

# Package ‘rgraph6’

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**Title** Interface to graph6 format for R

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**Depends** R (>= 2.2.1), methods

**Suggests** sna

**Description** This package contains implementation of methods that allow to represent undirected graphs in a compact ‘graph6’ format

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<code>asAMatrix</code>	<i>Convert a graph6 symbol to adjacency matrix</i>
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### Description

This function takes a graph6 symbol and converts it to a symmetric square adjacency matrix.

### Usage

```
asAMatrix(object)
## S4 method for signature 'character':
asAMatrix(object)
```

**Arguments**

`object` character, a graph6 symbol

**Details**

For detailed explanations of graph6 format see `graph6`.

**Value**

A square symmetric adjacency matrix representing the graph.

**Note**

This function aim at implementing format and methods originally created by Brendan McKay, (bdm@cs.anu.edu.au) and <http://cs.anu.edu.au/~bdm>.

**Author(s)**

Michal Bojanowski (mbojan@ifispan.waw.pl)

**References**

<http://cs.anu.edu.au/people/bdm/data/formats.txt>

**See Also**

`graph6` for format description and `asGraph6` for conversion in the opposite direction.

**Examples**

```
data(sampleg6)
sampleg6
l <- lapply(sampleg6, asAMatrix)
l
```

---

`asGraph6`

*Convert adjacency matrix to a graph6 symbol*

---

**Description**

This function converts a graph adjacency matrix to a graph6 symbol.

**Usage**

```
asGraph6(object)
## S4 method for signature 'matrix':
asGraph6(object)
```

**Arguments**

`object` a square adjacency matrix containing 0s and 1s

**Details**

If necessary, more details than the description above

**Value**

A graph6 symbol.

**Note**

This function aim at implementing format and methods originally created by Brendan McKay, (bdm@cs.anu.edu.au) and <http://cs.anu.edu.au/~bdm>.

**Author(s)**

Michal Bojanowski (mbojan@ifispan.waw.pl)

**References**

<http://cs.anu.edu.au/people/bdm/data/formats.txt>

**See Also**

`graph6` for format description and `asAMatrix` for conversion in the opposite direction.

**Examples**

```
g <- asAMatrix("F?Dco")
g
asGraph6(g)
```

---

**b2d***Conversions between binary and decimal numbers*

---

**Description**

These functions convert between binary numbers (as numeric vectors) and decimal numbers.

**Usage**

```
b2d(bin)
d2b(dec)
```

**Arguments**

<code>bin</code>	numeric vector of 0s and 1s representing the number in binary format
<code>dec</code>	numeric non-negative scalar, decimal number to be converted

**Value**

For `b2d` the decimal number representing the binary input. For `d2b` the numeric vector representing the decimal as binary number: sequence of 0s and 1s.

**See Also**

bin2dec and dec2bin for more user friendly interface.

**Examples**

```
b2d(c(1, 1, 0, 1))
d2b(13)
```

---

bin2dec

*Converting between decimal and binary numbers*


---

**Description**

These functions provide user-friendly interface to low-level routines b2d and d2b for converting between decimal and binary numbers.

**Usage**

```
dec2bin(dec, num = TRUE)
bin2dec(bin)
## S4 method for signature 'numeric':
bin2dec(bin)
## S4 method for signature 'character':
bin2dec(bin)
```

**Arguments**

bin	binary number as a numeric vector of 0s and 1s or a single character string containing 0s and 1s only
dec	single decimal number to be converted
num	logical, whether a numeric vector (instead of single character string) should be returned

**Value**

For bin2dec the decimal number representing the binary input.

For dec2bin, if num is TRUE, which is the default, the numeric vector containing the binary number. If num is FALSE then a single string containing the sequence of 0s and 1s is returned.

**See Also**

b2d and d2b for low-level procedures

**Examples**

```
bin2dec("1101")
bin2dec(c(1,1,0,1))

dec2bin(13)
dec2bin(13, FALSE)
```

graph6

*Description of the graph6 format***Description**

Description of graph6 format for storing undirected graphs.

**Details**

General principles:

- All numbers in this description are in decimal unless obviously in binary.
- Apart from the header, there is one object per line. Apart from the header and the end-of-line characters, all bytes have a value in the range 63-126 (which are all printable ASCII characters). A file of objects is a text file, so whatever end-of-line convention is locally used is fine).

Bit vectors:

A bit vector  $x$  of length  $k$  can be represented as follows. Example: 1000101100011100

1. Pad on the right with 0 to make the length a multiple of 6. Example: 100010110001110000
2. Split into groups of 6 bits each. Example: 100010 110001 110000
3. Add 63 to each group, considering them as bigendian binary numbers. Example: 97 112 111

These values are then stored one per byte. So, the number of bytes is  $\text{ceiling}(k/6)$ .

Let  $R(x)$  denote this representation of  $x$  as a string of bytes.

Small nonnegative integers:

Let  $n$  be an integer in the range 0-262143 ( $262143 = 2^{18} - 1$ ).

If  $0 \leq n \leq 62$ , define  $N(n)$  to be the single byte  $n + 63$ . If  $n \geq 63$ , define  $N(n)$  to be the four bytes  $126R(x)$ , where  $x$  is the bigendian 18-bit binary form of  $n$ .

Examples:

$$N(30) = 93$$

$$N(12345) = N(000011000000111001) = 1266963120$$

**0.1 Description of graph6 format**

Data type: simple undirected graphs of order 0 to 262143.

Optional Header: >>graph6<< (without end of line!)

File name extension: .g6

One graph:

Suppose  $G$  has  $n$  vertices. Write the upper triangle of the adjacency matrix of  $G$  as a bit vector  $x$  of length  $n(n-1)/2$ , using the ordering  $(0, 1), (0, 2), (1, 2), (0, 3), (1, 3), (2, 3), \dots, (n-1, n)$ .

Then the graph is represented as  $N(n) R(x)$ .

Example:

Suppose  $n = 5$  and  $G$  has edges 0-2, 0-4, 1-3 and 3-4.

$$x = 0100101001$$

Then  $N(n) = 68$  and  $R(x) = R(010010100100) = 8199$ . So, the graph is 688199.

## Description of graph6 format

### Author(s)

Michal Bojanowski (mbojan@ifispan.waw.pl) based on the above webpage

### References

<http://cs.anu.edu.au/people/bdm/data/formats.txt>

### See Also

`asAMatrix` and `asGraph6` for conversion functions.

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rgraph6-package

*Interface to graph6 format for R*

---

## Description

This package contain implementation of methods that allow to represent undirected graphs in a compact 'graph6' format

## Details

This package implements routines for reading and writing undirected graphs in graph6 format. The format itself was created by Brendan McKay <http://cs.anu.edu.au/~bdm>. See `help(graph6)` for detailed format description. The routines in this package are inspired by routines in McKay's `nauty` suite of programs for graph analysis.

See `help(package="rgraph6")` for a list of available functions.

The main interface consists of two functions: `asGraph6` and `asAMatrix`. The first one is for converting symmetric, square binary matrices representing an undirected graphs to a graph6 symbol. The second one for converting graph6 symbol into a square, symmetric binary matrix (adjacency matrix).

## Changes

### Version 1.2 (2007-11-19)

- Corrections in the documentation.
- Added description of the `graph6` format on `help(graph6)` page

### Version 1.1 (2007-06-12)

- Corrected code for binary to decimal conversion. Previous version was returning wrong results for binary numbers that begin with 1 and have all other entries to 0.
- Added some tests for testing binary to decimal conversions as well as for converting matrices to `graph6` format.

### Version 1.0 (2007-06-06)

- Added functions `b2d` and `d2b` for conversions between decimal and binary numbers. They are based on compiled C code so should be much faster than the older ones written in R.
- Functions `bin2dec` and `dec2bin` have been rewritten for use of newly added compiled code.
- Added a `sampleg6` file with couple of `g6` symbols

### Version 0.0-1 (2007-02-09)

- First beta version of the package

## Author(s)

Michal Bojanowski (mbojan@ifispan.waw.pl)

## References

The web page of Brendan McKay: <http://cs.anu.edu.au/~bdm>

## Examples

```
# TODO add examples
```

---

`sampleg6`

*A sample vector of g6 codes*

---

## Description

A vector of `graph6` symbols each representing an undirected graph.

## Usage

```
data(sampleg6)
```

## Format

The format is: `chr [1:9] "CR" "CJ" "CN" ...`

**See Also**

See `graph6` for format description, `asAMatrix` and `asGraph6` for conversion routines.

**Examples**

```
data(sampleg6)
l <- lapply( sampleg6, asAMatrix )
# list of adjacency matrices
str(l)
```

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