Московский Авиационный Институт

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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 8.

Цель работы

Приобретение практических навыков в:

● Управление потоками в ОС

● Обеспечение синхронизации между потоками

Составить программу на языке Си, обрабатывающую данные в многопоточном режиме. При обработки 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.

Есть К массивов одинаковой длины. Необходимо сложить эти массивы. Необходимо предусмотреть стратегию, адаптирующуюся под количество массивов и их длину (по количеству операций)

Общий метод и алгоритм решения

Использованные системные вызовы:

ssize_t write(int fd, const void *buf, size_t count); - записывает count байт из буфера в файл.

● int pthread_create(pthread_t *thread, const pthread_attr_t *attr,

● void *(*start)(void *), void *arg)– создание потока

● int pthread_join (pthread_t THREAD_ID, void ** DATA) – ожидание завершения потока

● int pthread_mutex_init(pthread_mutex_t *mutex, const pthread_mutexattr_t *attr) – инициализация мьютекса

● int pthread_mutex_lock(pthread_mutex_t *mutex) – блокировка мьютекса

● int pthread_mutex_unlock(pthread_mutex_t *mutex) – разблокировка мьютекса

● int pthread_mutex_destroy(pthread_mutex_t *mutex) – удаление мьютекса

Эта программа на языке C многопоточно суммирует строки или столбцы двумерных массивов, разделяя задачу между потоками. Вот пошаговое описание ее работы:

Ввод данных пользователем

Параметры программы: Пользователь передает три параметра командной строки

<num_arrays>: количество массивов (строк в двумерном массиве).

<array_length>: длина каждого массива (количество элементов в строке).

<max_threads>: максимальное количество потоков для выполнения задачи.

Основные шаги программы

1. Проверка входных параметров

Программа проверяет, чтобы все три параметра были положительными числами.

Если параметры некорректны, выводится ошибка, и программа завершает выполнение.

2. Инициализация массивов

Выделяется память для двумерного массива (arrays) размером <num_arrays> на <array_length>.

Каждый элемент массива заполняется случайным числом от 0 до 9.

Программа выводит сгенерированные массивы на экран.

3. Определение стратегии работы

Стратегия зависит от соотношения числа строк и длины строки:

Если строк больше, чем длина строки (в 2 и более раз), используется обработка строк (row_split).

В противном случае — обработка столбцов (column_split).

Программа выводит выбранную стратегию:

4. Создание потоков

Задача разбивается между потоками (max_threads).

Каждый поток получает диапазон строк или столбцов для обработки:

При обработке строк: каждый поток обрабатывает определенные строки.

При обработке столбцов: каждый поток обрабатывает определенные столбцы.

Потоки работают параллельно, записывая промежуточные результаты в массив result.

5. Обработка массивов (в потоках)

Каждый поток суммирует элементы своих строк или столбцов, обновляя массив result

Для синхронизации доступа к result используется мьютекс (pthread_mutex), предотвращающий одновременную запись несколькими потоками.

6. Ожидание завершения потоков

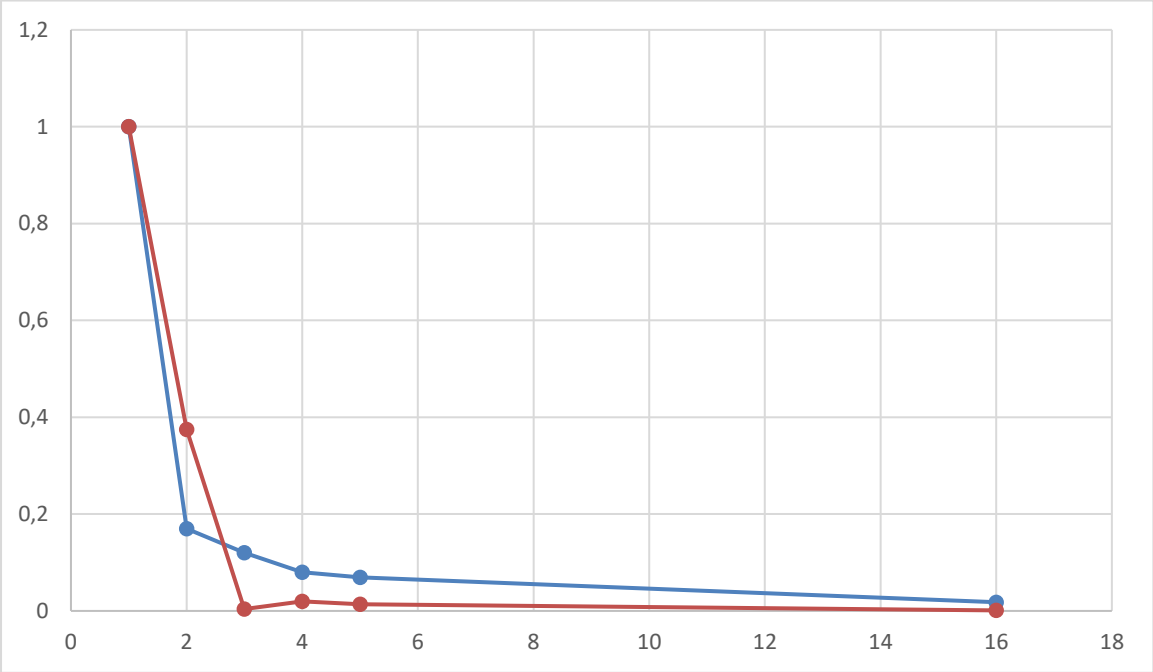
Программа ждет завершения всех потоков с помощью pthread_join.

7. Вывод результата

После завершения всех потоков выводится массив result, содержащий сумму элементов строк или столбцов.

Количество потоков	Время, мс	Ускорение	Эффективность
1	202	1	1
2	1178	0.17	0.375
3	1709	0.12	0.04
4	2345	0.08	0.02
5	2926	0.069	0.0138
16	10779	0.018	0.0011

Данные подсчитаны при 10000 массивах длины 1000



Код программы

main.c

```
#include <stdio.h>

#include <stdlib.h>

#include <pthread.h>

#include <stdbool.h>

#include <time.h>


typedef struct {

    int **arrays;

    int *result;

    int num_arrays;

    int array_length;

    int start;
```

```
    int end;
    bool row_split;
    pthread_mutex_t *mutex;
} thread_args_t;



void *process_arrays(void *arg) {
    thread_args_t *args = (thread_args_t *)arg;

    if (args->row_split) {

        for (int i = args->start; i < args->end; ++i) {
            for (int j = 0; j < args->array_length; ++j) {
                pthread_mutex_lock(args->mutex);
                args->result[j] += args->arrays[i][j];
                pthread_mutex_unlock(args->mutex);
            }
        }
    } else {

        for (int i = args->start; i < args->end; ++i) {
            for (int j = 0; j < args->num_arrays; ++j) {
                pthread_mutex_lock(args->mutex);
                args->result[i] += args->arrays[j][i];
                pthread_mutex_unlock(args->mutex);
            }
        }
    }

    return NULL;
}

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

```
    if (argc != 4) {
        fprintf(stderr, "Usage: %s <num_arrays> <array_length> <max_threads>\n",
argv[0]);
        return EXIT_FAILURE;
    }

    int num_arrays = atoi(argv[1]);
    int array_length = atoi(argv[2]);
    int max_threads = atoi(argv[3]);

    if (num_arrays <= 0 || array_length <= 0 || max_threads <= 0) {
        fprintf(stderr, "Invalid parameters. All values must be positive.\n");
        return EXIT_FAILURE;
    }

    int **arrays = (int **)malloc(num_arrays * sizeof(int *));
    for (int i = 0; i < num_arrays; i++) {
        arrays[i] = (int *)malloc(array_length * sizeof(int));
        for (int j = 0; j < array_length; j++) {
            arrays[i][j] = rand() % 10;
        }
    }
    int *result = (int *)calloc(array_length, sizeof(int));


    printf("Generated arrays:\n");
    for (int i = 0; i < num_arrays; i++) {
        for (int j = 0; j < array_length; j++) {
            printf("%d ", arrays[i][j]);
        }
        printf("\n");
    }
```

```
    pthread_mutex_t mutex;
    pthread_mutex_init(&mutex, NULL);



    bool row_split = (num_arrays / (double)array_length) > 2.0;
    printf("Using %s strategy\n", row_split ? "row_split" : "column_split");


    pthread_t *threads = (pthread_t *)malloc(max_threads * sizeof(pthread_t));
    thread_args_t *thread_args = (thread_args_t *)malloc(max_threads *
sizeof(thread_args_t));


    int work_size = row_split ? num_arrays : array_length;
    for (int i = 0; i < max_threads; i++) {
        thread_args[i].arrays = arrays;
        thread_args[i].result = result;
        thread_args[i].num_arrays = num_arrays;
        thread_args[i].array_length = array_length;
        thread_args[i].start = i * work_size / max_threads;
        thread_args[i].end = (i + 1) * work_size / max_threads;
        thread_args[i].row_split = row_split;
        thread_args[i].mutex = &mutex;


        if (pthread_create(&threads[i], NULL, process_arrays, &thread_args[i]) != 0) {
            perror("pthread_create");
            return EXIT_FAILURE;
        }
    }



    for (int i = 0; i < max_threads; i++) {
        pthread_join(threads[i], NULL);
    }
```

```
    printf("Result array: \n");
    for (int i = 0; i < array_length; i++) {
        printf("%d ", result[i]);
    }
    printf("\n");


    for (int i = 0; i < num_arrays; i++) {
        free(arrays[i]);
    }
    free(arrays);
    free(result);
    free(threads);
    free(thread_args);

    pthread_mutex_destroy(&mutex);

    return EXIT_SUCCESS;
}
```

Протокол работы программы

Тест 1:

Тестирование:

gcc main.c -lm -fsanitize=thread

lausniko@DESKTOP-MATHSNO:~/os/lab2$ ./a.out 10 1 1

Generated arrays:

3

6

7

5

3

5

6

2

9

1

Using row_split strategy

Result array:

47

Strace:

```
strace ./a.out 10 2  1

execve("./a.out", ["./a.out", "10", "2", "1"], 0x7ffd83aad478 /* 36 vars */) = 0

brk(NULL)                               = 0x55efd6469000

arch_prctl(0x3001 /* ARCH_??? */, 0x7ffe9322dac0) = -1 EINVAL (Invalid argument)

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3249bee000

access("/etc/ld.so.preload", R_OK)      = -1 ENOENT (No such file or directory)

openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3

newfstatat(3, "", {st_mode=S_IFREG|0644, st_size=37327, ...}, AT_EMPTY_PATH) = 0

mmap(NULL, 37327, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7f3249be4000

close(3)                                = 0

openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libtsan.so.0", 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"..., 832) =
832

newfstatat(3, "", {st_mode=S_IFREG|0644, st_size=7344248, ...}, AT_EMPTY_PATH) = 0

mmap(NULL, 11802184, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f32490a2000

mprotect(0x7f32490c9000, 954368, PROT_NONE) = 0

mmap(0x7f32490c9000, 737280, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x27000) = 0x7f32490c9000

mmap(0x7f324917d000, 212992, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0xdb000) = 0x7f324917d000

mmap(0x7f32491b2000, 45056, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x10f000) = 0x7f32491b2000
```

```
     mmap(0x7f32491bd000, 10643016, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7f32491bd000

     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"..., 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) = 0x7f3248fbb000

     mmap(0x7f3248fc9000, 507904, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0xe000) = 0x7f3248fc9000

     mmap(0x7f3249045000, 372736, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x8a000) = 0x7f3249045000

     mmap(0x7f32490a0000, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0xe4000) = 0x7f32490a0000

     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\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\0"..., 48,
848) = 48

     pread64(3,
"\4\0\0\0\24\0\0\0\3\0\0\0GNU\0I\17\357\204\3$\f\221\2039x\324\224\323\236S"..., 68, 896) =
68

     newfstatat(3, "", {st_mode=S_IFREG|0755, st_size=2220400, ...}, 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, 2264656, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f3248d92000

     mprotect(0x7f3248dba000, 2023424, PROT_NONE) = 0

     mmap(0x7f3248dba000, 1658880, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x28000) = 0x7f3248dba000

     mmap(0x7f3248f4f000, 360448, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x1bd000) = 0x7f3248f4f000

     mmap(0x7f3248fa8000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x215000) = 0x7f3248fa8000

     mmap(0x7f3248fae000, 52816, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS,
-1, 0) = 0x7f3248fae000

     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"..., 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) = 0x7f3248d72000

     mmap(0x7f3248d75000, 94208, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x3000) = 0x7f3248d75000

     mmap(0x7f3248d8c000, 16384, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x1a000) = 0x7f3248d8c000

     mmap(0x7f3248d90000, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x1d000) = 0x7f3248d90000

     close(3)                                = 0

     mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3248d70000

     mmap(NULL, 270336, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3248d2e000

     arch_prctl(ARCH_SET_FS, 0x7f3248d6e340) = 0

     set_tid_address(0x7f3248d6e610)         = 321142

     set_robust_list(0x7f3248d6e620, 24)     = 0

     rseq(0x7f3248d6ece0, 0x20, 0, 0x53053053) = 0

     mprotect(0x7f3248fa8000, 16384, PROT_READ) = 0

     mprotect(0x7f3248d90000, 4096, PROT_READ) = 0

     mprotect(0x7f32490a0000, 4096, PROT_READ) = 0

     mprotect(0x7f32491b2000, 16384, PROT_READ) = 0

     mprotect(0x55efc6cb5000, 4096, PROT_READ) = 0

     mprotect(0x7f3249c28000, 8192, PROT_READ) = 0

     prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024, rlim_max=RLIM64_INFINITY}) = 0

     munmap(0x7f3249be4000, 37327)           = 0

     mmap(NULL, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3248d1e000

     mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3249c27000

     mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3249bed000

     open("/proc/self/environ", O_RDONLY)    = 3

     read(3, "SHELL=/bin/bash\0COLORTERM=trueco"..., 4096) = 3338

     read(3, "", 758)                        = 0

     close(3)                                = 0

     readlink("/proc/self/exe", "/home/lausniko/os/lab2/a.out", 4096) = 28

     mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3249bec000

     open("/proc/self/cmdline", O_RDONLY)    = 3

     read(3, "./a.out\00010\0002\0001\0", 4096) = 15

     read(3, "", 4081)                       = 0
```

```
     close(3)                                = 0

     munmap(0x7f3249bec000, 4096)            = 0

     mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3249beb000

     mmap(0x7b0000000000, 1099511640064, PROT_NONE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x7b0000000000

     mmap(0x7c0000000000, 12288, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS,
-1, 0) = 0x7c0000000000

     mmap(NULL, 8388608, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) =
0x7f324851e000

     mmap(NULL, 4263936, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f324810d000

     mmap(NULL, 2097152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3247f0d000

     munmap(0x7f3247f0d000, 995328)          = 0

     munmap(0x7f3248100000, 53248)           = 0

     mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3249bea000

     getrandom("\x63\xca\x2c\x0a\xce\xe8\x32\x0c", 8, GRND_NONBLOCK) = 8

     mmap(NULL, 3481600, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3247cae000

     clock_gettime(CLOCK_MONOTONIC, {tv_sec=11330, tv_nsec=139792343}) = 0

     mmap(0x7b1400000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS,
-1, 0) = 0x7b1400000000

     mmap(0x7b1780000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS,
-1, 0) = 0x7b1780000000

     clock_gettime(CLOCK_MONOTONIC, {tv_sec=11330, tv_nsec=140482256}) = 0

     mmap(0x7b0800000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS,
-1, 0) = 0x7b0800000000

     mmap(0x7b0b80000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS,
-1, 0) = 0x7b0b80000000

     clock_gettime(CLOCK_MONOTONIC, {tv_sec=11330, tv_nsec=141188841}) = 0

     mmap(0x7b1800000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS,
-1, 0) = 0x7b1800000000

     mmap(0x7b1b80000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS,
-1, 0) = 0x7b1b80000000

     clock_gettime(CLOCK_MONOTONIC, {tv_sec=11330, tv_nsec=141865744}) = 0

     mmap(0x7b1000000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS,
-1, 0) = 0x7b1000000000

     mmap(0x7b1380000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS,
-1, 0) = 0x7b1380000000

     mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3249be9000
```

```
     prlimit64(0, RLIMIT_CORE, NULL, {rlim_cur=0, rlim_max=RLIM64_INFINITY}) = 0

     prlimit64(0, RLIMIT_CORE, {rlim_cur=0, rlim_max=RLIM64_INFINITY}, NULL) = 0

     prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024, rlim_max=RLIM64_INFINITY}) = 0

     prlimit64(0, RLIMIT_AS, NULL, {rlim_cur=RLIM64_INFINITY, rlim_max=RLIM64_INFINITY}) =
0

     mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3249be8000

     open("/proc/self/maps", O_RDONLY)       = 3

     read(3, "55efc6cb2000-55efc6cb3000 r--p 0"..., 4096) = 3981

     read(3, "7f32491b6000-7f32491bd000 rw-p 0"..., 115) = 115

     close(3)                                = 0

     munmap(0x7f3249be8000, 4096)            = 0

     mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3249be7000

     open("/proc/self/maps", O_RDONLY)       = 3

     read(3, "55efc6cb2000-55efc6cb3000 r--p 0"..., 8192) = 3981

     read(3, "7f32491b6000-7f32491bd000 rw-p 0"..., 4211) = 1104

     read(3, "", 3107)                       = 0

     close(3)                                = 0

     mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3249be6000

     open("/proc/self/maps", O_RDONLY)       = 3

     read(3, "55efc6cb2000-55efc6cb3000 r--p 0"..., 4096) = 3981

     read(3, "7f32491b6000-7f32491bd000 rw-p 0"..., 115) = 115

     close(3)                                = 0

     munmap(0x7f3249be6000, 4096)            = 0

     mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3249be5000

     open("/proc/self/maps", O_RDONLY)       = 3

     read(3, "55efc6cb2000-55efc6cb3000 r--p 0"..., 8192) = 3981

     read(3, "7f32491b6000-7f32491bd000 rw-p 0"..., 4211) = 1104

     read(3, "", 3107)                       = 0

     close(3)                                = 0

     mmap(0x8000000000, 549755813888, PROT_NONE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x8000000000

     mmap(0x200000000000, 17592186044416, PROT_NONE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x200000000000

     mmap(0x340000000000, 36283883716608, PROT_NONE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x340000000000
```

```
     mmap(0x568000000000, 10445360463872, PROT_NONE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x568000000000

     mmap(0x600000000000, 2199023255552, PROT_NONE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x600000000000

     mmap(0x620000000000, 27487790694400, PROT_NONE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x620000000000

     mmap(0x7c0000003000, 2748779057152, PROT_NONE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x7c0000003000

     munmap(0x7f3249be5000, 8192)            = 0

     mmap(0x10000000000, 34084860461056, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x10000000000

     madvise(0x10000000000, 34084860461056, MADV_NOHUGEPAGE) = 0

     madvise(0x10000000000, 34084860461056, MADV_DONTDUMP) = 0

     mmap(0x300000000000, 4398046511104, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x300000000000

     madvise(0x300000000000, 4398046511104, MADV_NOHUGEPAGE) = 0

     madvise(0x300000000000, 4398046511104, MADV_DONTDUMP) = 0

     getpid()                                = 321142

     open("/tmp/tsan.rodata.321142", O_RDWR|O_CREAT|O_EXCL, 0600) = 3

     unlink("/tmp/tsan.rodata.321142")       = 0

     mmap(NULL, 524288, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3247c2e000

     write(3,
"\377\377\377\377\377\377\377\377\377\377\377\377\377\377\377\377\377\377\377\377\377\377\377\377\377\37
7\377\377\377\377\377\377\377\377\377"..., 524288) = 524288

     mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, 3, 0) =
0x7f3249be6000

     mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3249be5000

     open("/proc/self/maps", O_RDONLY)       = 4

     read(4, "8000000000-10000000000 ---p 0000"..., 4096) = 4039

     read(4, "7f32491b1000-7f32491b2000 ---p 0"..., 57) = 57

     close(4)                                = 0

     munmap(0x7f3249be5000, 4096)            = 0

     mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3249be4000

     open("/proc/self/maps", O_RDONLY)       = 4

     read(4, "8000000000-10000000000 ---p 0000"..., 8192) = 4039

     read(4, "7f32491b1000-7f32491b2000 ---p 0"..., 4153) = 1336

     read(4, "", 2817)                       = 0

     close(4)                                = 0
```

```
munmap(0x7f3249be7000, 8192)            = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3249be8000

open("/proc/self/maps", O_RDONLY)       = 4

read(4, "8000000000-10000000000 ---p 0000"..., 4096) = 4039

read(4, "7f32491b1000-7f32491b2000 ---p 0"..., 57) = 57

close(4)                                = 0

munmap(0x7f3249be8000, 4096)            = 0

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3249be7000

open("/proc/self/maps", O_RDONLY)       = 4

read(4, "8000000000-10000000000 ---p 0000"..., 8192) = 4039

read(4, "7f32491b1000-7f32491b2000 ---p 0"..., 4153) = 1336

read(4, "", 2817)                       = 0

close(4)                                = 0

mmap(0x7bf1b2cc000, 16384, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0x7bf1b2cc000

mmap(0xcc9235d4000, 376832, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc9235d4000

mmap(0xcc9236e8000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc9236e8000

mmap(0xcc923768000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc923768000

mmap(0xcc9237e8000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc9237e8000

mmap(0xcc923868000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc923868000

mmap(0xcc9238e8000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc9238e8000

mmap(0xcc923968000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc923968000

mmap(0xcc9239e8000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc9239e8000

mmap(0xcc923a68000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc923a68000

mmap(0xcc923ae8000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc923ae8000

mmap(0xcc923b68000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc923b68000

mmap(0xcc923be8000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc923be8000

mmap(0xcc923c68000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc923c68000

mmap(0xcc923ce8000, 344064, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc923ce8000

mmap(0xcc923f24000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc923f24000

mmap(0xcc923fa4000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc923fa4000

mmap(0xcc924024000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc924024000

mmap(0xcc9240a4000, 458752, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc9240a4000

mmap(0xcc924324000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc924324000

mmap(0xcc9243a4000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc9243a4000
```

```
     mmap(0xcc924424000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc924424000

     mmap(0xcc9244a4000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc9244a4000

     mmap(0xcc924524000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc924524000

     mmap(0xcc9245a4000, 327680, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc9245a4000

     mmap(0xcc926fc8000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc926fc8000

     mmap(0xcc927048000, 163840, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xcc927048000

     close(3)                                = 0

     munmap(0x7f3249be7000, 8192)            = 0

     munmap(0x7f3247c2e000, 524288)          = 0

     sigaltstack(NULL, {ss_sp=NULL, ss_flags=SS_DISABLE, ss_size=0}) = 0

     mmap(NULL, 32768, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3248105000

     sigaltstack({ss_sp=0x7f3248105000, ss_flags=0, ss_size=32768}, NULL) = 0

     rt_sigaction(SIGSEGV, {sa_handler=0x7f3249133c40, sa_mask=[],
sa_flags=SA_RESTORER|SA_ONSTACK|SA_NODEFER|SA_SIGINFO, sa_restorer=0x7f3248dd4520}, NULL, 8)
= 0

     rt_sigaction(SIGBUS, {sa_handler=0x7f3249133c40, sa_mask=[],
sa_flags=SA_RESTORER|SA_ONSTACK|SA_NODEFER|SA_SIGINFO, sa_restorer=0x7f3248dd4520}, NULL, 8)
= 0

     rt_sigaction(SIGFPE, {sa_handler=0x7f3249133c40, sa_mask=[],
sa_flags=SA_RESTORER|SA_ONSTACK|SA_NODEFER|SA_SIGINFO, sa_restorer=0x7f3248dd4520}, NULL, 8)
= 0

     mmap(NULL, 2097152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3247aae000

     munmap(0x7f3247aae000, 335872)          = 0

     munmap(0x7f3247c00000, 712704)          = 0

     mmap(NULL, 2097152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3247900000

     munmap(0x7f3247a00000, 1048576)         = 0

     mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3249be8000

     mmap(NULL, 2097152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3247700000

     munmap(0x7f3247800000, 1048576)         = 0

     mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3249be7000

     mmap(NULL, 1179648, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f32475e0000

     mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3248104000

     mmap(NULL, 2097152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f32473e0000
```

```
munmap(0x7f32473e0000, 131072)          = 0

munmap(0x7f3247500000, 917504)          = 0

munmap(0x7f3248104000, 4096)            = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3248104000

munmap(0x7f3248104000, 4096)            = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3248104000

munmap(0x7f3248104000, 4096)            = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3248104000

munmap(0x7f3248104000, 4096)            = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3248104000

munmap(0x7f3248104000, 4096)            = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3248104000

munmap(0x7f3248104000, 4096)            = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3248104000

munmap(0x7f3248104000, 4096)            = 0

munmap(0x7f3249be7000, 4096)            = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3249be7000

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3248104000

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3248102000

mmap(0x600000000000, 1048576, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x600000000000

madvise(0x600000000000, 1048576, MADV_NOHUGEPAGE) = 0

mmap(0x600001000000, 1159168, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x600001000000

madvise(0x600001000000, 1157128, MADV_NOHUGEPAGE) = 0

munmap(0x60000108a000, 591880)          = 0

mmap(NULL, 2097152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3247200000

munmap(0x7f3247300000, 1048576)         = 0

gettid()                                = 321142

prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024, rlim_max=RLIM64_INFINITY}) = 0
```

```
     mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3248101000

     open("/proc/self/maps", O_RDONLY)       = 3

     read(3, "8000000000-10000000000 ---p 0000"..., 4096) = 4069

     read(3, "600001000000-60000108a000 r", 27) = 27

     close(3)                                = 0

     munmap(0x7f3248101000, 4096)            = 0

     mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3248100000

     open("/proc/self/maps", O_RDONLY)       = 3

     read(3, "8000000000-10000000000 ---p 0000"..., 8192) = 4069

     read(3, "600001000000-60000108a000 rw-p 0"..., 4123) = 3979

     read(3, "7f3249bf0000-7f3249bf2000 r--p 0"..., 144) = 144

     close(3)                                = 0

     munmap(0x7f3248100000, 8192)            = 0

     mmap(NULL, 16384, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3247caa000

     open("/proc/self/maps", O_RDONLY)       = 3

     read(3, "8000000000-10000000000 ---p 0000"..., 16384) = 4069

     read(3, "600001000000-60000108a000 rw-p 0"..., 12315) = 4028

     read(3, "7f3249bf0000-7f3249bf2000 r--p 0"..., 8287) = 890

     read(3, "", 7397)                       = 0

     close(3)                                = 0

     munmap(0x7f3249be4000, 8192)            = 0

     mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3249be5000

     open("/proc/self/maps", O_RDONLY)       = 3

     read(3, "8000000000-10000000000 ---p 0000"..., 4096) = 4069

     read(3, "600001000000-60000108a000 r", 27) = 27

     close(3)                                = 0

     munmap(0x7f3249be5000, 4096)            = 0

     mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3249be4000

     open("/proc/self/maps", O_RDONLY)       = 3

     read(3, "8000000000-10000000000 ---p 0000"..., 8192) = 4069

     read(3, "600001000000-60000108a000 rw-p 0"..., 4123) = 4028

     read(3, "7f3249bf0000-7f3249bf2000 r--p 0"..., 95) = 95

     close(3)                                = 0
```

```
munmap(0x7f3249be4000, 8192)            = 0

mmap(NULL, 16384, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3247ca6000

open("/proc/self/maps", O_RDONLY)       = 3

read(3, "8000000000-10000000000 ---p 0000"..., 16384) = 4069

read(3, "600001000000-60000108a000 rw-p 0"..., 12315) = 4028

read(3, "7f3249bf0000-7f3249bf2000 r--p 0"..., 8287) = 890

read(3, "", 7397)                       = 0

close(3)                                = 0

munmap(0x7f3247ca6000, 16384)           = 0

mmap(NULL, 2097152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3247000000

munmap(0x7f3247100000, 1048576)         = 0

mmap(NULL, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3247c9a000

mmap(NULL, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3247c8a000

clock_gettime(CLOCK_MONOTONIC, {tv_sec=11330, tv_nsec=188565034}) = 0

mmap(0x7b1c00000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS,
-1, 0) = 0x7b1c00000000

mmap(0x7b1f80000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS,
-1, 0) = 0x7b1f80000000

mmap(NULL, 73728, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3247c78000

munmap(0xcc91f1e1000, 274432)           = 0

mmap(0xcc91f1e1000, 274432, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0xcc91f1e1000

madvise(0xcc91f1e1000, 274432, MADV_NOHUGEPAGE) = 0

mmap(0x7b0400000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS,
-1, 0) = 0x7b0400000000

mmap(0x7b0780000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS,
-1, 0) = 0x7b0780000000

newfstatat(1, "", {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0x5), ...},
AT_EMPTY_PATH) = 0

mmap(0x7b6000000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS,
-1, 0) = 0x7b6000000000

mmap(0x7b6380000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS,
-1, 0) = 0x7b6380000000

write(1, "Generated arrays:\n", 18Generated arrays:

)      = 18

write(1, "3 6 \n", 53 6
```

) = 5

write(1, "7 5 \n", 57 5

) = 5

write(1, "3 5 \n", 53 5

) = 5

write(1, "6 2 \n", 56 2

) = 5

write(1, "9 1 \n", 59 1

) = 5

write(1, "2 7 \n", 52 7

) = 5

write(1, "0 9 \n", 50 9

) = 5

write(1, "3 6 \n", 53 6

) = 5

write(1, "0 6 \n", 50 6

) = 5

write(1, "2 6 \n", 52 6

) = 5

mmap(NULL, 163840, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f3247c50000

write(1, "Using row_split strategy\n", 25Using row_split strategy

) = 25

mmap(0x7b0c00000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7b0c00000000

mmap(0x7b0f80000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7b0f80000000

rt_sigprocmask(SIG_SETMASK, ~[RT_1], [], 8) = 0

rt_sigaction(SIGRT_1, {sa_handler=0x7f3248e23870, sa_mask=[], sa_flags=SA_RESTORER|SA_ONSTACK|SA_RESTART|SA_SIGINFO, sa_restorer=0x7f3248dd4520}, 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) = 0x7f32467ff000

mprotect(0x7f3246800000, 8388608, PROT_READ|PROT_WRITE) = 0

mmap(0x7b4400000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7b4400000000

mmap(0x7b4780000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7b4780000000

```
rt_sigprocmask(SIG_BLOCK, ~[], ~[KILL STOP RTMIN RT_1], 8) = 0

clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|C
LONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7f3246fff910,
parent_tid=0x7f3246fff910, exit_signal=0, stack=0x7f32467ff000, stack_size=0x7c0300,
tls=0x7f3246fff640} => {parent_tid=[321143]}, 88) = 321143

rt_sigprocmask(SIG_SETMASK, ~[KILL STOP RTMIN RT_1], NULL, 8) = 0

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

mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0) =
0x7f3245ffe000

mprotect(0x7f3245fff000, 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|C
LONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7f32467fe910,
parent_tid=0x7f32467fe910, exit_signal=0, stack=0x7f3245ffe000, stack_size=0x7c0300,
tls=0x7f32467fe640} => {parent_tid=[321144]}, 88) = 321144

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

mmap(0x600001130000, 1048576, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x600001130000

madvise(0x600001130000, 1048576, MADV_NOHUGEPAGE) = 0

mmap(0x600002130000, 1159168, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x600002130000

madvise(0x600002130000, 1157128, MADV_NOHUGEPAGE) = 0

munmap(0x6000021ba000, 591880)          = 0

mmap(NULL, 524288, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f3247a80000

sched_yield()                           = 0

futex(0x7f32467fe910, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 321144, NULL,
FUTEX_BITSET_MATCH_ANY) = -1 EAGAIN (Resource temporarily unavailable)

write(1, "Result array: \n", 15Result array:

)        = 15

write(1, "35 53 \n", 735 53

)                = 7

exit_group(0)                           = ?

+++ exited with 0 +++
```

Тест 2

```
lausniko@DESKTOP-MATHSNO:~/os/lab2$ ./a.out 20 10 7

Generated arrays:

3 6 7 5 3 5 6 2 9 1
```

```
2 7 0 9 3 6 0 6 2 6
1 8 7 9 2 0 2 3 7 5
9 2 2 8 9 7 3 6 1 2
9 3 1 9 4 7 8 4 5 0
3 6 1 0 6 3 2 0 6 1
5 5 4 7 6 5 6 9 3 7
4 5 2 5 4 7 4 4 3 0
7 8 6 8 8 4 3 1 4 9
2 0 6 8 9 2 6 6 4 9
5 0 4 8 7 1 7 2 7 2
2 6 1 0 6 1 5 9 4 9
0 9 1 7 7 1 1 5 9 7
7 6 7 3 6 5 6 3 9 4
8 1 2 9 3 9 0 8 8 5
0 9 6 3 8 5 6 1 1 5
9 8 4 8 1 0 3 0 4 4
4 4 7 6 3 1 7 5 9 6
2 1 7 8 5 7 4 1 8 5
9 7 5 3 8 8 3 1 8 9
Using row_split strategy
Result array:
91 101 80 123 108 84 82 76 111 96
```

```
lausniko@DESKTOP-MATHSNO:~/os/lab2$ strace ./a.out 20 10 7
execve("./a.out", ["./a.out", "20", "10", "7"], 0x7ffea5141598 /* 36 vars */) = 0
brk(NULL)                               = 0x556aa6336000
arch_prctl(0x3001 /* ARCH_??? */, 0x7ffcea2ad030) = -1 EINVAL (Invalid argument)
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fc0571000
access("/etc/ld.so.preload", R_OK)      = -1 ENOENT (No such file or directory)
openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3
newfstatat(3, "", {st_mode=S_IFREG|0644, st_size=37327, ...}, AT_EMPTY_PATH) = 0
mmap(NULL, 37327, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7f9fc0567000
close(3)                                = 0
openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libtsan.so.0", 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"..., 832) = 832
newfstatat(3, "", {st_mode=S_IFREG|0644, st_size=7344248, ...}, AT_EMPTY_PATH) = 0
mmap(NULL, 11802184, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f9fbfa25000
mprotect(0x7f9fbfa4c000, 954368, PROT_NONE) = 0
mmap(0x7f9fbfa4c000, 737280, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x27000) = 0x7f9fbfa4c000
mmap(0x7f9fbfb00000, 212992, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0xdb000) =
0x7f9fbfb00000
mmap(0x7f9fbfb35000, 45056, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x10f000) = 0x7f9fbfb35000
mmap(0x7f9fbfb40000, 10643016, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -
1, 0) = 0x7f9fbfb40000
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"..., 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) = 0x7f9fbf93e000
mmap(0x7f9fbf94c000, 507904, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0xe000) = 0x7f9fbf94c000
mmap(0x7f9fbf9c8000, 372736, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x8a000) =
0x7f9fbf9c8000
mmap(0x7f9fbfa23000, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0xe4000) = 0x7f9fbfa23000
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\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\0"..., 48, 848) =
48

pread64(3, "\4\0\0\0\24\0\0\0\3\0\0\0GNU\0I\17\357\204\3$\f\221\2039x\324\224\323\236S"...,
68, 896) = 68

    newfstatat(3, "", {st_mode=S_IFREG|0755, st_size=2220400, ...}, 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, 2264656, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f9fbf715000

                    mprotect(0x7f9fbf73d000, 2023424, PROT_NONE) = 0

mmap(0x7f9fbf73d000, 1658880, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x28000) = 0x7f9fbf73d000

mmap(0x7f9fbf8d2000, 360448, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1bd000) =
0x7f9fbf8d2000

mmap(0x7f9fbf92b000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x215000) = 0x7f9fbf92b000

mmap(0x7f9fbf931000, 52816, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1,
0) = 0x7f9fbf931000

                       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"..., 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) = 0x7f9fbf6f5000

mmap(0x7f9fbf6f8000, 94208, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x3000) = 0x7f9fbf6f8000

mmap(0x7f9fbf70f000, 16384, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1a000) =
0x7f9fbf70f000

mmap(0x7f9fbf713000, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x1d000) = 0x7f9fbf713000

                       close(3)                                 = 0

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbf6f3000

mmap(NULL, 270336, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbf6b1000

                       arch_prctl(ARCH_SET_FS, 0x7f9fbf6f1340) = 0

                    set_tid_address(0x7f9fbf6f1610)         = 323013

                       set_robust_list(0x7f9fbf6f1620, 24)     = 0
```

```
rseq(0x7f9fbf6f1ce0, 0x20, 0, 0x53053053) = 0
mprotect(0x7f9fbf92b000, 16384, PROT_READ) = 0
mprotect(0x7f9fbf713000, 4096, PROT_READ) = 0
mprotect(0x7f9fbfa23000, 4096, PROT_READ) = 0
mprotect(0x7f9fbfb35000, 16384, PROT_READ) = 0
mprotect(0x556a83aa5000, 4096, PROT_READ) = 0
mprotect(0x7f9fc05ab000, 8192, PROT_READ) = 0
prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024, rlim_max=RLIM64_INFINITY}) = 0
munmap(0x7f9fc0567000, 37327)           = 0
mmap(NULL, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbf6a1000
mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fc05aa000
mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fc0570000
open("/proc/self/environ", O_RDONLY)    = 3
read(3, "SHELL=/bin/bash\0COLORTERM=trueco"..., 4096) = 3338
read(3, "", 758)                        = 0
close(3)                                = 0
readlink("/proc/self/exe", "/home/lausniko/os/lab2/a.out", 4096) = 28
mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fc056f000
open("/proc/self/cmdline", O_RDONLY)    = 3
read(3, "./a.out\00020\00010\0007\0", 4096) = 16
read(3, "", 4080)                       = 0
close(3)                                = 0
munmap(0x7f9fc056f000, 4096)            = 0
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fc056e000
mmap(0x7b0000000000, 1099511640064, PROT_NONE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x7b0000000000
mmap(0x7c0000000000, 12288, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1,
0) = 0x7c0000000000
mmap(NULL, 8388608, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) =
0x7f9fbeea1000
mmap(NULL, 4263936, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbea90000
mmap(NULL, 2097152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbe890000
munmap(0x7f9fbe890000, 458752)          = 0
munmap(0x7f9fbea00000, 589824)          = 0
```

```
mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fc056d000

getrandom("\x95\x7b\xe9\x1d\xbc\x53\x95\x79", 8, GRND_NONBLOCK) = 8

mmap(NULL, 3481600, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbe5ae000

clock_gettime(CLOCK_MONOTONIC, {tv_sec=11477, tv_nsec=475098667}) = 0

mmap(0x7b1400000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1,
                                    0) = 0x7b1400000000

mmap(0x7b1780000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1,
                                    0) = 0x7b1780000000

clock_gettime(CLOCK_MONOTONIC, {tv_sec=11477, tv_nsec=475952633}) = 0

mmap(0x7b0800000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1,
                                    0) = 0x7b0800000000

mmap(0x7b0b80000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1,
                                    0) = 0x7b0b80000000

clock_gettime(CLOCK_MONOTONIC, {tv_sec=11477, tv_nsec=476895199}) = 0

mmap(0x7b1800000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1,
                                    0) = 0x7b1800000000

mmap(0x7b1b80000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1,
                                    0) = 0x7b1b80000000

clock_gettime(CLOCK_MONOTONIC, {tv_sec=11477, tv_nsec=477543737}) = 0

mmap(0x7b1000000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1,
                                    0) = 0x7b1000000000

mmap(0x7b1380000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1,
                                    0) = 0x7b1380000000

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fc056c000

       prlimit64(0, RLIMIT_CORE, NULL, {rlim_cur=0, rlim_max=RLIM64_INFINITY}) = 0

       prlimit64(0, RLIMIT_CORE, {rlim_cur=0, rlim_max=RLIM64_INFINITY}, NULL) = 0

   prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024, rlim_max=RLIM64_INFINITY}) = 0

 prlimit64(0, RLIMIT_AS, NULL, {rlim_cur=RLIM64_INFINITY, rlim_max=RLIM64_INFINITY}) = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fc056b000

                        open("/proc/self/maps", O_RDONLY)       = 3

                read(3, "556a83aa2000-556a83aa3000 r--p 0"..., 4096) = 3981

                 read(3, "7f9fbfb39000-7f9fbfb40000 rw-p 0"..., 115) = 115

                        close(3)                                = 0

                        munmap(0x7f9fc056b000, 4096)            = 0

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fc056a000

                        open("/proc/self/maps", O_RDONLY)       = 3
```

```
read(3, "556a83aa2000-556a83aa3000 r--p 0"..., 8192) = 3981

read(3, "7f9fbfb39000-7f9fbfb40000 rw-p 0"..., 4211) = 1104

read(3, "", 3107)                       = 0

close(3)                                = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fc0569000

open("/proc/self/maps", O_RDONLY)       = 3

read(3, "556a83aa2000-556a83aa3000 r--p 0"..., 4096) = 3981

read(3, "7f9fbfb39000-7f9fbfb40000 rw-p 0"..., 115) = 115

close(3)                                = 0

munmap(0x7f9fc0569000, 4096)            = 0

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fc0568000

open("/proc/self/maps", O_RDONLY)       = 3

read(3, "556a83aa2000-556a83aa3000 r--p 0"..., 8192) = 3981

read(3, "7f9fbfb39000-7f9fbfb40000 rw-p 0"..., 4211) = 1104

read(3, "", 3107)                       = 0

close(3)                                = 0

mmap(0x8000000000, 549755813888, PROT_NONE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x8000000000

mmap(0x200000000000, 17592186044416, PROT_NONE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x200000000000

mmap(0x340000000000, 36283883716608, PROT_NONE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x340000000000

mmap(0x568000000000, 10445360463872, PROT_NONE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x568000000000

mmap(0x600000000000, 2199023255552, PROT_NONE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x600000000000

mmap(0x620000000000, 27487790694400, PROT_NONE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x620000000000

mmap(0x7c0000003000, 2748779057152, PROT_NONE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x7c0000003000

munmap(0x7f9fc0568000, 8192)            = 0

mmap(0x10000000000, 34084860461056, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x10000000000

madvise(0x10000000000, 34084860461056, MADV_NOHUGEPAGE) = 0

madvise(0x10000000000, 34084860461056, MADV_DONTDUMP) = 0

mmap(0x300000000000, 4398046511104, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x300000000000
```

```
madvise(0x300000000000, 4398046511104, MADV_NOHUGEPAGE) = 0
 madvise(0x300000000000, 4398046511104, MADV_DONTDUMP) = 0
      getpid()                                  = 323013
open("/tmp/tsan.rodata.323013", O_RDWR|O_CREAT|O_EXCL, 0600) = 3
         unlink("/tmp/tsan.rodata.323013")       = 0
mmap(NULL, 524288, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbea10000
                                        write(3,
"\377\377\377\377\377\377\377\377\377\377\377\377\377\377\377\377\377\377\377\377\377\377\377\37
7\377\377\377\377\377\377\377\377\377"..., 524288) = 524288
 mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, 3, 0) = 0x7f9fc0569000
 mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fc0568000
         open("/proc/self/maps", O_RDONLY)       = 4
      read(4, "8000000000-10000000000 ---p 0000"..., 4096) = 4039
        read(4, "7f9fbfb34000-7f9fbfb35000 ---p 0"..., 57) = 57
         close(4)                                = 0
         munmap(0x7f9fc0568000, 4096)            = 0
 mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fc0567000
         open("/proc/self/maps", O_RDONLY)       = 4
      read(4, "8000000000-10000000000 ---p 0000"..., 8192) = 4039
      read(4, "7f9fbfb34000-7f9fbfb35000 ---p 0"..., 4153) = 1336
         read(4, "", 2817)                       = 0
         close(4)                                = 0
         munmap(0x7f9fc056a000, 8192)            = 0
 mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fc056b000
         open("/proc/self/maps", O_RDONLY)       = 4
      read(4, "8000000000-10000000000 ---p 0000"..., 4096) = 4039
        read(4, "7f9fbfb34000-7f9fbfb35000 ---p 0"..., 57) = 57
         close(4)                                = 0
         munmap(0x7f9fc056b000, 4096)            = 0
 mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fc056a000
         open("/proc/self/maps", O_RDONLY)       = 4
      read(4, "8000000000-10000000000 ---p 0000"..., 8192) = 4039
      read(4, "7f9fbfb34000-7f9fbfb35000 ---p 0"..., 4153) = 1336
         read(4, "", 2817)                       = 0
```

```
                    close(4)                                = 0
 mmap(0x5aa0ea8c000, 16384, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0x5aa0ea8c000
mmap(0xe7efdbe0000, 376832, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7efdbe0000
mmap(0xe7efdcf4000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7efdcf4000
mmap(0xe7efdd74000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7efdd74000
mmap(0xe7efddf4000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7efddf4000
mmap(0xe7efde74000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7efde74000
mmap(0xe7efdef4000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7efdef4000
mmap(0xe7efdf74000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7efdf74000
mmap(0xe7efdff4000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7efdff4000
mmap(0xe7efe074000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7efe074000
mmap(0xe7efe0f4000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7efe0f4000
mmap(0xe7efe174000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7efe174000
mmap(0xe7efe1f4000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7efe1f4000
mmap(0xe7efe274000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7efe274000
mmap(0xe7efe2f4000, 344064, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7efe2f4000
mmap(0xe7efe530000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7efe530000
mmap(0xe7efe5b0000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7efe5b0000
mmap(0xe7efe630000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7efe630000
mmap(0xe7efe6b0000, 458752, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7efe6b0000
mmap(0xe7efe930000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7efe930000
mmap(0xe7efe9b0000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7efe9b0000
mmap(0xe7efea30000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7efea30000
mmap(0xe7efeab0000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7efeab0000
mmap(0xe7efeb30000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7efeb30000
mmap(0xe7efebb0000, 327680, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7efebb0000
mmap(0xe7f015d4000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7f015d4000
mmap(0xe7f01654000, 163840, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0xe7f01654000
                    close(3)                                = 0
                    munmap(0x7f9fc056a000, 8192)            = 0
                    munmap(0x7f9fbea10000, 524288)          = 0
          sigaltstack(NULL, {ss_sp=NULL, ss_flags=SS_DISABLE, ss_size=0}) = 0
mmap(NULL, 32768, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbea88000
```

```
sigaltstack({ss_sp=0x7f9fbea88000, ss_flags=0, ss_size=32768}, NULL) = 0

rt_sigaction(SIGSEGV, {sa_handler=0x7f9fbfab6c40, sa_mask=[],
sa_flags=SA_RESTORER|SA_ONSTACK|SA_NODEFER|SA_SIGINFO, sa_restorer=0x7f9fbf757520}, NULL, 8)
= 0

rt_sigaction(SIGBUS, {sa_handler=0x7f9fbfab6c40, sa_mask=[],
sa_flags=SA_RESTORER|SA_ONSTACK|SA_NODEFER|SA_SIGINFO, sa_restorer=0x7f9fbf757520}, NULL, 8)
= 0

rt_sigaction(SIGFPE, {sa_handler=0x7f9fbfab6c40, sa_mask=[],
sa_flags=SA_RESTORER|SA_ONSTACK|SA_NODEFER|SA_SIGINFO, sa_restorer=0x7f9fbf757520}, NULL, 8)
= 0

mmap(NULL, 2097152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbe3ae000

munmap(0x7f9fbe3ae000, 335872)          = 0

munmap(0x7f9fbe500000, 712704)          = 0

mmap(NULL, 2097152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbe200000

munmap(0x7f9fbe300000, 1048576)         = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fc056b000

mmap(NULL, 2097152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbe000000

munmap(0x7f9fbe100000, 1048576)         = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fc056a000

mmap(NULL, 1179648, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbdee0000

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbea87000

mmap(NULL, 2097152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbdce0000

munmap(0x7f9fbdce0000, 131072)          = 0

munmap(0x7f9fbde00000, 917504)          = 0

munmap(0x7f9fbea87000, 4096)            = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbea87000

munmap(0x7f9fbea87000, 4096)            = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbea87000

munmap(0x7f9fbea87000, 4096)            = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbea87000

munmap(0x7f9fbea87000, 4096)            = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbea87000

munmap(0x7f9fbea87000, 4096)            = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbea87000

munmap(0x7f9fbea87000, 4096)            = 0
```

```
mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbea87000
                        munmap(0x7f9fbea87000, 4096)            = 0
                        munmap(0x7f9fc056a000, 4096)            = 0
mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fc056a000
mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbea87000
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbea85000
                    mmap(0x600000000000, 1048576, PROT_READ|PROT_WRITE,
        MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x600000000000
                   madvise(0x600000000000, 1048576, MADV_NOHUGEPAGE) = 0
                    mmap(0x600001000000, 1159168, PROT_READ|PROT_WRITE,
        MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x600001000000
                   madvise(0x600001000000, 1157128, MADV_NOHUGEPAGE) = 0
                        munmap(0x60000108a000, 591880)          = 0
mmap(NULL, 2097152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbdb00000
                        munmap(0x7f9fbdc00000, 1048576)         = 0
                      gettid()                                  = 323013
   prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024, rlim_max=RLIM64_INFINITY}) = 0
mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbea84000
                        open("/proc/self/maps", O_RDONLY)       = 3
                read(3, "8000000000-10000000000 ---p 0000"..., 4096) = 4069
                     read(3, "600001000000-60000108a000 r", 27) = 27
                        close(3)                                = 0
                        munmap(0x7f9fbea84000, 4096)            = 0
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbea83000
                        open("/proc/self/maps", O_RDONLY)       = 3
                read(3, "8000000000-10000000000 ---p 0000"..., 8192) = 4069
                read(3, "600001000000-60000108a000 rw-p 0"..., 4123) = 4028
                  read(3, "7f9fc0573000-7f9fc0575000 r--p 0"..., 95) = 95
                        close(3)                                = 0
                        munmap(0x7f9fbea83000, 8192)            = 0
mmap(NULL, 16384, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbea81000
                        open("/proc/self/maps", O_RDONLY)       = 3
               read(3, "8000000000-10000000000 ---p 0000"..., 16384) = 4069
               read(3, "600001000000-60000108a000 rw-p 0"..., 12315) = 4028
```

```
read(3, "7f9fc0573000-7f9fc0575000 r--p 0"..., 8287) = 890
read(3, "", 7397)                       = 0
close(3)                                = 0
munmap(0x7f9fc0567000, 8192)            = 0
mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fc0568000
open("/proc/self/maps", O_RDONLY)       = 3
read(3, "8000000000-10000000000 ---p 0000"..., 4096) = 4069
read(3, "600001000000-60000108a000 r", 27) = 27
close(3)                                = 0
munmap(0x7f9fc0568000, 4096)            = 0
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fc0567000
open("/proc/self/maps", O_RDONLY)       = 3
read(3, "8000000000-10000000000 ---p 0000"..., 8192) = 4069
read(3, "600001000000-60000108a000 rw-p 0"..., 4123) = 4028
read(3, "7f9fc0573000-7f9fc0575000 r--p 0"..., 95) = 95
close(3)                                = 0
munmap(0x7f9fc0567000, 8192)            = 0
mmap(NULL, 16384, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbea7d000
open("/proc/self/maps", O_RDONLY)       = 3
read(3, "8000000000-10000000000 ---p 0000"..., 16384) = 4069
read(3, "600001000000-60000108a000 rw-p 0"..., 12315) = 4028
read(3, "7f9fc0573000-7f9fc0575000 r--p 0"..., 8287) = 890
read(3, "", 7397)                       = 0
close(3)                                = 0
munmap(0x7f9fbea7d000, 16384)           = 0
mmap(NULL, 2097152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbd900000
munmap(0x7f9fbda00000, 1048576)         = 0
mmap(NULL, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbea71000
mmap(NULL, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbea61000
clock_gettime(CLOCK_MONOTONIC, {tv_sec=11477, tv_nsec=523816375}) = 0
mmap(0x7b1c00000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1,
                                    0) = 0x7b1c00000000
mmap(0x7b1f80000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1,
                                    0) = 0x7b1f80000000
```

```
mmap(0x7b2800000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1,
                                    0) = 0x7b2800000000

mmap(0x7b2b80000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1,
                                    0) = 0x7b2b80000000

mmap(NULL, 73728, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbea4f000

                        munmap(0xe7efa93d000, 274432)           = 0

                     mmap(0xe7efa93d000, 274432, PROT_READ|PROT_WRITE,
          MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0xe7efa93d000

                    madvise(0xe7efa93d000, 274432, MADV_NOHUGEPAGE) = 0

mmap(0x7b0c00000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1,
                                    0) = 0x7b0c00000000

mmap(0x7b0f80000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1,
                                    0) = 0x7b0f80000000

newfstatat(1, "", {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0x5), ...}, AT_EMPTY_PATH) =
                                         0

mmap(0x7b6000000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1,
                                    0) = 0x7b6000000000

mmap(0x7b6380000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1,
                                    0) = 0x7b6380000000

                      write(1, "Generated arrays:\n", 18Generated arrays:

                                    )     = 18

                   write(1, "3 6 7 5 3 5 6 2 9 1 \n", 213 6 7 5 3 5 6 2 9 1

                                     )  = 21

                   write(1, "2 7 0 9 3 6 0 6 2 6 \n", 212 7 0 9 3 6 0 6 2 6

                                     )  = 21

                   write(1, "1 8 7 9 2 0 2 3 7 5 \n", 211 8 7 9 2 0 2 3 7 5

                                     )  = 21

                   write(1, "9 2 2 8 9 7 3 6 1 2 \n", 219 2 2 8 9 7 3 6 1 2

                                     )  = 21

                   write(1, "9 3 1 9 4 7 8 4 5 0 \n", 219 3 1 9 4 7 8 4 5 0

                                     )  = 21

                   write(1, "3 6 1 0 6 3 2 0 6 1 \n", 213 6 1 0 6 3 2 0 6 1

                                     )  = 21

                   write(1, "5 5 4 7 6 5 6 9 3 7 \n", 215 5 4 7 6 5 6 9 3 7

                                     )  = 21

                   write(1, "4 5 2 5 4 7 4 4 3 0 \n", 214 5 2 5 4 7 4 4 3 0
```

```
                            )  = 21
                write(1, "7 8 6 8 8 4 3 1 4 9 \n", 217 8 6 8 8 4 3 1 4 9
                            )  = 21
                write(1, "2 0 6 8 9 2 6 6 4 9 \n", 212 0 6 8 9 2 6 6 4 9
                            )  = 21
                write(1, "5 0 4 8 7 1 7 2 7 2 \n", 215 0 4 8 7 1 7 2 7 2
                            )  = 21
                write(1, "2 6 1 0 6 1 5 9 4 9 \n", 212 6 1 0 6 1 5 9 4 9
                            )  = 21
                write(1, "0 9 1 7 7 1 1 5 9 7 \n", 210 9 1 7 7 1 1 5 9 7
                            )  = 21
                write(1, "7 6 7 3 6 5 6 3 9 4 \n", 217 6 7 3 6 5 6 3 9 4
                            )  = 21
                write(1, "8 1 2 9 3 9 0 8 8 5 \n", 218 1 2 9 3 9 0 8 8 5
                            )  = 21
                write(1, "0 9 6 3 8 5 6 1 1 5 \n", 210 9 6 3 8 5 6 1 1 5
                            )  = 21
                write(1, "9 8 4 8 1 0 3 0 4 4 \n", 219 8 4 8 1 0 3 0 4 4
                            )  = 21
                write(1, "4 4 7 6 3 1 7 5 9 6 \n", 214 4 7 6 3 1 7 5 9 6
                            )  = 21
                write(1, "2 1 7 8 5 7 4 1 8 5 \n", 212 1 7 8 5 7 4 1 8 5
                            )  = 21
                write(1, "9 7 5 3 8 8 3 1 8 9 \n", 219 7 5 3 8 8 3 1 8 9
                            )  = 21
mmap(NULL, 163840, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbea27000
            write(1, "Using row_split strategy\n", 25Using row_split strategy
                            ) = 25
mmap(0x7b4800000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1,
                            0) = 0x7b4800000000
mmap(0x7b4b80000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1,
                            0) = 0x7b4b80000000
                rt_sigprocmask(SIG_SETMASK, ~[RT_1], [], 8) = 0
```

rt_sigaction(SIGRT_1, {sa_handler=0x7f9fbf7a6870, sa_mask=[], sa_flags=SA_RESTORER|SA_ONSTACK|SA_RESTART|SA_SIGINFO, sa_restorer=0x7f9fbf757520}, 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) = 0x7f9fbd0ff000

mprotect(0x7f9fbd100000, 8388608, PROT_READ|PROT_WRITE) = 0

mmap(0x7b4400000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7b4400000000

mmap(0x7b4780000000, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7b4780000000

rt_sigprocmask(SIG_BLOCK, ~[], ~[KILL STOP RTMIN RT_1], 8) = 0

clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7f9fbd8ff910, parent_tid=0x7f9fbd8ff910, exit_signal=0, stack=0x7f9fbd0ff000, stack_size=0x7c0300, tls=0x7f9fbd8ff640} => {parent_tid=[323015]}, 88) = 323015

rt_sigprocmask(SIG_SETMASK, ~[KILL STOP RTMIN RT_1], NULL, 8) = 0

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

mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0) = 0x7f9fbc8fe000

mprotect(0x7f9fbc8ff000, 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_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7f9fbd0fe910, parent_tid=0x7f9fbd0fe910, exit_signal=0, stack=0x7f9fbc8fe000, stack_size=0x7c0300, tls=0x7f9fbd0fe640} => {parent_tid=[323016]}, 88) = 323016

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

mmap(0x600001130000, 1048576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x600001130000

madvise(0x600001130000, 1048576, MADV_NOHUGEPAGE) = 0

mmap(0x600002130000, 1159168, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x600002130000

madvise(0x600002130000, 1157128, MADV_NOHUGEPAGE) = 0

munmap(0x6000021ba000, 591880)   = 0

mmap(NULL, 524288, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f9fbe52e000

sched_yield()   = 0

sched_yield()   = 0

mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0) = 0x7f9fbc0fd000

mprotect(0x7f9fbc0fe000, 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_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7f9fbc8fd910, parent_tid=0x7f9fbc8fd910, exit_signal=0, stack=0x7f9fbc0fd000, stack_size=0x7c0300, tls=0x7f9fbc8fd640} => {parent_tid=[323017]}, 88) = 323017

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

mmap(0x600002260000, 1048576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x600002260000

madvise(0x600002260000, 1048576, MADV_NOHUGEPAGE) = 0

mmap(0x600003260000, 1159168, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x600003260000

madvise(0x600003260000, 1157128, MADV_NOHUGEPAGE) = 0

munmap(0x6000032ea000, 591880) = 0

sched_yield() = 0

sched_yield() = 0

mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0) = 0x7f9fbb8fc000

mprotect(0x7f9fbb8fd000, 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_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7f9fbc0fc910, parent_tid=0x7f9fbc0fc910, exit_signal=0, stack=0x7f9fbb8fc000, stack_size=0x7c0300, tls=0x7f9fbc0fc640} => {parent_tid=[323018]}, 88) = 323018

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

mmap(0x600003390000, 1048576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x600003390000

madvise(0x600003390000, 1048576, MADV_NOHUGEPAGE) = 0

mmap(0x600004390000, 1159168, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x600004390000

madvise(0x600004390000, 1157128, MADV_NOHUGEPAGE) = 0

munmap(0x60000441a000, 591880) = 0

sched_yield() = 0

mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0) = 0x7f9fbb0fb000

mprotect(0x7f9fbb0fc000, 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_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7f9fbb8fb910, parent_tid=0x7f9fbb8fb910, exit_signal=0, stack=0x7f9fbb0fb000, stack_size=0x7c0300, tls=0x7f9fbb8fb640} => {parent_tid=[323019]}, 88) = 323019

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

```
mmap(0x6000044c0000, 1048576, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x6000044c0000

madvise(0x6000044c0000, 1048576, MADV_NOHUGEPAGE) = 0

mmap(0x6000054c0000, 1159168, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x6000054c0000

madvise(0x6000054c0000, 1157128, MADV_NOHUGEPAGE) = 0

     munmap(0x60000554a000, 591880)          = 0

     sched_yield()                           = 0

mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0) = 0x7f9fba8fa000

mprotect(0x7f9fba8fb000, 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_S
ETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7f9fbb0fa910,
parent_tid=0x7f9fbb0fa910, exit_signal=0, stack=0x7f9fba8fa000, stack_size=0x7c0300,
tls=0x7f9fbb0fa640} => {parent_tid=[323020]}, 88) = 323020

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

mmap(0x6000055f0000, 1048576, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x6000055f0000

madvise(0x6000055f0000, 1048576, MADV_NOHUGEPAGE) = 0

mmap(0x6000065f0000, 1159168, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x6000065f0000

madvise(0x6000065f0000, 1157128, MADV_NOHUGEPAGE) = 0

     munmap(0x60000667a000, 591880)          = 0

     sched_yield()                           = 0

mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0) = 0x7f9fba0f9000

mprotect(0x7f9fba0fa000, 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_S
ETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7f9fba8f9910,
parent_tid=0x7f9fba8f9910, exit_signal=0, stack=0x7f9fba0f9000, stack_size=0x7c0300,
tls=0x7f9fba8f9640} => {parent_tid=[323021]}, 88) = 323021

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

mmap(0x600006720000, 1048576, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x600006720000

madvise(0x600006720000, 1048576, MADV_NOHUGEPAGE) = 0

mmap(0x600007720000, 1159168, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x600007720000

madvise(0x600007720000, 1157128, MADV_NOHUGEPAGE) = 0
```

```
munmap(0x6000077aa000, 591880)          = 0
sched_yield()                           = 0
mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0) = 0x7f9fb98f8000
mprotect(0x7f9fb98f9000, 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_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7f9fba0f8910, parent_tid=0x7f9fba0f8910, exit_signal=0, stack=0x7f9fb98f8000, stack_size=0x7c0300, tls=0x7f9fba0f8640} => {parent_tid=[323022]}, 88) = 323022
rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0
mmap(0x600007850000, 1048576, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x600007850000
madvise(0x600007850000, 1048576, MADV_NOHUGEPAGE) = 0
mmap(0x600008850000, 1159168, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x600008850000
madvise(0x600008850000, 1157128, MADV_NOHUGEPAGE) = 0
munmap(0x6000088da000, 591880)          = 0
sched_yield()                           = 0
sched_yield()                           = 0
munmap(0x7f9fbc8fe000, 8392704)         = 0
munmap(0x7f9fbc0fd000, 8392704)         = 0
munmap(0x7f9fbb8fc000, 8392704)         = 0
write(1, "Result array: \n", 15Result array:
)        = 15
write(1, "91 101 80 123 108 84 82 76 111 9"..., 3591 101 80 123 108 84 82 76 111 96
) = 35
exit_group(0)                           = ?
+++ exited with 0 +++
```

Вывод

В процессе выполнения лабораторной работы я научился управлять потоками в операционной системе. В рамках работы была создана и отлажена программа на языке Си, которая складывает массивы, используя потоки, работа с которыми производится через синхронизатор потоков mutex.