs the classes that can be converted to a sparta object

### Usage

allowed\_class\_to\_sparta()

---

|          |                 |
|----------|-----------------|
| as_array | <i>As array</i> |
|----------|-----------------|

---

## Description

Turn a sparse table into an array

## Usage

```
as_array(x)

## S3 method for class 'sparta'
as_array(x)

## S3 method for class 'sparta_unity'
as_array(x)
```

## Arguments

x                    sparta object

## Value

An array

## See Also

[as\\_array](#)

## Examples

```
x <- array(
  c(1,0,0,2,3,4,0,0),
  dim = c(2,2,2),
  dimnames = list(
    a = c("a1", "a2"),
    b = c("b1", "b2"),
    c = c("c1", "c2")
  )
)

as_array(as_sparta(x))
```

---

`as_cpt`*As cpt*

---

**Description**

Turn a sparta into a conditional probability table

**Usage**

```
as_cpt(x, y)

## S3 method for class 'sparta'
as_cpt(x, y)
```

**Arguments**

|                |                            |
|----------------|----------------------------|
| <code>x</code> | sparta object              |
| <code>y</code> | the conditioning variables |

**Examples**

```
x <- array(
  c(1,0,0,2,3,4,0,0),
  dim = c(2,2,2),
  dimnames = list(
    a = c("a1", "a2"),
    b = c("b1", "b2"),
    c = c("c1", "c2")
  )
)

sx <- as_sparta(x)

# A joint probability table p(a, b, c)
as_cpt(sx, character(0))
# the same as normalize
normalize(sx)

# A conditional probability table p(a, c | b)
pacb <- as_cpt(sx, "b")

# The probability distribution when b = b1
slice(pacb, c(b = "b1"))
```

---

|       |                      |
|-------|----------------------|
| as_df | <i>As data frame</i> |
|-------|----------------------|

---

## Description

Turn a sparse table into a data frame

## Usage

```
as_df(x, dense = FALSE)

## S3 method for class 'sparta'
as_df(x, dense = FALSE)
```

## Arguments

|       |   |
|-------|---|
| x     | sparta object   |
| dense | Logical indicating if zero cells should be present or not |

## Value

A data frame

## See Also

[as\\_array](#)

## Examples

```
x <- array(
  c(1,0,0,2,3,4,0,0),
  dim = c(2,2,2),
  dimnames = list(
    a = c("a1", "a2"),
    b = c("b1", "b2"),
    c = c("c1", "c2")
  )
)

as_df(as_sparta(x))
```

---

`as_sparta`*As sparse table*

---

## Description

Turn an array-like object or a data.frame into a sparse representation

## Usage

```
as_sparta(x)
```

```
## S3 method for class 'array'  
as_sparta(x)
```

```
## S3 method for class 'matrix'  
as_sparta(x)
```

```
## S3 method for class 'table'  
as_sparta(x)
```

```
## S3 method for class 'sparta'  
as_sparta(x)
```

```
## S3 method for class 'data.frame'  
as_sparta(x)
```

## Arguments

`x` array-like object or a data.frame

## Value

A sparta object

## See Also

[as\\_array](#)

## Examples

```
# -----  
# Example 1)  
# -----  
  
x <- array(  
  c(1,0,0,2,3,4,0,0),  
  dim = c(2,2,2),
```

```
dimnames = list(
  a = c("a1", "a2"),
  b = c("b1", "b2"),
  c = c("c1", "c2")
)
)

as_sparta(x)

# -----
# Example 2)
# -----

y <- mtcars[, c("gear", "carb")]
y[] <- lapply(y, as.character)
as_sparta(y)
```

---

equiv

*Equiv*

---

## Description

Determine if two sparta objects are equivalent

## Usage

```
equiv(x, y)
```

```
## S3 method for class 'sparta'
equiv(x, y)
```

## Arguments

|   |               |
|---|---------------|
| x | sparta object |
| y | sparta object |

## Value

Logical. TRUE if x and y are equivalent

## Examples

```
x <- array(
  c(1,0,0,2,3,4,0,0),
  dim = c(2,2,2),
  dimnames = list(
    a = c("a1", "a2"),
```

```
      b = c("b1", "b2"),
      c = c("c1", "c2")
    )
  )

y <- array(
  c(2,0,0,2,3,4,0,0),
  dim = c(2,2,2),
  dimnames = list(
    a = c("a1", "a2"),
    b = c("b1", "b2"),
    c = c("c1", "c2")
  )
)

sx <- as_sparta(x)
sy <- as_sparta(y)

equiv(sx, sy)
equiv(sx, sx)
```

---

get\_val

*Get value or cell name*

---

## Description

Find the value or the name of a cell

## Usage

```
get_val(x, y)

## S3 method for class 'sparta'
get_val(x, y)

get_cell_name(x, y)

## S3 method for class 'sparta'
get_cell_name(x, y)
```

## Arguments

|   |  |
|---|--|
| x | sparta   |
| y | named character vector or vector of cell indices |

**Examples**

```
x <- array(
  c(1,0,0,2,3,4,0,0),
  dim = c(2,2,2),
  dimnames = list(
    a = c("a1", "a2"),
    b = c("b1", "b2"),
    c = c("c1", "c2")
  )
)

sx <- as_sparta(x)
get_val(sx, c(a = "a2", b = "b1", c = "c2"))
get_cell_name(sx, sx[, 4])
```

---

marg

*Marginalization of sparse tables*


---

**Description**

Marginalize a sparse table given a vector of variables to marginalize out

**Usage**

```
marg(x, y, flow = "sum")

## S3 method for class 'sparta'
marg(x, y, flow = "sum")

## S3 method for class 'numeric'
marg(x, y, flow = "sum")
```

**Arguments**

|      |   |
|------|---|
| x    | sparta object or a numeric. If numeric, the value is just returned. |
| y    | character vector of the variables to marginalize out                |
| flow | either "sum" or "max"   |

**Value**

A sparta object (or scalar if all variables are summed out)

**Examples**

```
x <- array(
  c(1,0,0,2,3,4,0,0),
  dim = c(2,2,2),
  dimnames = list(
    a = c("a1", "a2"),
    b = c("b1", "b2"),
    c = c("c1", "c2")
  )
)

sx <- as_sparta(x)
marg(sx, c("c"))

su <- sparta_unity_struct(dim_names(sx), rank = 3.14)
marg(su, c("a", "b"))
```

---

 mult

*Multiplication and division of sparse tables*


---

**Description**

Multiplication and division of sparse tables

**Usage**

```
mult(x, y)

## S3 method for class 'sparta'
mult(x, y)

## S3 method for class 'numeric'
mult(x, y)

div(x, y)

## S3 method for class 'sparta'
div(x, y)

## S3 method for class 'numeric'
div(x, y)
```

**Arguments**

|   |                         |
|---|-------------------------|
| x | sparta object or scalar |
| y | sparta object or scalar |

**Value**

A sparta object or a scalar

**Examples**

```
# -----
# Example 1)
# -----

x <- array(
  c(1,0,0,2,3,4,0,0),
  dim = c(2,2,2),
  dimnames = list(
    a = c("a1", "a2"),
    b = c("b1", "b2"),
    c = c("c1", "c2")
  )
)

y <- array(
  c(1,3,0,2,4,2,7,0,
    1,8,0,1,6,2,1,0,
    1,5,0,3,2,9,1,0),
  dim = c(2,2,2, 3),
  dimnames = list(
    b = c("b1", "b2"),
    d = c("d1", "d2"),
    a = c("a1", "a2"),
    e = c("e1", "e2", "e3")
  )
)

sx <- as_sparta(x)
sy <- as_sparta(y)

sparsity(sx)
table_size(sx)
dim_names(sx)
names(sx)

mult(sx, sy)
div(sy, sx)

# -----
# Example 2)
# -----

d1 <- mtcars[, c("cyl", "vs", "am")]
d1[] <- lapply(d1, as.character)
d2 <- mtcars[, c("am", "gear", "carb")]
d2[] <- lapply(d2, as.character)
```

```

ds1 <- as_sparta(d1)
ds2 <- as_sparta(d2)

mult(ds1, ds2)

# -----
# Example 3)
# -----

su <- sparta_unity_struct(dim_names(sy), rank = 3.1415)
sparta_rank(su)
sum(su)
sun <- normalize(su)
sun
sum(sun)

mult(sx, sun)

# -----
# Example 4)
# -----
so <- sparta_ones(dim_names(sx))
mult(so, 2)

```

---

normalize

*Normalize*


---

### Description

Normalize

### Usage

```

normalize(x)

## S3 method for class 'sparta'
normalize(x)

```

### Arguments

x                    sparta

### Value

A sparta object

**Examples**

```
x <- array(
  c(1,0,0,2,3,4,0,0),
  dim = c(2,2,2),
  dimnames = list(
    a = c("a1", "a2"),
    b = c("b1", "b2"),
    c = c("c1", "c2")
  )
)

sx <- as_sparta(x)
normalize(sx)
```

---

|              |              |
|--------------|--------------|
| print.sparta | <i>Print</i> |
|--------------|--------------|

---

**Description**

Print method for sparta objects

**Usage**

```
## S3 method for class 'sparta'
print(x, ...)
```

**Arguments**

|     |                                 |
|-----|---------------------------------|
| x   | sparta object                   |
| ... | For S3 compatability. Not used. |

---

|       |              |
|-------|--------------|
| slice | <i>Slice</i> |
|-------|--------------|

---

**Description**

Find the slice of a sparse table

**Usage**

```
slice(x, s, drop = FALSE)

## S3 method for class 'sparta'
slice(x, s, drop = FALSE)
```

**Arguments**

|      |  |
|------|--|
| x    | sparta object                                    |
| s    | a slice in form of a named character vector      |
| drop | Logical. If TRUE, the variables in s are removed |

**Value**

A sparta object

**Examples**

```
x <- array(
  c(1,0,0,2,3,4,0,0),
  dim = c(2,2,2),
  dimnames = list(
    a = c("a1", "a2"),
    b = c("b1", "b2"),
    c = c("c1", "c2")
  )
)

sx <- as_sparta(x)

# conditional probability table p(b,c|a)
sx <- as_cpt(sx, "a")

# the probability distribution when 'a' is 'a2'
sxa2 <- slice(sx, c(a = "a2"))
get_val(sxa2, c(a = "a2", b = "b1", c = "c2"))

sxa2_drop <- slice(sx, c(a = "a2"), drop = TRUE)
get_val(sxa2_drop, c(b = "b1", c = "c2"))

u <- sparta_unity_struct(dim_names(sx))
slice(u, c(a = "a1"), drop = TRUE)
```

---

 sparsity

*Sparsity*


---

**Description**

Sparsity

**Usage**

```

sparsity(x)

## S3 method for class 'sparta'
sparsity(x)

## S3 method for class 'sparta_unity'
sparsity(x)

```

**Arguments**

x                    sparta

**Value**

The ratio of `ncol(x)` and the total statespace of `x`

**Examples**

```

x <- array(
  c(1,0,0,2,3,4,0,0),
  dim = c(2,2,2),
  dimnames = list(
    a = c("a1", "a2"),
    b = c("b1", "b2"),
    c = c("c1", "c2")
  )
)

sx <- as_sparta(x)
sparsity(sx)

```

---

sparta\_ones

*Sparta Ones*


---

**Description**

Construct a sparta object filled with ones

**Usage**

```
sparta_ones(dim_names)
```

**Arguments**

dim\_names            A named list of discrete levels

**Value**

A sparta object

**Examples**

```
sparta_ones(list(a = c("a1", "a2"), b = c("b1", "b2")))
```

---

|               |                                |
|---------------|--------------------------------|
| sparta_struct | <i>Construct sparta object</i> |
|---------------|--------------------------------|

---

**Description**

Helper function to construct a sparta object with given values and dim names

**Usage**

```
sparta_struct(x, vals, dim_names)
```

**Arguments**

|           |   |
|-----------|---|
| x         | matrix where columns represents cells in an array-like object |
| vals      | vector of values corresponding to x                           |
| dim_names | a named list  |

**Value**

A sparta object

**Examples**

```
x <- array(
  c(1,0,0,2,3,4,0,0),
  dim = c(2,2,2),
  dimnames = list(
    a = c("a1", "a2"),
    b = c("b1", "b2"),
    c = c("c1", "c2")
  )
)

sx <- as_sparta(x)
sparta_struct(unclass(sx), vals(sx), dim_names(sx))
```

---

sparta\_unity\_struct     *Sparse unity table*

---

**Description**

Construct a sparse table of ones

**Usage**

```
sparta_unity_struct(dim_names, rank = 1L)
```

**Arguments**

dim\_names     A named list of discrete levels  
rank           The value of each element. Default is 1.

**Value**

A sparta object

**Examples**

```
s <- sparta_unity_struct(list(a = c("a1", "a2"), b = c("b1", "b2")), rank = 1)
mult(s, 2)
```

---

sum.sparta             *Vector-like operations on sparta objects*

---

**Description**

Vector-like operations on sparta objects

**Usage**

```
## S3 method for class 'sparta'
sum(x, ...)

## S3 method for class 'sparta'
max(x, ...)

## S3 method for class 'sparta'
min(x, ...)

which_min_cell(x)

## S3 method for class 'sparta'
```

```

which_min_cell(x)

which_min_idx(x)

## S3 method for class 'sparta'
which_min_idx(x)

which_max_cell(x)

## S3 method for class 'sparta'
which_max_cell(x)

which_max_idx(x)

## S3 method for class 'sparta'
which_max_idx(x)

```

### Arguments

```

x          sparta
...       For S3 compatability.

```

---

|            |                                      |
|------------|--------------------------------------|
| table_size | <i>Number of elements in a table</i> |
|------------|--------------------------------------|

---

### Description

Number of elements in a table

### Usage

```

table_size(x)

## S3 method for class 'sparta'
table_size(x)

```

### Arguments

```

x          sparta

```

### Value

The size of the sparta table x

**Examples**

```
x <- array(
  c(1,0,0,2,3,4,0,0),
  dim = c(2,2,2),
  dimnames = list(
    a = c("a1", "a2"),
    b = c("b1", "b2"),
    c = c("c1", "c2")
  )
)

sx <- as_sparta(x)
table_size(sx)
```

---

vals

*Sparta getters*

---

**Description**

Getter methods for sparta objects

**Usage**

```
vals(x)

## S3 method for class 'sparta'
vals(x)

get_values(x)

## S3 method for class 'sparta'
get_values(x)

dim_names(x)

## S3 method for class 'sparta'
dim_names(x)

## S3 method for class 'sparta'
names(x)

sparta_rank(x)

## S3 method for class 'sparta_unity'
sparta_rank(x)
```

**Arguments**

x                    sparta object

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