

primesieve

7.6

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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()	15
7 Class Documentation	17
7.1 primesieve::iterator Class Reference	17
7.1.1 Detailed Description	17
7.1.2 Constructor & Destructor Documentation	18
7.1.2.1 iterator()	18
7.1.3 Member Function Documentation	18
7.1.3.1 next_prime()	18
7.1.3.2 prev_prime()	18
7.1.3.3 skipto()	19
7.2 primesieve::primesieve_error Class Reference	20
7.2.1 Detailed Description	21
7.3 primesieve_iterator Struct Reference	21

7.3.1 Detailed Description	21
8 File Documentation	23
8.1 iterator.h File Reference	23
8.1.1 Detailed Description	24
8.1.2 Function Documentation	24
8.1.2.1 primesieve_next_prime()	24
8.1.2.2 primesieve_prev_prime()	25
8.1.2.3 primesieve_skipto()	25
8.2 iterator.hpp File Reference	25
8.2.1 Detailed Description	27
8.3 primesieve.h File Reference	27
8.3.1 Detailed Description	29
8.3.2 Enumeration Type Documentation	29
8.3.2.1 anonymous enum	29
8.3.3 Function Documentation	29
8.3.3.1 primesieve_count_primes()	29
8.3.3.2 primesieve_count_quadruplets()	30
8.3.3.3 primesieve_count_quintuplets()	30
8.3.3.4 primesieve_count_sextuplets()	30
8.3.3.5 primesieve_count_triplets()	31
8.3.3.6 primesieve_count_twins()	31
8.3.3.7 primesieve_generate_n_primes()	31
8.3.3.8 primesieve_generate_primes()	31
8.3.3.9 primesieve_get_max_stop()	32
8.3.3.10 primesieve_nth_prime()	32
8.3.3.11 primesieve_set_num_threads()	33
8.3.3.12 primesieve_set_sieve_size()	33
8.4 primesieve.hpp File Reference	33
8.4.1 Detailed Description	35
8.5 primesieve_error.hpp File Reference	35
8.5.1 Detailed Description	36
9 Example Documentation	37
9.1 count_primes.cpp	37
9.2 primesieve_iterator.cpp	37
9.3 nth_prime.cpp	37
9.4 prev_prime.cpp	38
9.5 store_primes_in_vector.cpp	38
9.6 count_primes.c	38
9.7 prev_prime.c	38
9.8 primesieve_iterator.c	39
9.9 nth_prime.c	39

9.10 store_primes_in_array.c	39
Index	41

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://github.com/kimwalisch/primesieve>.

1.2 C++ API

- [primesieve.hpp](#) - primesieve C++ header.
- [primesieve::iterator](#) - Provides the `next_prime()` and `prev_prime()` methods.
- [C++ examples](#) - Example programs that show how to use libprimesieve.

1.3 C API

- [primesieve.h](#) - primesieve C header.
- [primesieve_iterator](#) - Provides the `primesieve_next_prime()` and `primesieve_prev_prime()` functions.
- [C examples](#) - Example programs that show how to use libprimesieve.

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:

<code>primesieve::iterator</code>	17
<code>primesieve_iterator</code>	21
<code>std::runtime_error</code>	
<code>primesieve::primesieve_error</code>	20

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	17
primesieve::primesieve_error	Primesieve throws a primesieve_error exception if an error occurs e.g	20
primesieve_iterator	C prime iterator, please refer to iterator.h for more information	21

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	23
iterator.hpp	The iterator class allows to easily iterate (forwards and backwards) over prime numbers	25
primesieve.h	Primesieve C API	27
primesieve.hpp	Primesieve C++ API	33
primesieve_error.hpp	The primesieve_error class is used for all exceptions within primesieve	35

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.

Note that each call to `count_primes()` incurs an initialization overhead of $O(\sqrt{\text{stop}})$ even if the interval [start, stop] is tiny. Hence if you have written an algorithm that makes many calls to `count_primes()` it may be preferable to use a `primesieve::iterator` which needs to be initialized only once.

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.

Note that each call to `nth_prime(n, start)` incurs an initialization overhead of $O(\sqrt{\text{start}})$ even if `n` is tiny. Hence it is not a good idea to use [nth_prime\(\)](#) repeatedly in a loop to get the next (or previous) prime. For this use case it is better to use a [primesieve::iterator](#) which needs to be initialized only once.

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.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) returns 0 for n <= 2. Note that [next_prime\(\)](#) runs up to 2x faster than [prev_prime\(\)](#). Hence if the same algorithm can be written using either [prev_prime\(\)](#) or [next_prime\(\)](#) it is preferable to use [next_prime\(\)](#).

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:

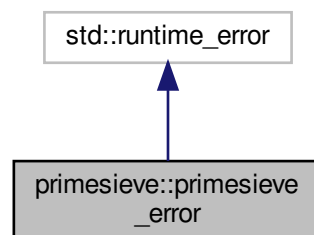
- [iterator.hpp](#)

7.2 primesieve::primesieve_error Class Reference

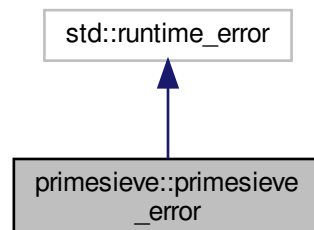
primesieve throws a [primesieve_error](#) exception if an error occurs e.g.

```
#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 > 2⁶⁴.

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

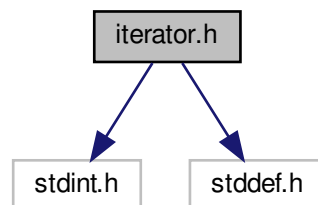
File Documentation

8.1 iterator.h File Reference

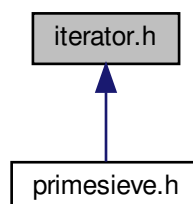
[primesieve_iterator](#) allows to easily iterate over primes both forwards and backwards.

```
#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_skip_to](#) ([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) returns 0 for $n \leq 2$. Note that [primesieve_next_prime\(\)](#) runs up to 2x faster than [primesieve_prev_prime\(\)](#). Hence if the same algorithm can be written using either [primesieve_prev_prime\(\)](#) or [primesieve_next_prime\(\)](#) it is preferable to use [primesieve_next_prime\(\)](#).

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 <code>stop_hint = 1000</code> , if you don't know use primesieve_get_max_stop() .

Examples

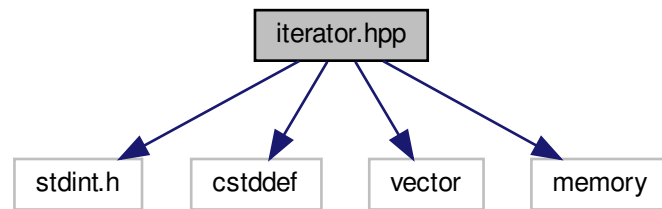
[prev_prime.c](#), and [primesieve_iterator.c](#).

8.2 iterator.hpp File Reference

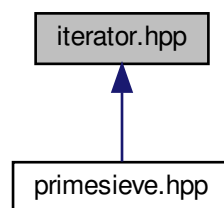
The iterator class allows to easily iterate (forwards and backwards) over prime numbers.

```
#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.

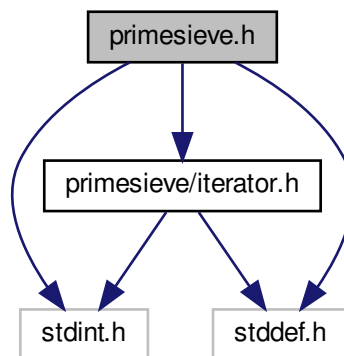
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8.3 primesieve.h File Reference

primesieve C API.

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



Macros

- `#define PRIMESIEVE_VERSION "7.6"`
- `#define PRIMESIEVE_VERSION_MAJOR 7`
- `#define PRIMESIEVE_VERSION_MINOR 6`
- `#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.

Note that each call to [primesieve_count_primes\(\)](#) incurs an initialization overhead of $O(\sqrt{\text{stop}})$ even if the interval [start, stop] is tiny. Hence if you have written an algorithm that makes many calls to [primesieve_count_primes\(\)](#) it may be preferable to use a [primesieve::iterator](#) which needs to be initialized only once.

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.

Note that each call to `primesieve_nth_prime(n, start)` incurs an initialization overhead of $O(\sqrt{\text{start}})$ even if `n` is tiny. Hence it is not a good idea to use [primesieve_nth_prime\(\)](#) repeatedly in a loop to get the next (or previous) prime. For this use case it is better to use a [primesieve::iterator](#) which needs to be initialized only once.

Parameters

<i>n</i>	if <code>n = 0</code> finds the 1st prime \geq start, if <code>n > 0</code> finds the nth prime $>$ start, if <code>n < 0</code> 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

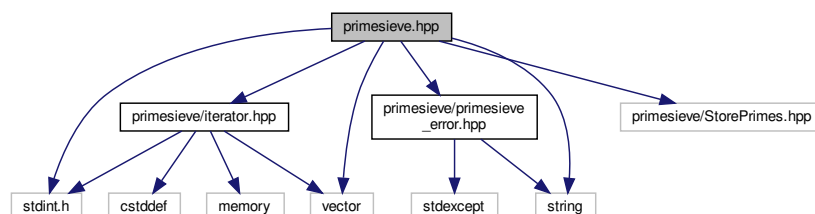
`sieve_size >= 8 && <= 4096.`

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 "7.6"`
- `#define PRIMESIEVE_VERSION_MAJOR 7`
- `#define PRIMESIEVE_VERSION_MINOR 6`

Functions

- `template<typename T >`
`void primesieve::generate_primes (uint64_t stop, std::vector< T > *primes)`
Store the primes \leq 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 \geq 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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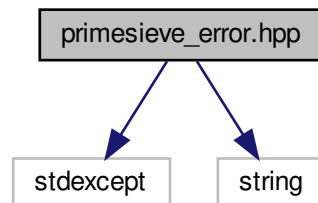
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8.5 primesieve_error.hpp File Reference

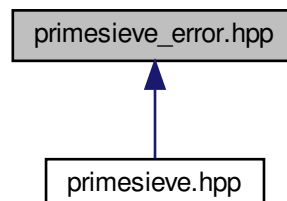
The `primesieve_error` class is used for all exceptions within primesieve.

```
#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.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;
}
```

9.2 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;
}
```

9.3 nth_prime.cpp

Find the *n*th 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;
}
```

9.4 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;
}
```

9.5 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;
}
```

9.6 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;
}
```

9.7 prev_prime.c

Iterate backwards over primes using `primesieve_iterator`. Note that `primesieve_next_prime()` runs up to 2x faster and uses only half as much memory as `primesieve_prev_prime()`. Hence if it is possible to write the same algorithm using either `primesieve_prev_prime()` or `primesieve_next_prime()` then it is preferable to use `primesieve_next_prime()`.

```
#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;
}
```

9.8 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;
}
```

9.9 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;
}
```

9.10 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;
}
```


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](#)
- INT16_PRIMES
 - primesieve.h, [29](#)
- INT32_PRIMES
 - primesieve.h, [29](#)
- INT64_PRIMES
 - primesieve.h, [29](#)
- INT_PRIMES
 - primesieve.h, [29](#)
- iterator
 - primesieve::iterator, [18](#)
- iterator.h, [23](#)
 - primesieve_next_prime, [24](#)
 - primesieve_prev_prime, [24](#)
 - primesieve_skipto, [25](#)
- iterator.hpp, [25](#)
- LONG_PRIMES
 - primesieve.h, [29](#)
- LONGLONG_PRIMES
 - primesieve.h, [29](#)
- next_prime
 - primesieve::iterator, [18](#)
- nth_prime
 - primesieve, [14](#)
- prev_prime
 - primesieve::iterator, [18](#)
- 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, [27](#)
 - INT16_PRIMES, [29](#)
 - INT32_PRIMES, [29](#)
 - INT64_PRIMES, [29](#)
 - INT_PRIMES, [29](#)
 - LONG_PRIMES, [29](#)
 - LONGLONG_PRIMES, [29](#)
 - primesieve_count_primes, [29](#)
 - primesieve_count_quadruplets, [30](#)
 - primesieve_count_quintuplets, [30](#)
 - primesieve_count_sextuplets, [30](#)
 - primesieve_count_triplets, [30](#)
 - primesieve_count_twins, [31](#)
 - primesieve_generate_n_primes, [31](#)
 - primesieve_generate_primes, [31](#)
 - primesieve_get_max_stop, [32](#)
 - primesieve_nth_prime, [32](#)
 - primesieve_set_num_threads, [32](#)
 - primesieve_set_sieve_size, [33](#)
 - SHORT_PRIMES, [29](#)
 - UINT16_PRIMES, [29](#)
 - UINT32_PRIMES, [29](#)
 - UINT64_PRIMES, [29](#)
 - UINT_PRIMES, [29](#)
 - ULONG_PRIMES, [29](#)
 - ULONGLONG_PRIMES, [29](#)
 - USHORT_PRIMES, [29](#)
- primesieve.hpp, [33](#)
- primesieve::iterator, [17](#)
 - iterator, [18](#)
 - next_prime, [18](#)
 - prev_prime, [18](#)
 - skipto, [18](#)
- primesieve::primesieve_error, [20](#)
- primesieve_count_primes
 - primesieve.h, [29](#)
- primesieve_count_quadruplets
 - primesieve.h, [30](#)
- primesieve_count_quintuplets
 - primesieve.h, [30](#)
- primesieve_count_sextuplets
 - primesieve.h, [30](#)
- primesieve_count_triplets
 - primesieve.h, [30](#)
- primesieve_count_twins

- primesieve.h, [31](#)
- primesieve_error.hpp, [35](#)
- primesieve_generate_n_primes
 - primesieve.h, [31](#)
- primesieve_generate_primes
 - primesieve.h, [31](#)
- primesieve_get_max_stop
 - primesieve.h, [32](#)
- primesieve_iterator, [21](#)
- primesieve_next_prime
 - iterator.h, [24](#)
- primesieve_nth_prime
 - primesieve.h, [32](#)
- primesieve_prev_prime
 - iterator.h, [24](#)
- primesieve_set_num_threads
 - primesieve.h, [32](#)
- primesieve_set_sieve_size
 - primesieve.h, [33](#)
- primesieve_skipto
 - iterator.h, [25](#)

- set_num_threads
 - primesieve, [14](#)
- set_sieve_size
 - primesieve, [14](#)
- SHORT_PRIMES
 - primesieve.h, [29](#)
- skipto
 - primesieve::iterator, [18](#)

- UINT16_PRIMES
 - primesieve.h, [29](#)
- UINT32_PRIMES
 - primesieve.h, [29](#)
- UINT64_PRIMES
 - primesieve.h, [29](#)
- UINT_PRIMES
 - primesieve.h, [29](#)
- ULONG_PRIMES
 - primesieve.h, [29](#)
- ULONGLONG_PRIMES
 - primesieve.h, [29](#)
- USHORT_PRIMES
 - primesieve.h, [29](#)