

Package ‘bigIntegerAlgos’

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Type Package

Title R Tool for Factoring Big Integers

Version 0.1.2

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Description Features the multiple polynomial quadratic sieve algorithm for factoring large integers and a vectorized factoring function that returns the complete factorization of an integer. Utilizes the C library GMP (GNU Multiple Precision Arithmetic) and classes created by Antoine Lucas et al. found in the 'gmp' package.

License GPL (>= 2)

BuildResaveData no

Encoding UTF-8

SystemRequirements gmp (>= 4.2.3)

Suggests testthat, numbers (>= 0.6-6), RcppAlgos (>= 1.0.1)

Depends gmp

NeedsCompilation yes

URL <https://github.com/jwood000/bigIntegerAlgos>,
<http://mathworld.wolfram.com/QuadraticSieve.html>

BugReports <https://github.com/jwood000/bigIntegerAlgos/issues>

RoxygenNote 6.0.1

Repository CRAN

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`divisorsBig`*Vectorized Factorization (Complete) with GMP*

Description

Quickly generates the complete factorization for many (possibly large) numbers.

Usage

```
divisorsBig(v, namedList = FALSE)
```

Arguments

<code>v</code>	Vector of integers, numerics, string values, or elements of class <code>bigz</code> .
<code>namedList</code>	Logical flag. If TRUE and the <code>length(v) > 1</code> , a named list is returned. The default is FALSE.

Details

Highly optimized algorithm to generate the complete factorization for many numbers. It is built specifically for the data type that is used in the `gmp` library (i.e. `mpz_t`).

The main part of this algorithm is essentially the same algorithm that is implemented in [divisorsRcpp](#) from the `RcppAlgos` package. A modified **merge sort** algorithm is implemented to better deal with the `mpz_t` data type. This algorithm avoids directly swapping elements of the main factor array of type `mpz_t` but instead generates a vector of indexing integers for ordering.

See this stack overflow post for examples and benchmarks : [R Function for returning ALL factors](#).

Value

- Returns an unnamed vector of class `bigz` if `length(v) == 1` regardless of the value of `namedList`.
- If `length(v) > 1`, a named/unnamed list of vectors of class `bigz` will be returned.

Author(s)

Joseph Wood

References

[Divisor](#)

See Also

[divisorsRcpp](#), [divisors](#), [factorize](#)

Examples

```
## Get the complete factorization of a single number
divisorsBig(10^15)

## Or get the complete factorization of many numbers
set.seed(29)
myVec <- sample(-1000000:1000000, 1000)
system.time(myFacs <- divisorsBig(myVec))

## Return named list
myFacsWithNames <- divisorsBig(myVec, namedList = TRUE)
```

quadraticSieve

Prime Factorization with the Quadratic Sieve

Description

Get the prime factorization of a number, n , using the [Quadratic Sieve](#).

Usage

```
quadraticSieve(n)
```

Arguments

`n` An integer, numeric, string value, or an element of class `bigz`.

Details

First, [trial division](#) is carried out to remove small prime numbers, then a modified version of [Pollard's rho algorithm](#) that is constrained is called to quickly remove further prime numbers. Next, we check to make sure that we are not passing a perfect power to the main quadratic sieve algorithm. After removing any perfect powers, we finally call the quadratic sieve with multiple polynomials in a recursive fashion until we have completely factored our number.

Value

Vector of class `bigz`

Author(s)

Joseph Wood

References

- Pomerance, C. (2008). Smooth numbers and the quadratic sieve. In *Algorithmic Number Theory Lattices, Number Fields, Curves and Cryptography* (pp. 69-81). Cambridge: Cambridge University Press.
- Silverman, R. D. (1987). The Multiple Polynomial Quadratic Sieve. *Mathematics of Computation*, 48(177), 329-339. doi:10.2307/2007894
- Integer Factorization using the Quadratic Sieve
- From <https://codegolf.stackexchange.com/> (Credit to user primo for answer) P., & Chowdhury, S. (2012, October 7). Fastest semiprime factorization. Retrieved October 06, 2017

See Also

[factorize](#)

Examples

```
mySemiPrime <- prod(nextprime(urand.bigz(2, 40, 17)))  
quadraticSieve(mySemiPrime)
```

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