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Институт №8 “Компьютерные науки и прикладная математика”  
Кафедра №806 “Вычислительная математика и программирование”

**Лабораторная работа №2 по курсу**  
**«Операционные системы»**

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# Постановка задачи

## Вариант 2.

Отсортировать массив целых чисел при помощи параллельного алгоритма быстрой сортировки.

Составить программу на языке Си, обрабатывающую данные в многопоточном режиме. При обработке использовать стандартные средства создания потоков операционной системы (Windows/Unix).

Ограничение максимального количества потоков, работающих в один момент времени, должно быть задано ключом запуска вашей программы. Так же необходимо уметь продемонстрировать количество потоков, используемое вашей программой с помощью стандартных средств операционной системы.

## Общий метод и алгоритм решения

Использованные системные вызовы:

1 int pthread\_create(pthread\_t \*thread, const pthread\_attr\_t \*attr, void \*(\*start\_routine) (void \*), void \*arg); – создаёт новый поток;

1 int pthread\_join(pthread\_t thread, void \*\*retval); – ожидает завершения потока.

Программа разбивает заданный массив на N частей (N = количество потоков). Далее создаётся N потоков и для каждого куска массива вызывается быстрая сортировка (условно делим части напополам, меняем местами по индексу “большие” элементы с “маленькими”). По окончании куски массива сливаются в один.

## Код программы

### main.cpp

```
#include "sort.hpp"

#include "threads.hpp"

#include <iostream>

#include <chrono>

using namespace std::chrono;

using namespace std;

int main(int argc, char* argv[]) {

    if (argc != 2) {

        perror("Using: ./lab2_exe number_of_threads");

        exit(-1);

    }

    int n;

    cout << "Enter the quantity of elements: ";

    cin >> n;

    int mas[n];

    cout << "Fill array: ";

    for (int i = 0; i < n; ++i) {

        std::cin >> mas[i];

    }

    int threads(atoi(argv[1]));

    auto start = std::chrono::high_resolution_clock::now();

    sort(mas, n, threads);

    auto end = std::chrono::high_resolution_clock::now();

    duration<double> sec = end - start;
```

```

    cout << "Result: ";

    cout << sec.count() << " s" << std::endl;

    return 0;
}

```

### threads.hpp

```

#pragma once

#include <pthread.h>

class ThreadsCount {
public:
    ThreadsCount();

    ThreadsCount(int count);

    ~ThreadsCount();

    int get_count();

    void set_count(int count);

    ThreadsCount& operator--();

private:
    int _count;

    pthread_mutex_t _mutex;
};

```

### threads.cpp

```

#include "threads.hpp"

ThreadsCount::ThreadsCount() : _count{0} {

    pthread_mutex_init(&_amp;_mutex, NULL);

}

```

```
ThreadsCount::ThreadsCount(int count) : _count{count} {

    pthread_mutex_init(&_mutex, NULL);

}

ThreadsCount::~ThreadsCount() {

    _count = 0;

    pthread_mutex_destroy(&_mutex);

}

int ThreadsCount::get_count() {

    int res;

    pthread_mutex_lock(&_mutex);

    res = _count;

    pthread_mutex_unlock(&_mutex);

    return res;

}

void ThreadsCount::set_count(int count) {

    pthread_mutex_lock(&_mutex);

    _count = count;

    pthread_mutex_unlock(&_mutex);

}

ThreadsCount& ThreadsCount::operator--() {

    pthread_mutex_lock(&_mutex);

    --_count;

    pthread_mutex_unlock(&_mutex);

    return *this;

}
```

## sort.hpp

```
#pragma once

struct Piece{

    int* mas;

    int start;

    int end;

};

void sort(int* array, int n, int threads);
```

## sort.cpp

```
#include "sort.hpp"

#include <pthread.h>

#include <iostream>

#include <algorithm>

void create_thread(pthread_t* thread, const pthread_attr_t* attr, void
>(*start)(void *), void* arg) {

    if (pthread_create(thread, attr, start, arg) != 0) {

        perror("create_thread error!");

        exit(-1);

    }

}

void* thread_sort(void* arg) {

    Piece* p = (Piece*) arg;

    int i = p->start;

    int j = p->end;

    int mid = p->mas[(i + j) / 2];
```

```

int swaps = 0;

do {

    while (p->mas[i] < mid) {

        ++i;

    }

    while (p->mas[j] > mid) {

        --j;

    }

    if (i <= j) {

        std::swap(p->mas[i], p->mas[j]);

        ++swaps;

        ++i;

        --j;

    }

} while (i <= j);

if (p->start < j) {

    Piece less = {p->mas, p->start, j};

    thread_sort(&less);

}

if (i < p->end) {

    Piece more = {p->mas, i, p->end};

    thread_sort(&more);

}

return 0;

}

int* merge(int* a, size_t size_a, int* b, size_t size_b) {

    size_t size_res = size_a + size_b;

```

```

int* res = new int[size_res];

int i = 0, j = 0, k = 0;

while (i < size_a || j < size_b) {

    if (i >= size_a) {

        res[k] = b[j];

        ++j;

    } else if (j >= size_b) {

        res[k] = a[i];

        ++i;

    } else {

        if (a[i] < b[j]) {

            res[k] = a[i];

            ++i;

        } else {

            res[k] = b[j];

            ++j;

        }

    }

    ++k;

}

return res;
}

void sort(int* array, int n, int threads) {

    Piece p[threads];

    pthread_t tid[threads];

    for (int i = 0; i < threads; ++i) {

        int* array_piece = new int[n / threads];

        int counter = 0;

```



```

        for (int j = i * (n / threads); j < (i + 1) * (n / threads); ++j) {

            array_piece[counter] = array[j];

            ++counter;

        }

        p[i] = Piece{array_piece, 0, n / threads - 1};

        create_thread(&tid[i], NULL, thread_sort, &p[i]);

    }

    for (int i = 0; i < threads; ++i) {

        pthread_join(tid[i], NULL);

    }

    for (int i = 0; i < threads; ++i) {

        int counter = 0;

        for (int j = i * (n / threads); j < (i + 1) * (n / threads); ++j) {

            array[j] = p[i].mas[counter];

            ++counter;

        }

    }

    int* res = new int[0];

    size_t res_size = 0;

    for (int i = 0; i < threads; ++i) {

        res = merge(res, res_size, p[i].mas, n / threads);

        res_size += n / threads;

    }

    for (int i = 0; i < n; ++i) {

        array[i] = res[i];

    }

}

```

## Протокол работы программы

### Тестирование:

**./lab02\_exe 1**

Enter the quantity of elements: 8

Fill array: 1 9 2 8 3 7 4 6

Result: 0.000450334 s

**./lab02\_exe 2**

Enter the quantity of elements: 8

Fill array: 1 9 2 8 3 7 4 6

Result: 0.000210875 s

**./lab02\_exe 3**

Enter the quantity of elements: 8

Fill array: 1 9 2 8 3 7 4 6

Result: 0.000771623 s

**./lab02\_exe 4**

Enter the quantity of elements: 8

Fill array: 1 9 2 8 3 7 4 6

Result: 0.000947049 s

**./lab02\_exe 5**

Enter the quantity of elements: 8

Fill array: 1 9 2 8 3 7 4 6

Result: 0.00142257 s

**./lab02\_exe 6**

Enter the quantity of elements: 8

Fill array: 1 9 2 8 3 7 4 6

Result: 0.00165539 s

Количество потоков	Время, с	Ускорение	Эффективность
1	0.000450334	1	1
2	0.000210875	2,135549496	1,067774748
3	0.000771623	0,583619203	0,194539734
4	0.000947049	0,475512883	0,118878221
5	0.00142257	0,316563684	0,063312737
6	0.00165539	0,27204103	0,045340172

При распараллеливании более, чем на 2 потока, превышаете предел количества ядер (в моем компьютере 2 ядра), из-за чего сильно падает эффективность.

## Strace:

```
strace -f ./lab02_exe 1

execve("./lab02_exe", [ "./lab02_exe", "1"], 0x7ffc76a7a0d0 /* 74 vars */) = 0
brk(NULL)                                = 0x564bcd567000
arch_prctl(0x3001 /* ARCH_??? */, 0x7fff371d36f0) = -1 EINVAL (Недопустимый аргумент)
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7fae2d183000
access("/etc/ld.so.preload", R_OK)       = -1 ENOENT (Нет такого файла или каталога)
openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3
newfstatat(3, "", {st_mode=S_IFREG|0644, st_size=68035, ...}, AT_EMPTY_PATH) = 0
mmap(NULL, 68035, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7fae2d172000
close(3)                                 = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libstdc++.so.6", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0\0\0\0\0"..., 832) = 832
newfstatat(3, "", {st_mode=S_IFREG|0644, st_size=2260296, ...}, AT_EMPTY_PATH) = 0
mmap(NULL, 2275520, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7fae2ce00000
mprotect(0x7fae2ce9a000, 1576960, PROT_NONE) = 0
mmap(0x7fae2ce9a000, 1118208, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x9a000) = 0x7fae2ce9a000
mmap(0x7fae2cfab000, 454656, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x1ab000) = 0x7fae2cfab000
mmap(0x7fae2d01b000, 57344, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x21a000) = 0x7fae2d01b000
mmap(0x7fae2d029000, 10432, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS,
-1, 0) = 0x7fae2d029000
close(3)                                 = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0P\237\2\0\0\0\0"..., 832) =
832
pread64(3, "\6\0\0\0\4\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0"..., 784, 64)
= 784
pread64(3, "\4\0\0\0 \0\0\0\5\0\0\0GNU\0\2\0\0\300\4\0\0\0\3\0\0\0\0\0\0"..., 48,
848) = 48
pread64(3,
"\4\0\0\0\24\0\0\0\3\0\0\0GNU\0\244;\374\204(\337f#\315I\214\234\f\256\271\32"..., 68, 896)
= 68
newfstatat(3, "", {st_mode=S_IFREG|0755, st_size=2216304, ...}, AT_EMPTY_PATH) = 0
pread64(3, "\6\0\0\0\4\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0"..., 784, 64)
= 784
mmap(NULL, 2260560, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7fae2ca00000
```

```

mmap(0x7fae2ca28000, 1658880, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x28000) = 0x7fae2ca28000

mmap(0x7fae2cbbd000, 360448, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x1bd000) = 0x7fae2cbbd000

mmap(0x7fae2cc15000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x214000) = 0x7fae2cc15000

mmap(0x7fae2cc1b000, 52816, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS,
-1, 0) = 0x7fae2cc1b000

close(3) = 0

openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libm.so.6", O_RDONLY|O_CLOEXEC) = 3

read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0"..., 832) = 832

newfstatat(3, "", {st_mode=S_IFREG|0644, st_size=940560, ...}, AT_EMPTY_PATH) = 0

mmap(NULL, 942344, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7fae2d08b000

mmap(0x7fae2d099000, 507904, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0xe000) = 0x7fae2d099000

mmap(0x7fae2d115000, 372736, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x8a000) = 0x7fae2d115000

mmap(0x7fae2d170000, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0xe4000) = 0x7fae2d170000

close(3) = 0

openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libgcc_s.so.1", O_RDONLY|O_CLOEXEC) = 3

read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0\0"..., 832) = 832

newfstatat(3, "", {st_mode=S_IFREG|0644, st_size=125488, ...}, AT_EMPTY_PATH) = 0

mmap(NULL, 127720, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7fae2d06b000

mmap(0x7fae2d06e000, 94208, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x3000) = 0x7fae2d06e000

mmap(0x7fae2d085000, 16384, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1a000)
= 0x7fae2d085000

mmap(0x7fae2d089000, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x1d000) = 0x7fae2d089000

close(3) = 0

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7fae2d069000

arch_prctl(ARCH_SET_FS, 0x7fae2d06a3c0) = 0

set_tid_address(0x7fae2d06a690) = 11822

set_robust_list(0x7fae2d06a6a0, 24) = 0

rseq(0x7fae2d06ad60, 0x20, 0, 0x53053053) = 0

mprotect(0x7fae2cc15000, 16384, PROT_READ) = 0

mprotect(0x7fae2d089000, 4096, PROT_READ) = 0

mprotect(0x7fae2d170000, 4096, PROT_READ) = 0

```

```

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7fae2d067000

mprotect(0x7fae2d01b000, 45056, PROT_READ) = 0
mprotect(0x564bcd2e8000, 4096, PROT_READ) = 0
mprotect(0x7fae2d1bd000, 8192, PROT_READ) = 0
prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024, rlim_max=RLIM64_INFINITY}) = 0
munmap(0x7fae2d172000, 68035) = 0
getrandom("\xf2\x63\x25\x07\x0e\x34\x06\xa9", 8, GRND_NONBLOCK) = 8
brk(NULL) = 0x564bcd567000
brk(0x564bcd588000) = 0x564bcd588000
futex(0x7fae2d02977c, FUTEX_WAKE_PRIVATE, 2147483647) = 0
newfstatat(1, "", {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}, AT_EMPTY_PATH)
= 0
write(1, "Enter the quantity of elements: ", 32Enter the quantity of elements: ) = 32
newfstatat(0, "", {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}, AT_EMPTY_PATH)
= 0
read(0, 8
"8\n", 1024) = 2
write(1, "Fill array: ", 12Fill array: ) = 12
read(0, 1 9 2 8 3 7 4 6
"1 9 2 8 3 7 4 6\n", 1024) = 16
rt_sigaction(SIGRT_1, {sa_handler=0x7fae2ca91870, sa_mask=[],
sa_flags=SA_RESTORER|SA_ONSTACK|SA_RESTART|SA_SIGINFO, sa_restorer=0x7fae2ca42520}, NULL, 8)
= 0
rt_sigprocmask(SIG_UNBLOCK, [RTMIN RT_1], NULL, 8) = 0
mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0) =
0x7fae2c1ff000
mprotect(0x7fae2c200000, 8388608, PROT_READ|PROT_WRITE) = 0
rt_sigprocmask(SIG_BLOCK, ~[], [], 8) = 0
clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CL
ONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7fae2c9ff910,
parent_tid=0x7fae2c9ff910, exit_signal=0, stack=0x7fae2c1ff000, stack_size=0x7fff00,
tls=0x7fae2c9ff640} => {parent_tid=[11859]}, 88) = 11859
rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0
futex(0x7fae2c9ff910, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 11859, NULL,
FUTEX_BITSET_MATCH_ANYstrace: Process 11859 attached
<unfinished ...>
[pid 11859] rseq(0x7fae2c9fffe0, 0x20, 0, 0x53053053) = 0
[pid 11859] set_robust_list(0x7fae2c9ff920, 24) = 0
[pid 11859] rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0

```

```

[pid 11859] rt_sigprocmask(SIG_BLOCK, ~[RT_1], NULL, 8) = 0
[pid 11859] madvise(0x7fae2c1ff000, 8368128, MADV_DONTNEED) = 0
[pid 11859] exit(0) = ?
[pid 11822] <... futex resumed>) = 0
[pid 11822] write(1, "Result: 0.00369566 s\n", 21Result: 0.00369566 s
) = 21
[pid 11859] +++ exited with 0 +++
lseek(0, -1, SEEK_CUR) = -1 ESPIPE (Недопустимая операция смещения)
exit_group(0) = ?
+++ exited with 0 +++
strace -f ./lab02_exe 2
execve("./lab02_exe", [ "./lab02_exe", "2"], 0x7fff028d05d0 /* 74 vars */) = 0
brk(NULL) = 0x55e1c039a000
arch_prctl(0x3001 /* ARCH_??? */, 0x7fffe76461d0) = -1 EINVAL (Недопустимый аргумент)
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f76c0ea2000
access("/etc/ld.so.preload", R_OK) = -1 ENOENT (Нет такого файла или каталога)
openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3
newfstatat(3, "", {st_mode=S_IFREG|0644, st_size=68035, ...}, AT_EMPTY_PATH) = 0
mmap(NULL, 68035, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7f76c0e91000
close(3) = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libstdc++.so.6", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0\0\0\0\0\0\0"... , 832) = 832
newfstatat(3, "", {st_mode=S_IFREG|0644, st_size=2260296, ...}, AT_EMPTY_PATH) = 0
mmap(NULL, 2275520, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f76c0c00000
mprotect(0x7f76c0c9a000, 1576960, PROT_NONE) = 0
mmap(0x7f76c0c9a000, 1118208, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x9a000) = 0x7f76c0c9a000
mmap(0x7f76c0dab000, 454656, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1ab000) = 0x7f76c0dab000
mmap(0x7f76c0e1b000, 57344, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x21a000) = 0x7f76c0e1b000
mmap(0x7f76c0e29000, 10432, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7f76c0e29000
close(3) = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0P\237\2\0\0\0\0"... , 832) =

```

```

pread64(3, "\6\0\0\0\4\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0"... , 784, 64)
= 784

pread64(3, "\4\0\0\0 \0\0\0\5\0\0\0GNU\0\2\0\0\300\4\0\0\0\3\0\0\0\0\0\0\0"... , 48,
848) = 48

pread64(3,
"\4\0\0\0\24\0\0\0\3\0\0\0GNU\0\244;\374\204(\337f#\315I\214\234\f\256\271\32"... , 68, 896)
= 68

newfstatat(3, "", {st_mode=S_IFREG|0755, st_size=2216304, ...}, AT_EMPTY_PATH) = 0

pread64(3, "\6\0\0\0\4\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0"... , 784, 64)
= 784

mmap(NULL, 2260560, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f76c0800000

mmap(0x7f76c0828000, 1658880, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x28000) = 0x7f76c0828000

mmap(0x7f76c09bd000, 360448, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x1bd000) = 0x7f76c09bd000

mmap(0x7f76c0a15000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x214000) = 0x7f76c0a15000

mmap(0x7f76c0a1b000, 52816, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS,
-1, 0) = 0x7f76c0a1b000

close(3) = 0

openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libm.so.6", O_RDONLY|O_CLOEXEC) = 3

read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0\0\0\0\0\0\0"... , 832) = 832

newfstatat(3, "", {st_mode=S_IFREG|0644, st_size=940560, ...}, AT_EMPTY_PATH) = 0

mmap(NULL, 942344, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f76c0b19000

mmap(0x7f76c0b27000, 507904, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0xe000) = 0x7f76c0b27000

mmap(0x7f76c0ba3000, 372736, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x8a000) = 0x7f76c0ba3000

mmap(0x7f76c0bfe000, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0xe4000) = 0x7f76c0bfe000

close(3) = 0

openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libgcc_s.so.1", O_RDONLY|O_CLOEXEC) = 3

read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0\0\0\0\0\0\0"... , 832) = 832

newfstatat(3, "", {st_mode=S_IFREG|0644, st_size=125488, ...}, AT_EMPTY_PATH) = 0

mmap(NULL, 127720, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f76c0e71000

mmap(0x7f76c0e74000, 94208, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x3000) = 0x7f76c0e74000

mmap(0x7f76c0e8b000, 16384, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1a000)
= 0x7f76c0e8b000

mmap(0x7f76c0e8f000, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x1d000) = 0x7f76c0e8f000

close(3) = 0

```

```

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f76c0e6f000

arch_prctl(ARCH_SET_FS, 0x7f76c0e703c0) = 0
set_tid_address(0x7f76c0e70690) = 11985
set_robust_list(0x7f76c0e706a0, 24) = 0
rseq(0x7f76c0e70d60, 0x20, 0, 0x53053053) = 0
mprotect(0x7f76c0a15000, 16384, PROT_READ) = 0
mprotect(0x7f76c0e8f000, 4096, PROT_READ) = 0
mprotect(0x7f76c0bfe000, 4096, PROT_READ) = 0
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f76c0e6d000

mprotect(0x7f76c0e1b000, 45056, PROT_READ) = 0
mprotect(0x55e1be759000, 4096, PROT_READ) = 0
mprotect(0x7f76c0edc000, 8192, PROT_READ) = 0
prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024, rlim_max=RLIM64_INFINITY}) = 0
munmap(0x7f76c0e91000, 68035) = 0
getrandom("\x35\x1e\x23\x7e\xb9\xb7\xdb\xa1", 8, GRND_NONBLOCK) = 8
brk(NULL) = 0x55e1c039a000
brk(0x55e1c03bb000) = 0x55e1c03bb000
futex(0x7f76c0e2977c, FUTEX_WAKE_PRIVATE, 2147483647) = 0
newfstatat(1, "", {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}, AT_EMPTY_PATH)
= 0
write(1, "Enter the quantity of elements: ", 32Enter the quantity of elements: ) = 32
newfstatat(0, "", {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}, AT_EMPTY_PATH)
= 0
read(0, 8
"8\n", 1024) = 2
write(1, "Fill array: ", 12Fill array: ) = 12
read(0, 1 9 2 8 3 7 4 6
"1 9 2 8 3 7 4 6\n", 1024) = 16
rt_sigaction(SIGRT_1, {sa_handler=0x7f76c0891870, sa_mask=[],
sa_flags=SA_RESTORER|SA_ONSTACK|SA_RESTART|SA_SIGINFO, sa_restorer=0x7f76c0842520}, NULL, 8)
= 0
rt_sigprocmask(SIG_UNBLOCK, [RTMIN RT_1], NULL, 8) = 0
mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0) =
0x7f76bffff000
mprotect(0x7f76c0000000, 8388608, PROT_READ|PROT_WRITE) = 0
rt_sigprocmask(SIG_BLOCK, ~[], [], 8) = 0

```



```

clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTID|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7f76c07ff910, parent_tid=0x7f76c07ff910, exit_signal=0, stack=0x7f76bffff000, stack_size=0x7fff00, tls=0x7f76c07ff640} => {parent_tid=[12024]}, 88) = 12024

rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0

mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0) = 0x7f76bf7fe000

mprotect(0x7f76bf7ff000, 8388608, PROT_READ|PROT_WRITE) = 0

rt_sigprocmask(SIG_BLOCK, ~[], [], 8) = 0

strace: Process 12024 attached

[pid 11985]
clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTID|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7f76bffffe910, parent_tid=0x7f76bffffe910, exit_signal=0, stack=0x7f76bf7fe000, stack_size=0x7fff00, tls=0x7f76bffffe640} <unfinished ...>

[pid 12024] rseq(0x7f76c07fffe0, 0x20, 0, 0x53053053strace: Process 12025 attached

<unfinished ...>

[pid 11985] <... clone3 resumed> => {parent_tid=[12025]}, 88) = 12025

[pid 12025] rseq(0x7f76bffffefe0, 0x20, 0, 0x53053053 <unfinished ...>

[pid 11985] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>

[pid 12025] <... rseq resumed>) = 0

[pid 11985] <... rt_sigprocmask resumed>NULL, 8) = 0

[pid 12025] set_robust_list(0x7f76bffffe920, 24 <unfinished ...>

[pid 11985] futex(0x7f76c07ff910, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 12024, NULL, FUTEX_BITSET_MATCH_ANY <unfinished ...>

[pid 12025] <... set_robust_list resumed>) = 0

[pid 12025] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>

[pid 12024] <... rseq resumed>) = 0

[pid 12025] <... rt_sigprocmask resumed>NULL, 8) = 0

[pid 12024] set_robust_list(0x7f76c07ff920, 24) = 0

[pid 12025] rt_sigprocmask(SIG_BLOCK, ~[RT_1], NULL, 8) = 0

[pid 12024] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>

[pid 12025] madvise(0x7f76bf7fe000, 8368128, MADV_DONTNEED <unfinished ...>

[pid 12024] <... rt_sigprocmask resumed>NULL, 8) = 0

[pid 12024] rt_sigprocmask(SIG_BLOCK, ~[RT_1], <unfinished ...>

[pid 12025] <... madvise resumed>) = 0

[pid 12025] exit(0 <unfinished ...>

[pid 12024] <... rt_sigprocmask resumed>NULL, 8) = 0

[pid 12025] <... exit resumed>) = ?

[pid 12024] madvise(0x7f76bffff000, 8368128, MADV_DONTNEED <unfinished ...>

```

```

[pid 12025] +++ exited with 0 +++
[pid 12024] <... madvise resumed>      = 0
[pid 12024] exit(0)                    = ?
[pid 11985] <... futex resumed>        = 0
[pid 12024] +++ exited with 0 +++
write(1, "Result: 0.00464304 s\n", 21Result: 0.00464304 s
) = 21
lseek(0, -1, SEEK_CUR)                 = -1 ESPIPE (Недопустимая операция смещения)
exit_group(0)                          = ?
+++ exited with 0 +++
strace -f ./lab02_exe 3
execve("./lab02_exe", [ "./lab02_exe", "3"], 0x7fffe9b53620 /* 74 vars */) = 0
brk(NULL)                              = 0x55c9e2538000
arch_prctl(0x3001 /* ARCH_??? */, 0x7ffef6650380) = -1 EINVAL (Недопустимый аргумент)
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7fdd56a3e000
access("/etc/ld.so.preload", R_OK)      = -1 ENOENT (Нет такого файла или каталога)
openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3
newfstatat(3, "", {st_mode=S_IFREG|0644, st_size=68035, ...}, AT_EMPTY_PATH) = 0
mmap(NULL, 68035, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7fdd56a2d000
close(3)                               = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libstdc++.so.6", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0\0\0\0\0\0"... , 832) = 832
newfstatat(3, "", {st_mode=S_IFREG|0644, st_size=2260296, ...}, AT_EMPTY_PATH) = 0
mmap(NULL, 2275520, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7fdd56800000
mprotect(0x7fdd5689a000, 1576960, PROT_NONE) = 0
mmap(0x7fdd5689a000, 1118208, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x9a000) = 0x7fdd5689a000
mmap(0x7fdd569ab000, 454656, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1ab000) = 0x7fdd569ab000
mmap(0x7fdd56a1b000, 57344, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x21a000) = 0x7fdd56a1b000
mmap(0x7fdd56a29000, 10432, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7fdd56a29000
close(3)                               = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0P\237\2\0\0\0\0"... , 832) =

```

```

pread64(3, "\6\0\0\0\4\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0"... , 784, 64)
= 784

pread64(3, "\4\0\0\0 \0\0\0\5\0\0\0GNU\0\2\0\0\300\4\0\0\0\3\0\0\0\0\0\0\0"... , 48,
848) = 48

pread64(3,
"\4\0\0\0\24\0\0\0\3\0\0\0GNU\0\244;\374\204(\337f#\315I\214\234\f\256\271\32"... , 68, 896)
= 68

newfstatat(3, "", {st_mode=S_IFREG|0755, st_size=2216304, ...}, AT_EMPTY_PATH) = 0

pread64(3, "\6\0\0\0\4\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0"... , 784, 64)
= 784

mmap(NULL, 2260560, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7fdd56400000

mmap(0x7fdd56428000, 1658880, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x28000) = 0x7fdd56428000

mmap(0x7fdd565bd000, 360448, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x1bd000) = 0x7fdd565bd000

mmap(0x7fdd56615000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x214000) = 0x7fdd56615000

mmap(0x7fdd5661b000, 52816, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS,
-1, 0) = 0x7fdd5661b000

close(3) = 0

openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libm.so.6", O_RDONLY|O_CLOEXEC) = 3

read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0\0\0\0\0\0\0"... , 832) = 832

newfstatat(3, "", {st_mode=S_IFREG|0644, st_size=940560, ...}, AT_EMPTY_PATH) = 0

mmap(NULL, 942344, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7fdd56719000

mmap(0x7fdd56727000, 507904, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0xe000) = 0x7fdd56727000

mmap(0x7fdd567a3000, 372736, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x8a000) = 0x7fdd567a3000

mmap(0x7fdd567fe000, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0xe4000) = 0x7fdd567fe000

close(3) = 0

openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libgcc_s.so.1", O_RDONLY|O_CLOEXEC) = 3

read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0\0\0\0\0\0\0"... , 832) = 832

newfstatat(3, "", {st_mode=S_IFREG|0644, st_size=125488, ...}, AT_EMPTY_PATH) = 0

mmap(NULL, 127720, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7fdd566f9000

mmap(0x7fdd566fc000, 94208, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x3000) = 0x7fdd566fc000

mmap(0x7fdd56713000, 16384, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1a000)
= 0x7fdd56713000

mmap(0x7fdd56717000, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x1d000) = 0x7fdd56717000

close(3) = 0

```

```

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7fdd566f7000

arch_prctl(ARCH_SET_FS, 0x7fdd566f83c0) = 0
set_tid_address(0x7fdd566f8690) = 12088
set_robust_list(0x7fdd566f86a0, 24) = 0
rseq(0x7fdd566f8d60, 0x20, 0, 0x53053053) = 0
mprotect(0x7fdd56615000, 16384, PROT_READ) = 0
mprotect(0x7fdd56717000, 4096, PROT_READ) = 0
mprotect(0x7fdd567fe000, 4096, PROT_READ) = 0
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7fdd566f5000

mprotect(0x7fdd56a1b000, 45056, PROT_READ) = 0
mprotect(0x55c9e05a5000, 4096, PROT_READ) = 0
mprotect(0x7fdd56a78000, 8192, PROT_READ) = 0
prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024, rlim_max=RLIM64_INFINITY}) = 0
munmap(0x7fdd56a2d000, 68035) = 0
getrandom("\xd2\x05\x31\xe\x0b\x1a", 8, GRND_NONBLOCK) = 8
brk(NULL) = 0x55c9e2538000
brk(0x55c9e2559000) = 0x55c9e2559000
futex(0x7fdd56a2977c, FUTEX_WAKE_PRIVATE, 2147483647) = 0
newfstatat(1, "", {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}, AT_EMPTY_PATH)
= 0
write(1, "Enter the quantity of elements: ", 32Enter the quantity of elements: ) = 32
newfstatat(0, "", {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}, AT_EMPTY_PATH)
= 0
read(0, 8
"8\n", 1024) = 2
write(1, "Fill array: ", 12Fill array: ) = 12
read(0, 1 9 2 8 3 7 4 6
"1 9 2 8 3 7 4 6\n", 1024) = 16
rt_sigaction(SIGRT_1, {sa_handler=0x7fdd56491870, sa_mask=[],
sa_flags=SA_RESTORER|SA_ONSTACK|SA_RESTART|SA_SIGINFO, sa_restorer=0x7fdd56442520}, NULL, 8)
= 0
rt_sigprocmask(SIG_UNBLOCK, [RTMIN RT_1], NULL, 8) = 0
mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0) =
0x7fdd55bfb000
mprotect(0x7fdd55c00000, 8388608, PROT_READ|PROT_WRITE) = 0
rt_sigprocmask(SIG_BLOCK, ~[], [], 8) = 0

```

```
clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTID|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7fdd563ff910, parent_tid=0x7fdd563ff910, exit_signal=0, stack=0x7fdd55bfff00, stack_size=0x7fff00, tls=0x7fdd563ff640})strace: Process 12145 attached
```

```
=> {parent_tid=[12145]}, 88) = 12145
```

```
[pid 12088] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
```

```
[pid 12145] rseq(0x7fdd563fffe0, 0x20, 0, 0x53053053 <unfinished ...>
```

```
[pid 12088] <... rt_sigprocmask resumed>NULL, 8) = 0
```

```
[pid 12088] mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0 <unfinished ...>
```

```
[pid 12145] <... rseq resumed> = 0
```

```
[pid 12088] <... mmap resumed> = 0x7fdd553fe000
```

```
[pid 12088] mprotect(0x7fdd553ff000, 8388608, PROT_READ|PROT_WRITE <unfinished ...>
```

```
[pid 12145] set_robust_list(0x7fdd563ff920, 24 <unfinished ...>
```

```
[pid 12088] <... mprotect resumed> = 0
```

```
[pid 12088] rt_sigprocmask(SIG_BLOCK, ~[], <unfinished ...>
```

```
[pid 12145] <... set_robust_list resumed> = 0
```

```
[pid 12088] <... rt_sigprocmask resumed>[], 8) = 0
```

```
[pid 12088] clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTID|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7fdd55bfe910, parent_tid=0x7fdd55bfe910, exit_signal=0, stack=0x7fdd553fe000, stack_size=0x7fff00, tls=0x7fdd55bfe640} <unfinished ...>
```

```
[pid 12145] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
```

```
[pid 12088] <... clone3 resumed> => {parent_tid=[12146]}, 88) = 12146
```

```
[pid 12088] rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0
```

```
strace: Process 12146 attached
```

```
[pid 12088] mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0 <unfinished ...>
```

```
[pid 12145] <... rt_sigprocmask resumed>NULL, 8) = 0
```

```
[pid 12088] <... mmap resumed> = 0x7fdd54bfd000
```

```
[pid 12088] mprotect(0x7fdd54bfe000, 8388608, PROT_READ|PROT_WRITE <unfinished ...>
```

```
[pid 12146] rseq(0x7fdd55bfefe0, 0x20, 0, 0x53053053 <unfinished ...>
```

```
[pid 12088] <... mprotect resumed> = 0
```

```
[pid 12145] rt_sigprocmask(SIG_BLOCK, ~[RT_1], <unfinished ...>
```

```
[pid 12088] rt_sigprocmask(SIG_BLOCK, ~[], <unfinished ...>
```

```
[pid 12146] <... rseq resumed> = 0
```

```
[pid 12088] <... rt_sigprocmask resumed>[], 8) = 0
```

```
[pid 12145] <... rt_sigprocmask resumed>NULL, 8) = 0
```

```
[pid 12088]
clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_S
ETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7fdd553fd910,
parent_tid=0x7fdd553fd910, exit_signal=0, stack=0x7fdd54bfd000, stack_size=0x7fff00,
tls=0x7fdd553fd640}strace: Process 12147 attached
```

```
<unfinished ...>
```

```
[pid 12145] madvise(0x7fdd55bff000, 8368128, MADV_DONTNEED <unfinished ...>
```

```
[pid 12088] <... clone3 resumed> => {parent_tid=[12147]}, 88) = 12147
```

```
[pid 12147] rseq(0x7fdd553fdfe0, 0x20, 0, 0x53053053 <unfinished ...>
```

```
[pid 12088] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
```

```
[pid 12147] <... rseq resumed>          = 0
```

```
[pid 12145] <... madvise resumed>      = 0
```

```
[pid 12088] <... rt_sigprocmask resumed>NULL, 8) = 0
```

```
[pid 12147] set_robust_list(0x7fdd553fd920, 24 <unfinished ...>
```

```
[pid 12145] exit(0 <unfinished ...>
```

```
[pid 12088] futex(0x7fdd563ff910, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 12145, NULL,
FUTEX_BITSET_MATCH_ANY <unfinished ...>
```

```
[pid 12147] <... set_robust_list resumed>) = 0
```

```
[pid 12146] set_robust_list(0x7fdd55bfe920, 24 <unfinished ...>
```

```
[pid 12145] <... exit resumed>          = ?
```

```
[pid 12147] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
```

```
[pid 12088] <... futex resumed>          = 0
```

```
[pid 12147] <... rt_sigprocmask resumed>NULL, 8) = 0
```

```
[pid 12145] +++ exited with 0 +++
```

```
[pid 12088] futex(0x7fdd55bfe910, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 12146, NULL,
FUTEX_BITSET_MATCH_ANY <unfinished ...>
```

```
[pid 12147] rt_sigprocmask(SIG_BLOCK, ~[RT_1], NULL, 8) = 0
```

```
[pid 12146] <... set_robust_list resumed>) = 0
```

```
[pid 12146] rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0
```

```
[pid 12147] madvise(0x7fdd54bfd000, 8368128, MADV_DONTNEED <unfinished ...>
```

```
[pid 12146] rt_sigprocmask(SIG_BLOCK, ~[RT_1], NULL, 8) = 0
```

```
[pid 12146] madvise(0x7fdd553fe000, 8368128, MADV_DONTNEED <unfinished ...>
```

```
[pid 12147] <... madvise resumed>          = 0
```

```
[pid 12146] <... madvise resumed>          = 0
```

```
[pid 12147] exit(0 <unfinished ...>
```

```
[pid 12146] exit(0 <unfinished ...>
```

```
[pid 12147] <... exit resumed>          = ?
```

```
[pid 12146] <... exit resumed>          = ?
```

```

[pid 12088] <... futex resumed>)          = 0
[pid 12146] +++ exited with 0 +++
[pid 12147] +++ exited with 0 +++
write(1, "Result: 0.00369793 s\n", 21Result: 0.00369793 s
) = 21
lseek(0, -1, SEEK_CUR)                    = -1 EPIPE (Недопустимая операция смещения)
exit_group(0)                             = ?
+++ exited with 0 +++
trace -f ./lab02_exe 6
execve("./lab02_exe", ["/lab02_exe", "6"], 0x7ffdbf806e70 /* 74 vars */) = 0
brk(NULL)                                 = 0x5564cbdaf000
arch_prctl(0x3001 /* ARCH_??? */, 0x7fff7ec01040) = -1 EINVAL (Недопустимый аргумент)
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f13bd486000
access("/etc/ld.so.preload", R_OK)        = -1 ENOENT (Нет такого файла или каталога)
openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3
newfstatat(3, "", {st_mode=S_IFREG|0644, st_size=68035, ...}, AT_EMPTY_PATH) = 0
mmap(NULL, 68035, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7f13bd475000
close(3)                                  = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libstdc++.so.6", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0\0\0\0\0"..., 832) = 832
newfstatat(3, "", {st_mode=S_IFREG|0644, st_size=2260296, ...}, AT_EMPTY_PATH) = 0
mmap(NULL, 2275520, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f13bd200000
mprotect(0x7f13bd29a000, 1576960, PROT_NONE) = 0
mmap(0x7f13bd29a000, 1118208, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x9a000) = 0x7f13bd29a000
mmap(0x7f13bd3ab000, 454656, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x1ab000) = 0x7f13bd3ab000
mmap(0x7f13bd41b000, 57344, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x21a000) = 0x7f13bd41b000
mmap(0x7f13bd429000, 10432, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS,
-1, 0) = 0x7f13bd429000
close(3)                                  = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0P\237\2\0\0\0\0"..., 832) =
832
pread64(3, "\6\0\0\0\4\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0"..., 784, 64)
= 784

```

```

pread64(3, "\\4\\0\\0\\0 \\0\\0\\0\\5\\0\\0\\0GNU\\0\\2\\0\\0\\300\\4\\0\\0\\0\\3\\0\\0\\0\\0\\0\\0"..., 48,
848) = 48

pread64(3,
"\4\\0\\0\\0\\24\\0\\0\\0\\3\\0\\0\\0GNU\\0\\244;\\374\\204(\\337f#\\315I\\214\\234\\f\\256\\271\\32"..., 68, 896)
= 68

newfstatat(3, "", {st_mode=S_IFREG|0755, st_size=2216304, ...}, AT_EMPTY_PATH) = 0

pread64(3, "\\6\\0\\0\\0\\4\\0\\0\\0@\\0\\0\\0\\0\\0\\0@\\0\\0\\0\\0\\0\\0@\\0\\0\\0\\0\\0\\0"..., 784, 64)
= 784

mmap(NULL, 2260560, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f13bce00000

mmap(0x7f13bce28000, 1658880, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x28000) = 0x7f13bce28000

mmap(0x7f13bcfbd000, 360448, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x1bd000) = 0x7f13bcfbd000

mmap(0x7f13bd015000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x214000) = 0x7f13bd015000

mmap(0x7f13bd01b000, 52816, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS,
-1, 0) = 0x7f13bd01b000

close(3) = 0

openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libm.so.6", O_RDONLY|O_CLOEXEC) = 3

read(3, "\\177ELF\\2\\1\\1\\3\\0\\0\\0\\0\\0\\0\\0\\0\\0\\3\\0>\\0\\1\\0\\0\\0\\0\\0\\0\\0\\0\\0\\0\\0"..., 832) = 832

newfstatat(3, "", {st_mode=S_IFREG|0644, st_size=940560, ...}, AT_EMPTY_PATH) = 0

mmap(NULL, 942344, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f13bd119000

mmap(0x7f13bd127000, 507904, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0xe000) = 0x7f13bd127000

mmap(0x7f13bd1a3000, 372736, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x8a000) = 0x7f13bd1a3000

mmap(0x7f13bd1fe000, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0xe4000) = 0x7f13bd1fe000

close(3) = 0

openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libgcc_s.so.1", O_RDONLY|O_CLOEXEC) = 3

read(3, "\\177ELF\\2\\1\\1\\0\\0\\0\\0\\0\\0\\0\\0\\0\\0\\3\\0>\\0\\1\\0\\0\\0\\0\\0\\0\\0\\0\\0\\0\\0"..., 832) = 832

newfstatat(3, "", {st_mode=S_IFREG|0644, st_size=125488, ...}, AT_EMPTY_PATH) = 0

mmap(NULL, 127720, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f13bd455000

mmap(0x7f13bd458000, 94208, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x3000) = 0x7f13bd458000

mmap(0x7f13bd46f000, 16384, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1a000)
= 0x7f13bd46f000

mmap(0x7f13bd473000, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x1d000) = 0x7f13bd473000

close(3) = 0

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f13bd453000

```



```

arch_prctl(ARCH_SET_FS, 0x7f13bd4543c0) = 0
set_tid_address(0x7f13bd454690) = 12192
set_robust_list(0x7f13bd4546a0, 24) = 0
rseq(0x7f13bd454d60, 0x20, 0, 0x53053053) = 0
mprotect(0x7f13bd015000, 16384, PROT_READ) = 0
mprotect(0x7f13bd473000, 4096, PROT_READ) = 0
mprotect(0x7f13bd1fe000, 4096, PROT_READ) = 0
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f13bd451000
mprotect(0x7f13bd41b000, 45056, PROT_READ) = 0
mprotect(0x5564cbd77000, 4096, PROT_READ) = 0
mprotect(0x7f13bd4c0000, 8192, PROT_READ) = 0
prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024, rlim_max=RLIM64_INFINITY}) = 0
munmap(0x7f13bd475000, 68035) = 0
getrandom("\xd3\x9f\xea\x8d\x49\x2d\x07\xea", 8, GRND_NONBLOCK) = 8
brk(NULL) = 0x5564cbdaf000
brk(0x5564cbdd0000) = 0x5564cbdd0000
futex(0x7f13bd42977c, FUTEX_WAKE_PRIVATE, 2147483647) = 0
newfstatat(1, "", {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}, AT_EMPTY_PATH)
= 0
write(1, "Enter the quantity of elements: ", 32Enter the quantity of elements: ) = 32
newfstatat(0, "", {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}, AT_EMPTY_PATH)
= 0
read(0, 8
"8\n", 1024) = 2
write(1, "Fill array: ", 12Fill array: ) = 12
read(0, 1 9 2 8 3 7 4 6
"1 9 2 8 3 7 4 6\n", 1024) = 16
rt_sigaction(SIGRT_1, {sa_handler=0x7f13bce91870, sa_mask=[],
sa_flags=SA_RESTORER|SA_ONSTACK|SA_RESTART|SA_SIGINFO, sa_restorer=0x7f13bce42520}, NULL, 8)
= 0
rt_sigprocmask(SIG_UNBLOCK, [RTMIN RT_1], NULL, 8) = 0
mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0) =
0x7f13bc5ff000
mprotect(0x7f13bc600000, 8388608, PROT_READ|PROT_WRITE) = 0
rt_sigprocmask(SIG_BLOCK, ~[], [], 8) = 0
clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CL
ONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7f13bcdff910,
parent_tid=0x7f13bcdff910, exit_signal=0, stack=0x7f13bc5ff000, stack_size=0x7fff00,
tls=0x7f13bcdff640} => {parent_tid=[12254]}, 88) = 12254

```

```

rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0

mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0) =
0x7f13bbdf000

mprotect(0x7f13bbdff000, 8388608, PROT_READ|PROT_WRITE) = 0

strace: Process 12254 attached

[pid 12192] rt_sigprocmask(SIG_BLOCK, ~[], [], 8) = 0

[pid 12254] rseq(0x7f13bcdfffe0, 0x20, 0, 0x53053053 <unfinished ...>

[pid 12192]
clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_S
ETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7f13bc5fe910,
parent_tid=0x7f13bc5fe910, exit_signal=0, stack=0x7f13bbdf000, stack_size=0x7fff00,
tls=0x7f13bc5fe640} <unfinished ...>

[pid 12254] <... rseq resumed>          = 0

[pid 12254] set_robust_list(0x7f13bcdff920, 24) = 0

strace: Process 12255 attached

[pid 12192] <... clone3 resumed> => {parent_tid=[12255]}, 88) = 12255

[pid 12254] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>

[pid 12192] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>

[pid 12255] rseq(0x7f13bc5fefe0, 0x20, 0, 0x53053053 <unfinished ...>

[pid 12192] <... rt_sigprocmask resumed>NULL, 8) = 0

[pid 12254] <... rt_sigprocmask resumed>NULL, 8) = 0

[pid 12192] mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0)
= 0x7f13bb5fd000

[pid 12255] <... rseq resumed>          = 0

[pid 12254] rt_sigprocmask(SIG_BLOCK, ~[RT_1], <unfinished ...>

[pid 12192] mprotect(0x7f13bb5fe000, 8388608, PROT_READ|PROT_WRITE <unfinished ...>

[pid 12255] set_robust_list(0x7f13bc5fe920, 24 <unfinished ...>

[pid 12254] <... rt_sigprocmask resumed>NULL, 8) = 0

[pid 12192] <... mprotect resumed>      = 0

[pid 12255] <... set_robust_list resumed> = 0

[pid 12254] madvise(0x7f13bc5ff000, 8368128, MADV_DONTNEED <unfinished ...>

[pid 12192] rt_sigprocmask(SIG_BLOCK, ~[], <unfinished ...>

[pid 12255] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>

[pid 12192] <... rt_sigprocmask resumed>[], 8) = 0

[pid 12254] <... madvise resumed>       = 0

[pid 12192]
clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_S
ETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7f13bbdfd910,
parent_tid=0x7f13bbdfd910, exit_signal=0, stack=0x7f13bb5fd000, stack_size=0x7fff00,
tls=0x7f13bbdfd640} <unfinished ...>

```

```

[pid 12255] <... rt_sigprocmask resumed>NULL, 8) = 0
strace: Process 12256 attached
[pid 12255] rt_sigprocmask(SIG_BLOCK, ~[RT_1], <unfinished ...>
[pid 12254] exit(0 <unfinished ...>
[pid 12192] <... clone3 resumed> => {parent_tid=[12256]}, 88) = 12256
[pid 12256] rseq(0x7f13bbdfdf0, 0x20, 0, 0x53053053 <unfinished ...>
[pid 12255] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 12254] <... exit resumed>          = ?
[pid 12192] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
[pid 12256] <... rseq resumed>          = 0
[pid 12255] madvise(0x7f13bbdf000, 8368128, MADV_DONTNEED <unfinished ...>
[pid 12192] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 12256] set_robust_list(0x7f13bbdfd920, 24 <unfinished ...>
[pid 12254] +++ exited with 0 +++
[pid 12255] <... madvise resumed>        = 0
[pid 12192] mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0
<unfinished ...>
[pid 12256] <... set_robust_list resumed>) = 0
[pid 12192] <... mmap resumed>          = 0x7f13badfc000
[pid 12255] exit(0 <unfinished ...>
[pid 12192] mprotect(0x7f13badfd000, 8388608, PROT_READ|PROT_WRITE <unfinished ...>
[pid 12256] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
[pid 12192] <... mprotect resumed>      = 0
[pid 12255] <... exit resumed>          = ?
[pid 12256] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 12192] rt_sigprocmask(SIG_BLOCK, ~[], <unfinished ...>
[pid 12255] +++ exited with 0 +++
[pid 12256] rt_sigprocmask(SIG_BLOCK, ~[RT_1], <unfinished ...>
[pid 12192] <... rt_sigprocmask resumed>[], 8) = 0
[pid 12256] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 12192]
clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_S
ETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7f13bb5fc910,
parent_tid=0x7f13bb5fc910, exit_signal=0, stack=0x7f13badfc000, stack_size=0x7fff00,
tls=0x7f13bb5fc640} <unfinished ...>
[pid 12256] madvise(0x7f13bb5fd000, 8368128, MADV_DONTNEEDstrace: Process 12257
attached
<unfinished ...>

```

```

[pid 12192] <... clone3 resumed> => {parent_tid=[12257]}, 88) = 12257
[pid 12256] <... madvise resumed>)      = 0
[pid 12192] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
[pid 12257] rseq(0x7f13bb5fcfe0, 0x20, 0, 0x53053053 <unfinished ...>
[pid 12192] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 12257] <... rseq resumed>)          = 0
[pid 12192] mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0
<unfinished ...>
[pid 12257] set_robust_list(0x7f13bb5fc920, 24 <unfinished ...>
[pid 12192] <... mmap resumed>)          = 0x7f13ba5fb000
[pid 12257] <... set_robust_list resumed>) = 0
[pid 12192] mprotect(0x7f13ba5fc000, 8388608, PROT_READ|PROT_WRITE <unfinished ...>
[pid 12257] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
[pid 12192] <... mprotect resumed>)      = 0
[pid 12256] exit(0 <unfinished ...>
[pid 12257] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 12192] rt_sigprocmask(SIG_BLOCK, ~[], <unfinished ...>
[pid 12256] <... exit resumed>)          = ?
[pid 12192] <... rt_sigprocmask resumed>[], 8) = 0
[pid 12257] rt_sigprocmask(SIG_BLOCK, ~[RT_1], <unfinished ...>
[pid 12192]
clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_S
ETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7f13badfb910,
parent_tid=0x7f13badfb910, exit_signal=0, stack=0x7f13ba5fb000, stack_size=0x7fff00,
tls=0x7f13badfb640} <unfinished ...>
[pid 12256] +++ exited with 0 +++
[pid 12257] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 12257] madvise(0x7f13badfc000, 8368128, MADV_DONTNEEDstrace: Process 12258
attached
<unfinished ...>
[pid 12192] <... clone3 resumed> => {parent_tid=[12258]}, 88) = 12258
[pid 12257] <... madvise resumed>)      = 0
[pid 12192] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
[pid 12258] rseq(0x7f13badfbfe0, 0x20, 0, 0x53053053 <unfinished ...>
[pid 12257] exit(0 <unfinished ...>
[pid 12192] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 12258] <... rseq resumed>)          = 0
[pid 12192] mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0
<unfinished ...>

```

```

[pid 12257] <... exit resumed>          = ?
[pid 12192] <... mmap resumed>          = 0x7f13b9dfa000
[pid 12258] set_robust_list(0x7f13badfb920, 24 <unfinished ...>
[pid 12257] +++ exited with 0 +++
[pid 12192] mprotect(0x7f13b9dfb000, 8388608, PROT_READ|PROT_WRITE <unfinished ...>
[pid 12258] <... set_robust_list resumed>) = 0
[pid 12192] <... mprotect resumed>      = 0
[pid 12258] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
[pid 12192] rt_sigprocmask(SIG_BLOCK, ~[], <unfinished ...>
[pid 12258] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 12192] <... rt_sigprocmask resumed>[], 8) = 0
[pid 12258] rt_sigprocmask(SIG_BLOCK, ~[RT_1], <unfinished ...>
[pid 12192]
clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_S
ETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7f13ba5fa910,
parent_tid=0x7f13ba5fa910, exit_signal=0, stack=0x7f13b9dfa000, stack_size=0x7fff00,
tls=0x7f13ba5fa640} <unfinished ...>

[pid 12258] <... rt_sigprocmask resumed>NULL, 8) = 0
strace: Process 12259 attached
[pid 12258] madvise(0x7f13ba5fb000, 8368128, MADV_DONTNEED <unfinished ...>
[pid 12192] <... clone3 resumed> => {parent_tid=[12259]}, 88) = 12259
[pid 12259] rseq(0x7f13ba5fafe0, 0x20, 0, 0x53053053 <unfinished ...>
[pid 12192] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
[pid 12258] <... madvise resumed>      = 0
[pid 12192] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 12259] <... rseq resumed>          = 0
[pid 12192] futex(0x7f13badfb910, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 12258, NULL,
FUTEX_BITSET_MATCH_ANY <unfinished ...>
[pid 12258] exit(0 <unfinished ...>
[pid 12259] set_robust_list(0x7f13ba5fa920, 24 <unfinished ...>
[pid 12258] <... exit resumed>          = ?
[pid 12259] <... set_robust_list resumed>) = 0
[pid 12192] <... futex resumed>          = 0
[pid 12258] +++ exited with 0 +++
[pid 12259] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
[pid 12192] munmap(0x7f13bc5ff000, 8392704 <unfinished ...>
[pid 12259] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 12192] <... munmap resumed>        = 0

```

```
[pid 12259] rt_sigprocmask(SIG_BLOCK, ~[RT_1], <unfinished ...>  
[pid 12192] futex(0x7f13ba5fa910, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 12259, NULL,  
FUTEX_BITSET_MATCH_ANY <unfinished ...>  
[pid 12259] <... rt_sigprocmask resumed>NULL, 8) = 0  
[pid 12259] madvise(0x7f13b9dfa000, 8368128, MADV_DONTNEED) = 0  
[pid 12259] exit(0) = ?  
[pid 12192] <... futex resumed>) = 0  
[pid 12259] +++ exited with 0 +++  
munmap(0x7f13bbdfe000, 8392704) = 0  
write(1, "Result: 0.00343606 s\n", 21Result: 0.00343606 s  
) = 21  
lseek(0, -1, SEEK_CUR) = -1 ESPIPE (Недопустимая операция смещения)  
exit_group(0) = ?  
+++ exited with 0 +++
```

## Вывод

В ходе лабораторной работы я научилась создавать потоки в пределах одного процесса. Для реализации конкретного задания была использована условно видимая функция `sort`, которая на самом деле не содержала сортировок, только соединяла уже отсортированные по потокам части массива, что облегчило внешнюю работу с данной функцией, хотя в качестве аргументов ей передавались только количество потоков и массив данных. Более того, в ходе работы я столкнулась с `Race Condition`, когда потоки могли перехватывать данные, и, как результат, вылезала ошибка. Для решения этой проблемы я использовала `mutex`.