

primesieve

7.4

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Contents

1	Main Page	1
1.1	About	1
1.2	C++ API	1
1.3	C API	1
2	Namespace Index	3
2.1	Namespace List	3
3	Hierarchical Index	5
3.1	Class Hierarchy	5
4	Class Index	7
4.1	Class List	7
5	File Index	9
5.1	File List	9
6	Namespace Documentation	11
6.1	primesieve Namespace Reference	11
6.1.1	Detailed Description	12
6.1.2	Function Documentation	12
6.1.2.1	count_primes()	12
6.1.2.2	count_quadruplets()	13
6.1.2.3	count_quintuplets()	13
6.1.2.4	count_sextuplets()	13
6.1.2.5	count_triplets()	13
6.1.2.6	count_twins()	13
6.1.2.7	get_max_stop()	14
6.1.2.8	nth_prime()	14
6.1.2.9	set_num_threads()	14
6.1.2.10	set_sieve_size()	14

7	Class Documentation	15
7.1	primesieve::iterator Class Reference	15
7.1.1	Detailed Description	15
7.1.2	Constructor & Destructor Documentation	16
7.1.2.1	iterator()	16
7.1.3	Member Function Documentation	16
7.1.3.1	next_prime()	16
7.1.3.2	prev_prime()	16
7.1.3.3	skipto()	16
7.2	primesieve::primesieve_error Class Reference	17
7.2.1	Detailed Description	18
7.3	primesieve_iterator Struct Reference	18
7.3.1	Detailed Description	18
8	File Documentation	19
8.1	iterator.h File Reference	19
8.1.1	Detailed Description	20
8.1.2	Function Documentation	20
8.1.2.1	primesieve_next_prime()	20
8.1.2.2	primesieve_prev_prime()	21
8.1.2.3	primesieve_skipto()	21
8.2	iterator.hpp File Reference	21
8.2.1	Detailed Description	23
8.3	primesieve.h File Reference	23
8.3.1	Detailed Description	25
8.3.2	Enumeration Type Documentation	25
8.3.2.1	anonymous enum	25
8.3.3	Function Documentation	25
8.3.3.1	primesieve_count_primes()	25
8.3.3.2	primesieve_count_quadruplets()	26
8.3.3.3	primesieve_count_quintuplets()	26

8.3.3.4	<code>primesieve_count_sextuplets()</code>	26
8.3.3.5	<code>primesieve_count_triplets()</code>	26
8.3.3.6	<code>primesieve_count_twins()</code>	27
8.3.3.7	<code>primesieve_generate_n_primes()</code>	27
8.3.3.8	<code>primesieve_generate_primes()</code>	27
8.3.3.9	<code>primesieve_get_max_stop()</code>	28
8.3.3.10	<code>primesieve_nth_prime()</code>	28
8.3.3.11	<code>primesieve_set_num_threads()</code>	28
8.3.3.12	<code>primesieve_set_sieve_size()</code>	28
8.4	<code>primesieve.hpp</code> File Reference	29
8.4.1	Detailed Description	30
8.5	<code>primesieve_error.hpp</code> File Reference	31
8.5.1	Detailed Description	31
9	Example Documentation	33
9.1	<code>count_primes.c</code>	33
9.2	<code>count_primes.cpp</code>	33
9.3	<code>nth_prime.c</code>	33
9.4	<code>nth_prime.cpp</code>	34
9.5	<code>prev_prime.c</code>	34
9.6	<code>prev_prime.cpp</code>	35
9.7	<code>primesieve_iterator.c</code>	35
9.8	<code>primesieve_iterator.cpp</code>	35
9.9	<code>store_primes_in_array.c</code>	36
9.10	<code>store_primes_in_vector.cpp</code>	36
	Index	39

Chapter 1

Main Page

1.1 About

primesieve is a C/C++ library for fast prime number generation. It generates the primes below 10^9 in just 0.2 seconds on a single core of an Intel Core i7-6700 3.4GHz CPU. primesieve can generate primes and prime k-tuplets up to 2^{64} . primesieve's memory requirement is about $\pi(\sqrt{n}) * 8$ bytes per thread, its run-time complexity is $O(n \log \log n)$ operations. The recommended way to get started is to first have a look at a few C or C++ example programs. The most common use cases are iterating over primes using `next_prime()` or `prev_prime()` and storing primes in a vector or an array.

For more information please visit <https://primesieve.org>.

1.2 C++ API

- [primesieve.hpp](#) - primesieve C++ header.
- [primesieve_iterator.cpp](#) - Example that shows how to iterate over primes using `primesieve::iterator`.
- [store_primes_in_vector.cpp](#) - Example that shows how to store primes in a `std::vector`.
- [count_primes.cpp](#) - Example that shows how to count primes.

1.3 C API

- [primesieve.h](#) - primesieve C header.
- [primesieve_iterator.c](#) - Example that shows how to iterate over primes using `primesieve_iterator`.
- [store_primes_in_array.c](#) - Example that shows how to store primes in an array.
- [count_primes.c](#) - Example that shows how to count primes.

Chapter 2

Namespace Index

2.1 Namespace List

Here is a list of all documented namespaces with brief descriptions:

primesieve	
Contains primesieve's C++ functions and classes	11

Chapter 3

Hierarchical Index

3.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

primesieve::iterator	15
primesieve_iterator	18
runtime_error	
primesieve::primesieve_error	17

Chapter 4

Class Index

4.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

primesieve::iterator	Primesieve::iterator allows to easily iterate over primes both forwards and backwards	15
primesieve::primesieve_error	Primesieve throws a primesieve_error exception if an error occurs e.g	17
primesieve_iterator	C prime iterator, please refer to iterator.h for more information	18

Chapter 5

File Index

5.1 File List

Here is a list of all documented files with brief descriptions:

iterator.h	Primesieve_iterator allows to easily iterate over primes both forwards and backwards	19
iterator.hpp	The iterator class allows to easily iterate (forwards and backwards) over prime numbers	21
primesieve.h	Primesieve C API	23
primesieve.hpp	Primesieve C++ API	29
primesieve_error.hpp	The primesieve_error class is used for all exceptions within primesieve	31

Chapter 6

Namespace Documentation

6.1 primesieve Namespace Reference

Contains primesieve's C++ functions and classes.

Classes

- class [iterator](#)
[primesieve::iterator](#) allows to easily iterate over primes both forwards and backwards.
- class [primesieve_error](#)
primesieve throws a [primesieve_error](#) exception if an error occurs e.g.

Functions

- `template<typename T >`
`void generate_primes (uint64_t stop, std::vector< T > *primes)`
Store the primes \leq stop in the primes vector.
- `template<typename T >`
`void generate_primes (uint64_t start, uint64_t stop, std::vector< T > *primes)`
Store the primes within the interval [start, stop] in the primes vector.
- `template<typename T >`
`void generate_n_primes (uint64_t n, std::vector< T > *primes)`
Store the first n primes in the primes vector.
- `template<typename T >`
`void generate_n_primes (uint64_t n, uint64_t start, std::vector< T > *primes)`
Store the first n primes \geq start in the primes vector.
- `uint64_t nth_prime (int64_t n, uint64_t start=0)`
Find the nth prime.
- `uint64_t count_primes (uint64_t start, uint64_t stop)`
Count the primes within the interval [start, stop].
- `uint64_t count_twins (uint64_t start, uint64_t stop)`
Count the twin primes within the interval [start, stop].
- `uint64_t count_triplets (uint64_t start, uint64_t stop)`
Count the prime triplets within the interval [start, stop].
- `uint64_t count_quadruplets (uint64_t start, uint64_t stop)`

- Count the prime quadruplets within the interval [start, stop].*
- uint64_t [count_quintuplets](#) (uint64_t start, uint64_t stop)
- Count the prime quintuplets within the interval [start, stop].*
- uint64_t [count_sextuplets](#) (uint64_t start, uint64_t stop)
- Count the prime sextuplets within the interval [start, stop].*
- void [print_primes](#) (uint64_t start, uint64_t stop)
- Print the primes within the interval [start, stop] to the standard output.*
- void [print_twins](#) (uint64_t start, uint64_t stop)
- Print the twin primes within the interval [start, stop] to the standard output.*
- void [print_triplets](#) (uint64_t start, uint64_t stop)
- Print the prime triplets within the interval [start, stop] to the standard output.*
- void [print_quadruplets](#) (uint64_t start, uint64_t stop)
- Print the prime quadruplets within the interval [start, stop] to the standard output.*
- void [print_quintuplets](#) (uint64_t start, uint64_t stop)
- Print the prime quintuplets within the interval [start, stop] to the standard output.*
- void [print_sextuplets](#) (uint64_t start, uint64_t stop)
- Print the prime sextuplets within the interval [start, stop] to the standard output.*
- uint64_t [get_max_stop](#) ()
- Returns the largest valid stop number for primesieve.*
- int [get_sieve_size](#) ()
- Get the current set sieve size in KiB.*
- int [get_num_threads](#) ()
- Get the current set number of threads.*
- void [set_sieve_size](#) (int sieve_size)
- Set the sieve size in KiB (kibibyte).*
- void [set_num_threads](#) (int num_threads)
- Set the number of threads for use in primesieve::count_*() and [primesieve::nth_prime\(\)](#).*
- std::string [primesieve_version](#) ()
- Get the primesieve version number, in the form "i.j".*

6.1.1 Detailed Description

Contains primesieve's C++ functions and classes.

6.1.2 Function Documentation

6.1.2.1 count_primes()

```
uint64_t primesieve::count_primes (
    uint64_t start,
    uint64_t stop )
```

Count the primes within the interval [start, stop].

By default all CPU cores are used, use [primesieve::set_num_threads\(int threads\)](#) to change the number of threads.

Examples:

[count_primes.cpp](#).

6.1.2.2 count_quadruplets()

```
uint64_t primesieve::count_quadruplets (
    uint64_t start,
    uint64_t stop )
```

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

By default all CPU cores are used, use [primesieve::set_num_threads\(int threads\)](#) to change the number of threads.

6.1.2.3 count_quintuplets()

```
uint64_t primesieve::count_quintuplets (
    uint64_t start,
    uint64_t stop )
```

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

By default all CPU cores are used, use [primesieve::set_num_threads\(int threads\)](#) to change the number of threads.

6.1.2.4 count_sextuplets()

```
uint64_t primesieve::count_sextuplets (
    uint64_t start,
    uint64_t stop )
```

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

By default all CPU cores are used, use [primesieve::set_num_threads\(int threads\)](#) to change the number of threads.

6.1.2.5 count_triplets()

```
uint64_t primesieve::count_triplets (
    uint64_t start,
    uint64_t stop )
```

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

By default all CPU cores are used, use [primesieve::set_num_threads\(int threads\)](#) to change the number of threads.

6.1.2.6 count_twins()

```
uint64_t primesieve::count_twins (
    uint64_t start,
    uint64_t stop )
```

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

By default all CPU cores are used, use [primesieve::set_num_threads\(int threads\)](#) to change the number of threads.

6.1.2.7 `get_max_stop()`

```
uint64_t primesieve::get_max_stop ( )
```

Returns the largest valid stop number for primesieve.

Returns

$2^{64}-1$ (UINT64_MAX).

6.1.2.8 `nth_prime()`

```
uint64_t primesieve::nth_prime (
    int64_t n,
    uint64_t start = 0 )
```

Find the nth prime.

By default all CPU cores are used, use [primesieve::set_num_threads\(int threads\)](#) to change the number of threads.

Parameters

<i>n</i>	if <i>n</i> = 0 finds the 1st prime \geq start, if <i>n</i> > 0 finds the nth prime > start, if <i>n</i> < 0 finds the nth prime < start (backwards).
----------	---

Examples:

[nth_prime.cpp](#).

6.1.2.9 `set_num_threads()`

```
void primesieve::set_num_threads (
    int num_threads )
```

Set the number of threads for use in `primesieve::count_*`() and [primesieve::nth_prime\(\)](#).

By default all CPU cores are used.

6.1.2.10 `set_sieve_size()`

```
void primesieve::set_sieve_size (
    int sieve_size )
```

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).

Precondition

`sieve_size` ≥ 8 && ≤ 4096 .

Chapter 7

Class Documentation

7.1 primesieve::iterator Class Reference

[primesieve::iterator](#) allows to easily iterate over primes both forwards and backwards.

```
#include <iterator.hpp>
```

Public Member Functions

- [iterator](#) (uint64_t start=0, uint64_t stop_hint=[get_max_stop](#)())
Create a new iterator object.
- [iterator](#) (const [iterator](#) &)=delete
[primesieve::iterator](#) objects cannot be copied.
- [iterator](#) & **operator=** (const [iterator](#) &)=delete
- [iterator](#) ([iterator](#) &&) noexcept
[primesieve::iterator](#) objects support move semantics.
- [iterator](#) & **operator=** ([iterator](#) &&) noexcept
- void [skipto](#) (uint64_t start, uint64_t stop_hint=[get_max_stop](#)())
Reset the primesieve iterator to start.
- uint64_t [next_prime](#) ()
Get the next prime.
- uint64_t [prev_prime](#) ()
Get the previous prime.

7.1.1 Detailed Description

[primesieve::iterator](#) 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 $\text{PrimePi}(n^{0.5}) * 8$ bytes.

Examples:

[prev_prime.cpp](#), and [primesieve_iterator.cpp](#).

7.1.2 Constructor & Destructor Documentation

7.1.2.1 iterator()

```
primesieve::iterator::iterator (
    uint64_t start = 0,
    uint64_t stop_hint = get_max_stop() )
```

Create a new iterator object.

Parameters

<i>start</i>	Generate primes > start (or < start).
<i>stop_hint</i>	Stop number optimization hint, gives significant speed up if few primes are generated. E.g. if you want to generate the primes below 1000 use stop_hint = 1000.

7.1.3 Member Function Documentation

7.1.3.1 next_prime()

```
uint64_t primesieve::iterator::next_prime ( ) [inline]
```

Get the next prime.

Returns UINT64_MAX if next prime > 2⁶⁴.

Examples:

[primesieve_iterator.cpp](#).

7.1.3.2 prev_prime()

```
uint64_t primesieve::iterator::prev_prime ( ) [inline]
```

Get the previous prime.

prev_prime(n) = 0 if n <= 2.

Examples:

[prev_prime.cpp](#).

7.1.3.3 skipto()

```
void primesieve::iterator::skipto (
    uint64_t start,
    uint64_t stop_hint = get_max_stop() )
```

Reset the primesieve iterator to start.

Parameters

<i>start</i>	Generate primes > start (or < start).
<i>stop_hint</i>	Stop number optimization hint, gives significant speed up if few primes are generated. E.g. if you want to generate the primes below 1000 use stop_hint = 1000.

Examples:

[prev_prime.cpp](#), and [primesieve_iterator.cpp](#).

The documentation for this class was generated from the following file:

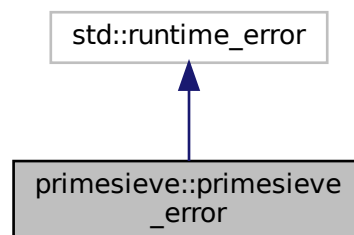
- [iterator.hpp](#)

7.2 primesieve::primesieve_error Class Reference

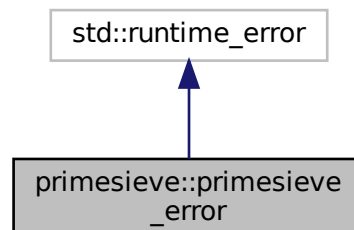
primesieve throws a [primesieve_error](#) exception if an error occurs e.g.

```
#include <primesieve_error.hpp>
```

Inheritance diagram for primesieve::primesieve_error:



Collaboration diagram for primesieve::primesieve_error:



Public Member Functions

- **primesieve_error** (const std::string &msg)

7.2.1 Detailed Description

primesieve throws a [primesieve_error](#) exception if an error occurs e.g.

prime > 2^64.

The documentation for this class was generated from the following file:

- [primesieve_error.hpp](#)

7.3 primesieve_iterator Struct Reference

C prime iterator, please refer to [iterator.h](#) for more information.

```
#include <iterator.h>
```

Public Attributes

- size_t **i**
- size_t **last_idx**
- uint64_t **start**
- uint64_t **stop**
- uint64_t **stop_hint**
- uint64_t **dist**
- uint64_t * **primes**
- void * **vector**
- void * **primeGenerator**
- int **is_error**

7.3.1 Detailed Description

C prime iterator, please refer to [iterator.h](#) for more information.

Examples:

[prev_prime.c](#), and [primesieve_iterator.c](#).

The documentation for this struct was generated from the following file:

- [iterator.h](#)

Chapter 8

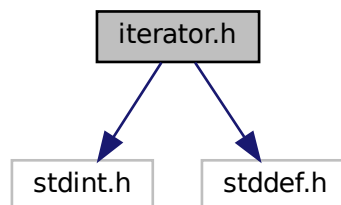
File Documentation

8.1 iterator.h File Reference

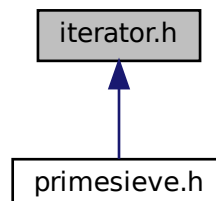
[primesieve_iterator](#) allows to easily iterate over primes both forwards and backwards.

```
#include <stdint.h>
#include <stddef.h>
```

Include dependency graph for iterator.h:



This graph shows which files directly or indirectly include this file:



Classes

- struct [primesieve_iterator](#)
C prime iterator, please refer to [iterator.h](#) for more information.

Functions

- void [primesieve_init](#) ([primesieve_iterator](#) *it)
Initialize the primesieve iterator before first using it.
- void [primesieve_free_iterator](#) ([primesieve_iterator](#) *it)
Free all memory.
- void [primesieve_skipto](#) ([primesieve_iterator](#) *it, uint64_t start, uint64_t stop_hint)
Reset the primesieve iterator to start.
- static uint64_t [primesieve_next_prime](#) ([primesieve_iterator](#) *it)
Get the next prime.
- static uint64_t [primesieve_prev_prime](#) ([primesieve_iterator](#) *it)
Get the previous prime.

8.1.1 Detailed Description

[primesieve_iterator](#) 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 $\text{PrimePi}(n^{0.5}) * 8$ bytes.

The [primesieve_iterator.c](#) example shows how to use [primesieve_iterator](#). If any error occurs [primesieve_next_prime\(\)](#) and [primesieve_prev_prime\(\)](#) return `PRIMESIEVE_ERROR`. Furthermore `primesieve_iterator.is_error` is initialized to 0 and set to 1 if any error occurs.

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8.1.2 Function Documentation

8.1.2.1 [primesieve_next_prime\(\)](#)

```
static uint64_t primesieve_next_prime (
    primesieve\_iterator * it ) [inline], [static]
```

Get the next prime.

Returns `UINT64_MAX` if next prime $> 2^{64}$.

Examples:

[primesieve_iterator.c](#).

8.1.2.2 primesieve_prev_prime()

```
static uint64_t primesieve_prev_prime (
    primesieve_iterator * it ) [inline], [static]
```

Get the previous prime.

primesieve_prev_prime(n) = 0 if n <= 2.

Examples:

[prev_prime.c](#).

8.1.2.3 primesieve_skipto()

```
void primesieve_skipto (
    primesieve_iterator * it,
    uint64_t start,
    uint64_t stop_hint )
```

Reset the primesieve iterator to start.

Parameters

<i>start</i>	Generate primes > start (or < start).
<i>stop_hint</i>	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() .

Examples:

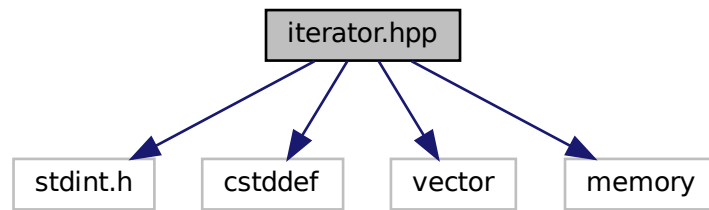
[prev_prime.c](#), and [primesieve_iterator.c](#).

8.2 iterator.hpp File Reference

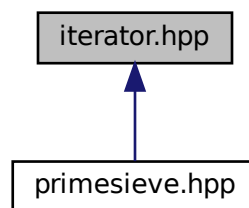
The iterator class allows to easily iterate (forwards and backwards) over prime numbers.

```
#include <stdint.h>
#include <cstdint>
#include <vector>
#include <memory>
```

Include dependency graph for iterator.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class [primesieve::iterator](#)
[primesieve::iterator](#) allows to easily iterate over primes both forwards and backwards.

Namespaces

- [primesieve](#)
Contains primesieve's C++ functions and classes.

Functions

- `uint64_t primesieve::get_max_stop ()`
Returns the largest valid stop number for primesieve.

8.2.1 Detailed Description

The iterator class allows to easily iterate (forwards and backwards) over prime numbers.

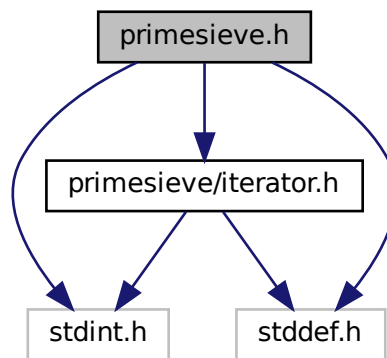
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8.3 primesieve.h File Reference

primesieve C API.

```
#include <primesieve/iterator.h>
#include <stdint.h>
#include <stddef.h>
Include dependency graph for primesieve.h:
```



Macros

- `#define PRIMESIEVE_VERSION "7.4"`
- `#define PRIMESIEVE_VERSION_MAJOR 7`
- `#define PRIMESIEVE_VERSION_MINOR 4`
- `#define PRIMESIEVE_ERROR ((uint64_t) ~((uint64_t) 0))`
primesieve functions return PRIMESIEVE_ERROR (UINT64_MAX) if any error occurs.

Enumerations

- `enum {`
`SHORT_PRIMES, USHORT_PRIMES, INT_PRIMES, UINT_PRIMES,`
`LONG_PRIMES, ULONG_PRIMES, LONGLONG_PRIMES, ULLONGLONG_PRIMES,`
`INT16_PRIMES, UINT16_PRIMES, INT32_PRIMES, UINT32_PRIMES,`
`INT64_PRIMES, UINT64_PRIMES }`

Functions

- void * [primesieve_generate_primes](#) (uint64_t start, uint64_t stop, size_t *size, int type)
Get an array with the primes inside the interval [start, stop].
- void * [primesieve_generate_n_primes](#) (uint64_t n, uint64_t start, int type)
Get an array with the first n primes \geq start.
- uint64_t [primesieve_nth_prime](#) (int64_t n, uint64_t start)
Find the nth prime.
- uint64_t [primesieve_count_primes](#) (uint64_t start, uint64_t stop)
Count the primes within the interval [start, stop].
- uint64_t [primesieve_count_twins](#) (uint64_t start, uint64_t stop)
Count the twin primes within the interval [start, stop].
- uint64_t [primesieve_count_triplets](#) (uint64_t start, uint64_t stop)
Count the prime triplets within the interval [start, stop].
- uint64_t [primesieve_count_quadruplets](#) (uint64_t start, uint64_t stop)
Count the prime quadruplets within the interval [start, stop].
- uint64_t [primesieve_count_quintuplets](#) (uint64_t start, uint64_t stop)
Count the prime quintuplets within the interval [start, stop].
- uint64_t [primesieve_count_sextuplets](#) (uint64_t start, uint64_t stop)
Count the prime sextuplets within the interval [start, stop].
- void [primesieve_print_primes](#) (uint64_t start, uint64_t stop)
Print the primes within the interval [start, stop] to the standard output.
- void [primesieve_print_twins](#) (uint64_t start, uint64_t stop)
Print the twin primes within the interval [start, stop] to the standard output.
- void [primesieve_print_triplets](#) (uint64_t start, uint64_t stop)
Print the prime triplets within the interval [start, stop] to the standard output.
- void [primesieve_print_quadruplets](#) (uint64_t start, uint64_t stop)
Print the prime quadruplets within the interval [start, stop] to the standard output.
- void [primesieve_print_quintuplets](#) (uint64_t start, uint64_t stop)
Print the prime quintuplets within the interval [start, stop] to the standard output.
- void [primesieve_print_sextuplets](#) (uint64_t start, uint64_t stop)
Print the prime sextuplets within the interval [start, stop] to the standard output.
- uint64_t [primesieve_get_max_stop](#) ()
Returns the largest valid stop number for primesieve.
- int [primesieve_get_sieve_size](#) ()
Get the current set sieve size in KiB.
- int [primesieve_get_num_threads](#) ()
Get the current set number of threads.
- void [primesieve_set_sieve_size](#) (int sieve_size)
Set the sieve size in KiB (kibibyte).
- void [primesieve_set_num_threads](#) (int num_threads)
Set the number of threads for use in [primesieve_count_\(\)](#) and [primesieve_nth_prime\(\)](#).*
- void [primesieve_free](#) (void *primes)
Deallocate a primes array created using the [primesieve_generate_primes\(\)](#) or [primesieve_generate_n_primes\(\)](#) functions.
- const char * [primesieve_version](#) ()
Get the primesieve version number, in the form "i.j"

8.3.1 Detailed Description

primesieve C API.

primesieve is a library for fast prime number generation. In case an error occurs `errno` is set to `EDOM` and `PRIMESIEVE_ERROR` is returned.

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8.3.2 Enumeration Type Documentation

8.3.2.1 anonymous enum

anonymous enum

Enumerator

SHORT_PRIMES	Generate primes of short type.
USHORT_PRIMES	Generate primes of unsigned short type.
INT_PRIMES	Generate primes of int type.
UINT_PRIMES	Generate primes of unsigned int type.
LONG_PRIMES	Generate primes of long type.
ULONG_PRIMES	Generate primes of unsigned long type.
LONGLONG_PRIMES	Generate primes of long long type.
ULONGLONG_PRIMES	Generate primes of unsigned long long type.
INT16_PRIMES	Generate primes of int16_t type.
UINT16_PRIMES	Generate primes of uint16_t type.
INT32_PRIMES	Generate primes of int32_t type.
UINT32_PRIMES	Generate primes of uint32_t type.
INT64_PRIMES	Generate primes of int64_t type.
UINT64_PRIMES	Generate primes of uint64_t type.

8.3.3 Function Documentation

8.3.3.1 primesieve_count_primes()

```
uint64_t primesieve_count_primes (
    uint64_t start,
    uint64_t stop )
```

Count the primes within the interval [start, stop].

By default all CPU cores are used, use [primesieve_set_num_threads\(int threads\)](#) to change the number of threads.

Examples:

[count_primes.c](#).

8.3.3.2 primesieve_count_quadruplets()

```
uint64_t primesieve_count_quadruplets (
    uint64_t start,
    uint64_t stop )
```

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

By default all CPU cores are used, use [primesieve_set_num_threads\(int threads\)](#) to change the number of threads.

8.3.3.3 primesieve_count_quintuplets()

```
uint64_t primesieve_count_quintuplets (
    uint64_t start,
    uint64_t stop )
```

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

By default all CPU cores are used, use [primesieve_set_num_threads\(int threads\)](#) to change the number of threads.

8.3.3.4 primesieve_count_sextuplets()

```
uint64_t primesieve_count_sextuplets (
    uint64_t start,
    uint64_t stop )
```

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

By default all CPU cores are used, use [primesieve_set_num_threads\(int threads\)](#) to change the number of threads.

8.3.3.5 primesieve_count_triplets()

```
uint64_t primesieve_count_triplets (
    uint64_t start,
    uint64_t stop )
```

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

By default all CPU cores are used, use [primesieve_set_num_threads\(int threads\)](#) to change the number of threads.

8.3.3.6 primesieve_count_twins()

```
uint64_t primesieve_count_twins (
    uint64_t start,
    uint64_t stop )
```

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

By default all CPU cores are used, use [primesieve_set_num_threads\(int threads\)](#) to change the number of threads.

8.3.3.7 primesieve_generate_n_primes()

```
void* primesieve_generate_n_primes (
    uint64_t n,
    uint64_t start,
    int type )
```

Get an array with the first n primes \geq start.

Parameters

<i>type</i>	The type of the primes to generate, e.g. INT_PRIMES.
-------------	--

Examples:

[store_primes_in_array.c](#).

8.3.3.8 primesieve_generate_primes()

```
void* primesieve_generate_primes (
    uint64_t start,
    uint64_t stop,
    size_t * size,
    int type )
```

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

Parameters

<i>size</i>	The size of the returned primes array.
<i>type</i>	The type of the primes to generate, e.g. INT_PRIMES.

Examples:

[store_primes_in_array.c](#).

8.3.3.9 primesieve_get_max_stop()

```
uint64_t primesieve_get_max_stop ( )
```

Returns the largest valid stop number for primesieve.

Returns

$2^{64}-1$ (UINT64_MAX).

8.3.3.10 primesieve_nth_prime()

```
uint64_t primesieve_nth_prime (
    int64_t n,
    uint64_t start )
```

Find the nth prime.

By default all CPU cores are used, use [primesieve_set_num_threads\(int threads\)](#) to change the number of threads.

Parameters

<i>n</i>	if $n = 0$ finds the 1st prime \geq start, if $n > 0$ finds the nth prime $>$ start, if $n < 0$ finds the nth prime $<$ start (backwards).
----------	--

Examples:

[nth_prime.c](#).

8.3.3.11 primesieve_set_num_threads()

```
void primesieve_set_num_threads (
    int num_threads )
```

Set the number of threads for use in [primesieve_count_*](#)() and [primesieve_nth_prime\(\)](#).

By default all CPU cores are used.

8.3.3.12 primesieve_set_sieve_size()

```
void primesieve_set_sieve_size (
    int sieve_size )
```

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).

Precondition

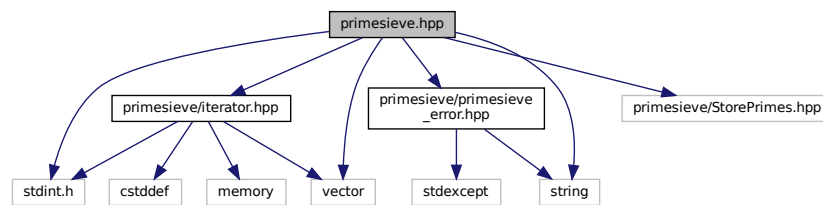
$\text{sieve_size} \geq 8 \ \&\& \leq 4096$.

8.4 primesieve.hpp File Reference

primesieve C++ API.

```
#include <primesieve/iterator.hpp>
#include <primesieve/primesieve_error.hpp>
#include <primesieve/StorePrimes.hpp>
#include <stdint.h>
#include <vector>
#include <string>
```

Include dependency graph for primesieve.hpp:



Namespaces

- [primesieve](#)

Contains primesieve's C++ functions and classes.

Macros

- `#define PRimesieve_VERSION "7.4"`
- `#define PRimesieve_VERSION_MAJOR 7`
- `#define PRimesieve_VERSION_MINOR 4`

Functions

- template<typename T >
void [primesieve::generate_primes](#) (uint64_t stop, std::vector< T > *primes)
Store the primes <= stop in the primes vector.
- template<typename T >
void [primesieve::generate_primes](#) (uint64_t start, uint64_t stop, std::vector< T > *primes)
Store the primes within the interval [start, stop] in the primes vector.
- template<typename T >
void [primesieve::generate_n_primes](#) (uint64_t n, std::vector< T > *primes)
Store the first n primes in the primes vector.
- template<typename T >
void [primesieve::generate_n_primes](#) (uint64_t n, uint64_t start, std::vector< T > *primes)
Store the first n primes >= start in the primes vector.
- uint64_t [primesieve::nth_prime](#) (int64_t n, uint64_t start=0)
Find the nth prime.
- uint64_t [primesieve::count_primes](#) (uint64_t start, uint64_t stop)

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

 - uint64_t [primesieve::count_twins](#) (uint64_t start, uint64_t stop)

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

 - uint64_t [primesieve::count_triplets](#) (uint64_t start, uint64_t stop)

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

 - uint64_t [primesieve::count_quadruplets](#) (uint64_t start, uint64_t stop)

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

 - uint64_t [primesieve::count_quintuplets](#) (uint64_t start, uint64_t stop)

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

 - uint64_t [primesieve::count_sextuplets](#) (uint64_t start, uint64_t stop)

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

 - void [primesieve::print_primes](#) (uint64_t start, uint64_t stop)

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

 - void [primesieve::print_twins](#) (uint64_t start, uint64_t stop)

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

 - void [primesieve::print_triplets](#) (uint64_t start, uint64_t stop)

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

 - void [primesieve::print_quadruplets](#) (uint64_t start, uint64_t stop)

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

 - void [primesieve::print_quintuplets](#) (uint64_t start, uint64_t stop)

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

 - void [primesieve::print_sextuplets](#) (uint64_t start, uint64_t stop)

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

 - uint64_t [primesieve::get_max_stop](#) ()

Returns the largest valid stop number for primesieve.

 - int [primesieve::get_sieve_size](#) ()

Get the current set sieve size in KiB.

 - int [primesieve::get_num_threads](#) ()

Get the current set number of threads.

 - void [primesieve::set_sieve_size](#) (int sieve_size)

Set the sieve size in KiB (kibibyte).

 - void [primesieve::set_num_threads](#) (int num_threads)

Set the number of threads for use in [primesieve::count_\(\)](#) and [primesieve::nth_prime\(\)](#).*

 - std::string [primesieve::primesieve_version](#) ()

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

8.4.1 Detailed Description

primesieve C++ API.

primesieve is a library for fast prime number generation, in case an error occurs a [primesieve::primesieve_error](#) exception (derived from `std::runtime_error`) is thrown.

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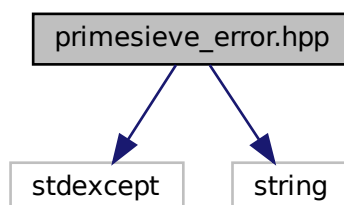
8.5 primesieve_error.hpp File Reference

The primesieve_error class is used for all exceptions within primesieve.

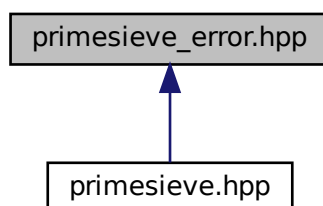
```
#include <stdexcept>
```

```
#include <string>
```

Include dependency graph for primesieve_error.hpp:



This graph shows which files directly or indirectly include this file:



Classes

- class `primesieve::primesieve_error`
primesieve throws a `primesieve_error` exception if an error occurs e.g.

Namespaces

- `primesieve`
Contains primesieve's C++ functions and classes.

8.5.1 Detailed Description

The primesieve_error class is used for all exceptions within primesieve.

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Chapter 9

Example Documentation

9.1 count_primes.c

C program that shows how to count primes.

```
#include <primesieve.h>
#include <inttypes.h>
#include <stdio.h>

int main()
{
    uint64_t count = primesieve_count_primes(0, 1000);
    printf("Primes below 1000 = %" PRIu64 "\n", count);

    return 0;
}
```

9.2 count_primes.cpp

This example shows how to count primes.

```
#include <primesieve.hpp>
#include <stdint.h>
#include <iostream>

int main()
{
    uint64_t count = primesieve::count_primes(0, 1000);
    std::cout << "Primes below 1000 = " << count << std::endl;

    return 0;
}
```

9.3 nth_prime.c

C program that finds the nth prime.

```
#include <primesieve.h>
#include <stdlib.h>
#include <inttypes.h>
#include <stdio.h>

int main(int argc, char** argv)
{
    uint64_t n = 1000;

    if (argc > 1 && argv[1])
        n = atol(argv[1]);

    uint64_t prime = primesieve_nth_prime(n, 0);
    printf("%" PRIu64 "th prime = %" PRIu64 "\n", n, prime);

    return 0;
}
```

9.4 nth_prime.cpp

Find the *nth* prime.

```
#include <primesieve.hpp>
#include <stdint.h>
#include <iostream>
#include <cstdlib>

int main(int, char** argv)
{
    uint64_t n = 1000;

    if (argv[1])
        n = std::atol(argv[1]);

    uint64_t nth_prime = primesieve::nth_prime(n);
    std::cout << n << "th prime = " << nth_prime << std::endl;

    return 0;
}
```

9.5 prev_prime.c

Iterate backwards over primes using [primesieve_iterator](#).

```
#include <primesieve.h>
#include <inttypes.h>
#include <stdio.h>

int main()
{
    primesieve_iterator it;
    primesieve_init(&it);

    /* primesieve_skipto(&it, start_number, stop_hint) */
    primesieve_skipto(&it, 2000, 1000);
    uint64_t prime;

    /* iterate over primes from 2000 to 1000 */
    while ((prime = primesieve_prev_prime(&it)) >= 1000)
        printf("%" PRIu64 "\n", prime);

    primesieve_free_iterator(&it);

    return 0;
}
```


9.6 prev_prime.cpp

Iterate backwards over primes using `primesieve::iterator`.

```
#include <primesieve.hpp>
#include <iostream>

int main()
{
    primesieve::iterator it;
    it.skipto(2000);
    uint64_t prime = it.prev_prime();

    // iterate over primes from 2000 to 1000
    for (; prime >= 1000; prime = it.prev_prime())
        std::cout << prime << std::endl;

    return 0;
}
```

9.7 primesieve_iterator.c

Iterate over primes using C `primesieve_iterator`.

```
#include <primesieve.h>
#include <inttypes.h>
#include <stdio.h>

int main()
{
    primesieve_iterator it;
    primesieve_init(&it);

    uint64_t sum = 0;
    uint64_t prime = 0;

    /* iterate over the primes below 10^9 */
    while ((prime = primesieve_next_prime(&it)) < 1000000000ull)
        sum += prime;

    printf("Sum of the primes below 10^9 = %" PRIu64 "\n", sum);

    /* generate primes > 1000 */
    primesieve_skipto(&it, 1000, 1100);

    while ((prime = primesieve_next_prime(&it)) < 1100)
        printf("%" PRIu64 "\n", prime);

    primesieve_free_iterator(&it);

    return 0;
}
```

9.8 primesieve_iterator.cpp

Iterate over primes using `primesieve::iterator`.

```
#include <primesieve.hpp>
#include <iostream>

int main()
{
    primesieve::iterator it;
    uint64_t prime = it.next_prime();
    uint64_t sum = 0;
```

```
// iterate over the primes below 10^9
for (; prime < 1000000000ull; prime = it.next_prime())
    sum += prime;

std::cout << "Sum of the primes below 10^9 = " << sum << std::endl;

// generate primes > 1000
it.skipto(1000);
prime = it.next_prime();

for (; prime < 1100; prime = it.next_prime())
    std::cout << prime << std::endl;

return 0;
}
```

9.9 store_primes_in_array.c

Store primes in a C array.

```
#include <primesieve.h>
#include <stdio.h>

int main()
{
    uint64_t start = 0;
    uint64_t stop = 1000;
    size_t i;
    size_t size;

    /* store the primes below 1000 */
    int* primes = (int*) primesieve_generate_primes(start, stop, &size,
        INT_PRIMES);

    for (i = 0; i < size; i++)
        printf("%i\n", primes[i]);

    primesieve_free(primes);
    uint64_t n = 1000;

    /* store the first 1000 primes */
    primes = (int*) primesieve_generate_n_primes(n, start,
        INT_PRIMES);

    for (i = 0; i < n; i++)
        printf("%i\n", primes[i]);

    primesieve_free(primes);
    return 0;
}
```

9.10 store_primes_in_vector.cpp

Store primes in a `std::vector` using `primesieve`.

```
#include <primesieve.hpp>
#include <vector>

int main()
{
    std::vector<int> primes;

    // Store primes <= 1000
    primesieve::generate_primes(1000, &primes);

    primes.clear();

    // Store primes inside [1000, 2000]
    primesieve::generate_primes(1000, 2000, &primes);
}
```

```
primes.clear();

// Store first 1000 primes
primesieve::generate_n_primes(1000, &primes);

primes.clear();

// Store first 10 primes >= 1000
primesieve::generate_n_primes(10, 1000, &primes);

return 0;
}
```


Index

- count_primes
 - primesieve, 12
- count_quadruplets
 - primesieve, 12
- count_quintuplets
 - primesieve, 13
- count_sextuplets
 - primesieve, 13
- count_triplets
 - primesieve, 13
- count_twins
 - primesieve, 13
- get_max_stop
 - primesieve, 13
- iterator
 - primesieve::iterator, 16
- iterator.h, 19
 - primesieve_next_prime, 20
 - primesieve_prev_prime, 20
 - primesieve_skipto, 21
- iterator.hpp, 21
- next_prime
 - primesieve::iterator, 16
- nth_prime
 - primesieve, 14
- prev_prime
 - primesieve::iterator, 16
- primesieve, 11
 - count_primes, 12
 - count_quadruplets, 12
 - count_quintuplets, 13
 - count_sextuplets, 13
 - count_triplets, 13
 - count_twins, 13
 - get_max_stop, 13
 - nth_prime, 14
 - set_num_threads, 14
 - set_sieve_size, 14
- primesieve.h, 23
 - primesieve_count_primes, 25
 - primesieve_count_quadruplets, 26
 - primesieve_count_quintuplets, 26
 - primesieve_count_sextuplets, 26
 - primesieve_count_triplets, 26
 - primesieve_count_twins, 26
 - primesieve_generate_n_primes, 27
 - primesieve_generate_primes, 27
 - primesieve_get_max_stop, 27
 - primesieve_nth_prime, 28
 - primesieve_set_num_threads, 28
 - primesieve_set_sieve_size, 28
- primesieve.hpp, 29
- primesieve::iterator, 15
 - iterator, 16
 - next_prime, 16
 - prev_prime, 16
 - skipto, 16
- primesieve::primesieve_error, 17
- primesieve_count_primes
 - primesieve.h, 25
- primesieve_count_quadruplets
 - primesieve.h, 26
- primesieve_count_quintuplets
 - primesieve.h, 26
- primesieve_count_sextuplets
 - primesieve.h, 26
- primesieve_count_triplets
 - primesieve.h, 26
- primesieve_count_twins
 - primesieve.h, 26
- primesieve_error.hpp, 31
- primesieve_generate_n_primes
 - primesieve.h, 27
- primesieve_generate_primes
 - primesieve.h, 27
- primesieve_get_max_stop
 - primesieve.h, 27
- primesieve_iterator, 18
- primesieve_next_prime
 - iterator.h, 20
- primesieve_nth_prime
 - primesieve.h, 28
- primesieve_prev_prime
 - iterator.h, 20
- primesieve_set_num_threads
 - primesieve.h, 28
- primesieve_set_sieve_size
 - primesieve.h, 28
- primesieve_skipto
 - iterator.h, 21
- set_num_threads
 - primesieve, 14
- set_sieve_size
 - primesieve, 14
- skipto

primesieve::iterator, [16](#)