primesieve-pas

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Chapter 1

Unit primesieve

1.1 Description

Pascal bindings for primesieve library.
primesieve - library for fast prime number generation.

https://github.com/kimwalisch/primesieve
primesieve-pas - FPC/Delphi API for primesieve library.

https://github.com/JulStrat/primesieve-pas

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1.3 Classes, Interfaces, Objects and Records

primesieve_iterator Record

Description

primesieve_iterator(1.3) allows to easily iterate over primes both forwards and backwards. Generating the first prime has a complexity of *O(r log log r)* operations with *r = n^0.5*, after that any additional prime is generated in amortized *O(log n log log n)* operations. The memory usage is about *PrimePi(n^0.5) * 8* bytes.
The *primesieve_iterator.pas* example shows how to use primesieve_iterator(1.3). If any error occurs primesieve_next_prime(1.4) and @limk(primesieve_prev_prime) return _PRIMESIEVE_ERROR(1.6). Furthermore *primesieve_iterator.is_error* is initialized to 0 and set to 1 if any error occurs.

1.4 Functions and Procedures

primesieve_generate_primes

Declaration `function primesieve_generate_primes(start: UInt64; stop: UInt64; var size: NativeUInt; ptype: Integer): Pointer; cdecl; external LIB_PRIMESIEVE name LIB_FNPFX + 'primesieve_generate_primes';`

Description Get an array with the primes inside the interval *[start, stop]*.

Parameters **size** The size of the returned primes array

ptype The type of the primes to generate, e.g. `INT_PRIMES32`

primesieve_generate_n_primes

Declaration `function primesieve_generate_n_primes(n: UInt64; start: UInt64; ptype: Integer): Pointer; cdecl; external LIB_PRIMESIEVE name LIB_FNPFX + 'primesieve_generate_n_primes';`

Description Get an array with the first *n primes >= start*.

Parameters **ptype** The type of the primes to generate, e.g. `INT_PRIMES32`

primesieve_nth_prime

Declaration `function primesieve_nth_prime(n: Int64; start: UInt64): UInt64; cdecl; external LIB_PRIMESIEVE name LIB_FNPFX + 'primesieve_nth_prime';`

Description Find the nth prime. By default all CPU cores are used, use `primesieve_set_num_threads`(1.4) to change the number of threads.

Note that each call to `primesieve_nth_prime`(1.4) incurs an initialization overhead of *O(sqrt(start))* even if n is tiny. Hence it is not a good idea to use `primesieve_nth_prime`(1.4) repeatedly in a loop to get the next (or previous) prime. For this use case it is better to use a `primesieve_iterator`(1.3) which needs to be initialized only once.

Parameters **n** if *n = 0* finds the *1st prime >= start*,
if *n > 0* finds the *nth prime > start*,
if *n < 0* finds the *nth prime < start* (backwards).

primesieve_count_primes

Declaration `function primesieve_count_primes(start: UInt64; stop: UInt64): UInt64; cdecl; external LIB_PRIMESIEVE name LIB_FNPFX + 'primesieve_count_primes';`

Description Count the primes within the interval *[start, stop]*. By default all CPU cores are used, use `primesieve_set_num_threads`(1.4) to change the number of threads.

Note that each call to `primesieve_count_primes`(1.4) incurs an initialization overhead of *O(sqrt(stop))* even if the interval *[start, stop]* is tiny. Hence if you have written an algorithm that makes many calls to `primesieve_count_primes`(1.4) it may be preferable to use a `primesieve_iterator`(1.3) which needs to be initialized only once.

primesieve_count_twins

Declaration `function primesieve_count_twins(start: UInt64; stop: UInt64): UInt64; cdecl; external LIB_PRIMESIEVE name LIB_FNPFX + 'primesieve_count_twins';`

Description Count the twin primes within the interval *[start, stop]*.

By default all CPU cores are used, use `primesieve_set_num_threads`(1.4) to change the number of threads.

primesieve_count_triplets

Declaration `function primesieve_count_triplets(start: UInt64; stop: UInt64): UInt64; cdecl; external LIB_PRIMESIEVE name LIB_FNPFX + 'primesieve_count_triplets';`

Description Count the prime triplets within the interval *[start, stop]*.

By default all CPU cores are used, use `primesieve_set_num_threads`(1.4) to change the number of threads.

primesieve_count_quadruplets

Declaration `function primesieve_count_quadruplets(start: UInt64; stop: UInt64): UInt64; cdecl; external LIB_PRIMESIEVE name LIB_FNPFX + 'primesieve_count_quadruplets';`

Description Count the prime quadruplets within the interval *[start, stop]*.

By default all CPU cores are used, use `primesieve_set_num_threads`(1.4) to change the number of threads.

primesieve_count_quintuplets

Declaration `function primesieve_count_quintuplets(start: UInt64; stop: UInt64): UInt64; cdecl; external LIB_PRIMESIEVE name LIB_FNPFX + 'primesieve_count_quintuplets';`

Description Count the prime quintuplets within the interval *[start, stop]*.

By default all CPU cores are used, use `primesieve_set_num_threads`(1.4) to change the number of threads.

primesieve_count_sextuplets

Declaration `function primesieve_count_sextuplets(start: UInt64; stop: UInt64): UInt64; cdecl; external LIB_PRIMESIEVE name LIB_FNPFX + 'primesieve_count_sextuplets';`

Description Count the prime sextuplets within the interval *[start, stop]*.

By default all CPU cores are used, use `primesieve_set_num_threads`(1.4) to change the number of threads.

primesieve_print_primes

Declaration `procedure primesieve_print_primes(start: UInt64; stop: UInt64); cdecl; external LIB_PRIMESIEVE name LIB_FNPFX + 'primesieve_print_primes';`

Description Print the primes within the interval *[start, stop]* to the standard output.

primesieve_print_twins

Declaration `procedure primesieve_print_twins(start: UInt64; stop: UInt64); cdecl; external LIB_PRIMESIEVE name LIB_FNPFX + 'primesieve_print_twins';`

Description Print the twin primes within the interval *[start, stop]* to the standard output.

primesieve_print_triplets

Declaration `procedure primesieve_print_triplets(start: UInt64; stop: UInt64); cdecl; external LIB_PRIMESIEVE name LIB_FNPFX + 'primesieve_print_triplets';`

Description Print the prime triplets within the interval *[start, stop]* to the standard output.

primesieve_print_quadruplets

Declaration `procedure primesieve_print_quadruplets(start: UInt64; stop: UInt64); cdecl; external LIB_PRIMESIEVE name LIB_FNPFX + 'primesieve_print_quadruplets';`

Description Print the prime quadruplets within the interval *[start, stop]* to the standard output.

primesieve_print_quintuplets

Declaration `procedure primesieve_print_quintuplets(start: UInt64; stop: UInt64); cdecl; external LIB_PRIMESIEVE name LIB_FNPFX + 'primesieve_print_quintuplets';`

Description Print the prime quintuplets within the interval *[start, stop]* to the standard output.

primesieve_print_sextuplets

Declaration `procedure primesieve_print_sextuplets(start: UInt64; stop: UInt64); cdecl; external LIB_PRIMESIEVE name LIB_FNPFX + 'primesieve_print_sextuplets';`

Description Print the prime sextuplets within the interval *[start, stop]* to the standard output.

primesieve_get_max_stop

Declaration `function primesieve_get_max_stop(): UInt64; cdecl; external LIB_PRIMESIEVE name LIB_FNPFX + 'primesieve_get_max_stop';`

Description Returns the largest valid stop number for primesieve.

2^64-1 (UINT64_MAX)

primesieve_get_sieve_size

Declaration `function primesieve_get_sieve_size(): Integer; cdecl; external LIB_PRIMESIEVE name LIB_FNPFX + 'primesieve_get_sieve_size';`

Description Get the current set sieve size in KiB

primesieve_get_num_threads

Declaration `function primesieve_get_num_threads(): Integer; cdecl; external LIB_PRIMESIEVE name LIB_FNPFX + 'primesieve_get_num_threads';`

Description Get the current set number of threads

primesieve_set_sieve_size

Declaration `procedure primesieve_set_sieve_size(sieve_size: Integer); cdecl; external LIB_PRIMESIEVE name LIB_FNPFX + 'primesieve_set_sieve_size';`

Description Set the sieve size in KiB (kibibyte). The best sieving performance is achieved with a sieve size of your CPU's L1 or L2 cache size (per core). *sieve_size >= 8 and <= 4096*

primesieve_set_num_threads

Declaration `procedure primesieve_set_num_threads(num_threads: Integer); cdecl; external LIB_PRIMESIEVE name LIB_FNPFX + 'primesieve_set_num_threads';`

Description Set the number of threads for use in *primesieve_count_*()* and `primesieve_nth_prime`(1.4). By default all CPU cores are used.

primesieve_free

Declaration `procedure primesieve_free(primes: Pointer); cdecl; external LIB_PRIMESIEVE name LIB_FNPFX + 'primesieve_free';`

Description Deallocate a primes array created using the `primesieve_generate_primes`(1.4) or `primesieve_generate_n_pr` functions.

primesieve_version

Declaration `function primesieve_version(): PAnsiChar; cdecl; external LIB_PRIMESIEVE name LIB_FNPFX + 'primesieve_version';`

Description Get the primesieve version number, in the form "i.j"

primesieve_init

Declaration `procedure primesieve_init(var it: primesieve_iterator); cdecl; external LIB_PRIMESIEVE name LIB_FNPFX + 'primesieve_init';`

Description Initialize the primesieve iterator before first using it

primesieve_free_iterator

Declaration `procedure primesieve_free_iterator(var it: primesieve_iterator); cdecl; external LIB_PRIMESIEVE name LIB_FNPFX + 'primesieve_free_iterator';`

Description Free all iterator memory

primesieve_skipto

Declaration `procedure primesieve_skipto(var it: primesieve_iterator; start: UInt64; stop_hint: UInt64); cdecl; external LIB_PRIMESIEVE name LIB_FNPFX + 'primesieve_skipto';`

Description Reset the primesieve iterator to start.

Parameters **start** Generate *primes > start (or < start)*

stop_hint Stop number optimization hint. E.g. if you want to generate the primes below 1000 use *stop_hint = 1000*, if you don't know use `primesieve_get_max_stop`(1.4)

primesieve_next_prime

Declaration `function primesieve_next_prime(var it: primesieve_iterator): UInt64; inline;`

Description Get the next prime.

Returns *UINT64_MAX* if next *prime > 2^64*.

primesieve_prev_prime

Declaration `function primesieve_prev_prime(var it: primesieve_iterator): UInt64; inline;`

Description Get the previous prime.

`primesieve_prev_prime`(1.4) returns 0 for $n <= 2$. Note that `primesieve_next_prime`(1.4) runs up to 2x faster than `primesieve_prev_prime`(1.4). Hence if the same algorithm can be written using either `primesieve_prev_prime`(1.4) or `primesieve_next_prime`(1.4) it is preferable to use `primesieve_next_prime`(1.4).

1.5 Types

PUInt64

Declaration `PUInt64 = ^UInt64;`

PInt64

Declaration `PInt64 = ^Int64;`

1.6 Constants

_PRIMESIEVE_VERSION

Declaration `_PRIMESIEVE_VERSION = '7.5';`

_PRIMESIEVE_VERSION_MAJOR

Declaration `_PRIMESIEVE_VERSION_MAJOR = 7;`

_PRIMESIEVE_VERSION_MINOR

Declaration `_PRIMESIEVE_VERSION_MINOR = 5;`

_PRIMESIEVE_PAS_VERSION

Declaration `_PRIMESIEVE_PAS_VERSION = '0.3';`

Description Pascal API version

_PRIMESIEVE_ERROR

Declaration `_PRIMESIEVE_ERROR = not UInt64(0);`

Description primesieve functions return *PRIMESIEVE_ERROR (UINT64_MAX)* if any error occurs.

INT16_PRIMES

Declaration `INT16_PRIMES = 8;`

Description Generate primes of Int16 (c int16_t) type

UINT16_PRIMES

Declaration `UINT16_PRIMES = 9;`

Description Generate primes of UInt16 (c uint16_t) type

INT32_PRIMES

Declaration `INT32_PRIMES = 10;`

Description Generate primes of Int32 (c int32_t) type

UINT32_PRIMES

Declaration `UINT32_PRIMES = 11;`

Description Generate primes of UInt32 (c uint32_t) type

INT64_PRIMES

Declaration `INT64_PRIMES = 12;`

Description Generate primes of Int64 (c int64_t) type

UINT64_PRIMES

Declaration `UINT64_PRIMES = 13;`

Description Generate primes of UInt64 (c uint64_t) type