Московский Авиационный Институт

(Национальный Исследовательский Университет)

Институт №8 “Компьютерные науки и прикладная математика”

Кафедра №806 “Вычислительная математика и программирование”

Лабораторная работа №2 по курсу

«Операционные системы»

Группа: М8О-216БВ-24

Студент: Гуськов А.В.

Преподаватель: Бахарев В.Д.

Оценка: _____

Дата: 07.10.25

Москва, 2025

Постановка задачи

Вариант 8.

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.

Так же необходимо уметь продемонстрировать количество потоков, используемое вашей программой с помощью стандартных средств операционной системы. В отчете привести исследование зависимости ускорения и эффективности алгоритма от входных данных и количества потоков. Получившиеся результаты необходимо объяснить.

Есть *K* 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 данные из буфера в файловый дескриптор.
- *void exit(int status)* – завершает выполнение процесса с указанным статусом.
- *int clock_gettime(clockid_t clk_id, struct timespec* tp)* – получает время от указанных часов *(CLOCK_MONOTONIC)*. Используется для измерения *wall-time* времени выполнения программы.
- *int pthread_create(pthread_t* thread, const pthread_attr_t* attr, void* (start_routine)(void*), void* arg)* – создает новый поток выполнения.
- *int pthread_join(pthread_t thread, void **thread_return)* – ожидает завершения указанного потока и получает его возвращаемое значение. Используется для синхронизации потоков и получения результатов.

Программа принимает три аргумента командной строки: количество потоков, количество массивов и размер каждого массива. Выполняется проверка корректности введенных параметров, после чего осуществляется выделение памяти под необходимое количество массивов. Массивы заполняются случайными числами в диапазоне от 1 до 100 с одновременным вычислением контрольной суммы. Для измерения времени выполнения используется системный вызов *clock_gettime* с параметром *CLOCK_MONOTONIC*.

Создаются и запускаются рабочие потоки, каждому из которых назначается определенная часть массивов для обработки. Основной поток ожидает завершения вычислений с помощью функции *pthread_join* и аккумулирует частичные суммы. По окончании вычислений производится сравнение полученной суммы с контрольным значением и вывод результата. Программа освобождает всю выделенную память и завершает работу с кодом возврата 0.

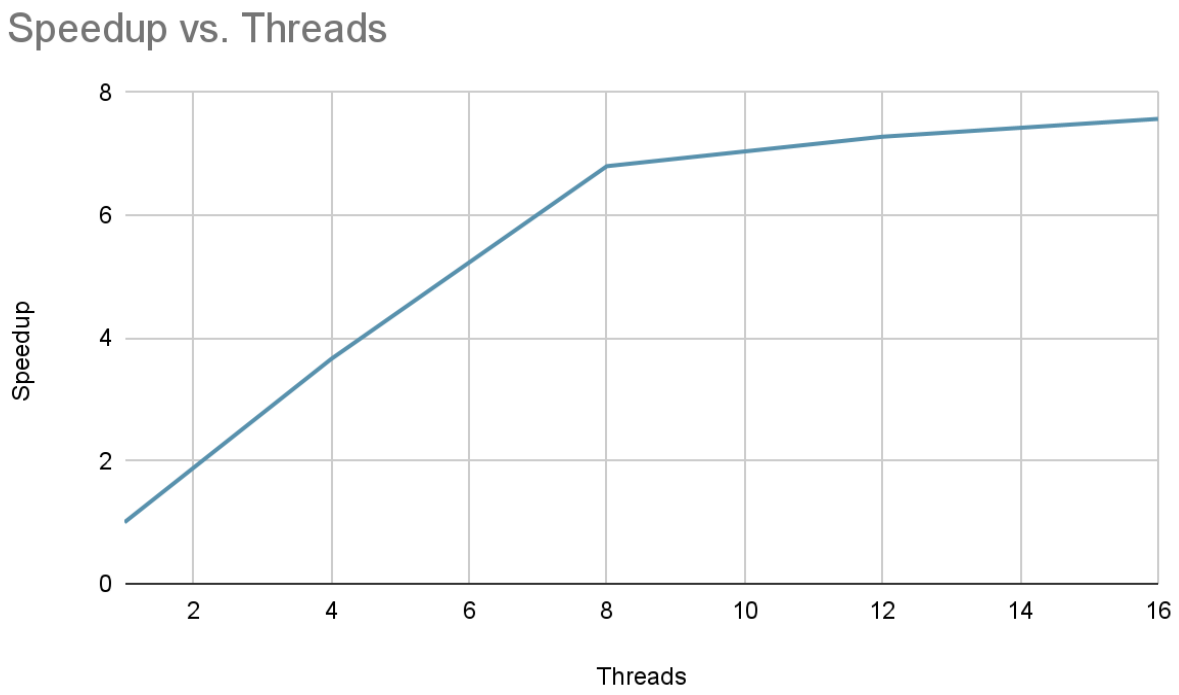
Представленное решение демонстрирует эффективное использование многопоточности для распараллеливания вычислительных задач.

Анализ ускорения и эффективности

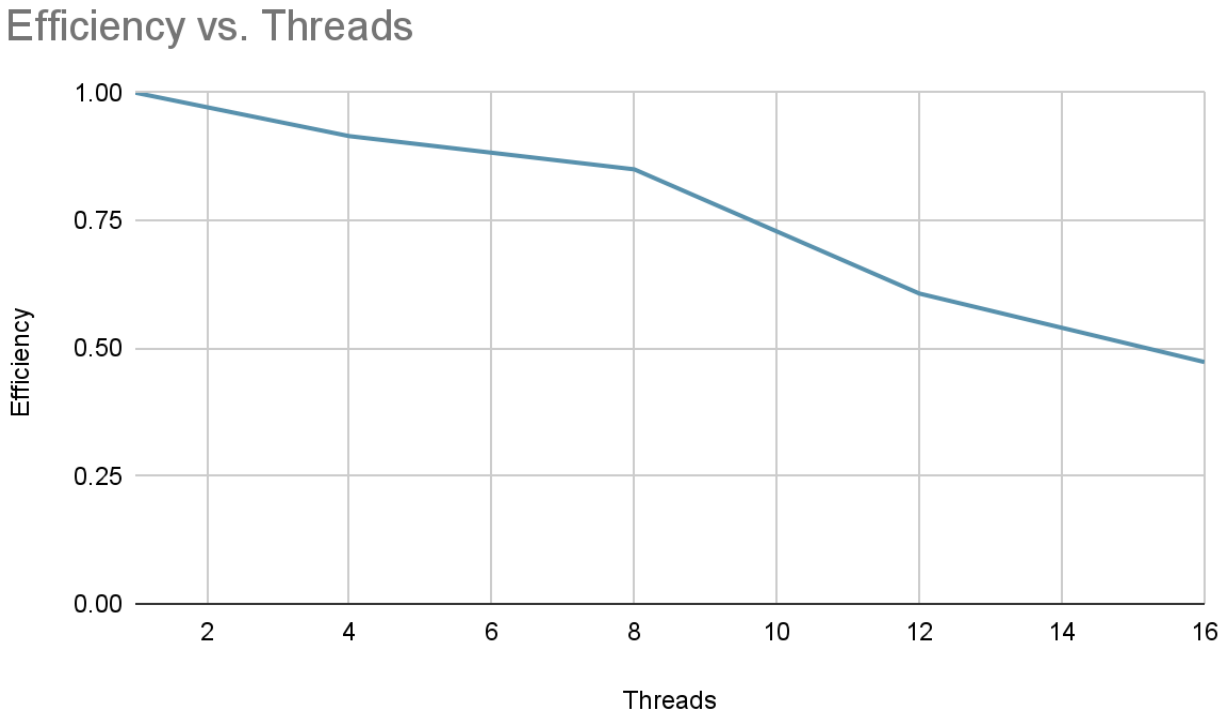
Число потоков	Время исполнения (мс)	Ускорение	Эффективность
1	2869	1	1
4	784	3,66	0.915
8	422	6,8	0.85
12	394	7,28	0.607
16	379	7,57	0.473
1000	384	7,47	0.0747

Ускорение показывает во сколько раз применение параллельного алгоритма уменьшает время решения задачи по сравнению с последовательным алгоритмом. Ускорение определяется величиной $S_N=T_1/T_N$, где T_1 - время выполнения на одном потоке, T_N - время выполнения на N потоках.

Эффективность - величина $E_N=S_N/N$, где S_N - ускорение, N - количество используемых потоков.



Из графика четко видна зависимость ускорения работы программы от числа потоков. При увеличении числа потоков с 1 до 8 виден стремительный рост. Последние потоки же демонстрируют эффект “плато”, когда увеличение числа потоков не ведет к значительному ускорению работы программы.



Из графика видна зависимость эффективности выполнения программы от числа потоков. Ключевой аспект, на который необходимо обратить внимание, что мы стремительно теряем в эффективности после 8 потоков, что соотносится с графиком зависимости ускорения программы от числа потоков.

Данные графики очень четко демонстрируют закон Амдала. Закон иллюстрирует ограничение роста производительности вычислительной системы с увеличением числа вычислителей.

Максимальное ускорение — не всегда лучшая цель. Гораздо важнее найти баланс между ускорением и эффективностью использования ресурсов. Запуск 16 потоков вместо 8 дает минимальный прирост в скорости (всего ~10%), но при этом эффективность падает в 2 раза.

Пример с 1000 потоками — это демонстрация того, как можно "убить" производительность, неправильно используя параллелизм.

Код программы

main.c

```
#include <pthread.h>
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
#include <string.h>
#include <time.h>

#include "../include/validator.h"



typedef struct
{
  int thread_id;
  int PTH_NUMBER;
  int ARR_NUMBER;
  int ARRAY_SIZE;
  int** arrays;
} ThreadInfo;



void* computing(void* arg)
{
  ThreadInfo thread_info = *((ThreadInfo*)arg);


  int size = thread_info.ARRAY_SIZE / thread_info.PTH_NUMBER;
  int index = thread_info.thread_id * size;
  int end = (thread_info.thread_id == thread_info.PTH_NUMBER - 1) ?
thread_info.ARRAY_SIZE : index + size;
  long long* sum = malloc(sizeof(long long));
  *sum = 0;
```

```
    char buffer[128];
    if (sprintf(buffer, "Thread (id: %d) is working...\n", thread_info.thread_id))
    {
        write(STDOUT_FILENO, buffer, strlen(buffer));
    }

    for (int i = 0; i < thread_info.ARR_NUMBER; ++i)
    {
        for (int j = index; j < end; ++j)
        {
            *sum += thread_info.arrays[i][j];
        }
    }

    return (void*)sum;
}


int main(int argc, char** argv)
{
    int number = args_processing(argc, argv);

    if (number != 0)
    {
        char buffer[64];
        char* message = "Error: unable to get number of threads from CL\n";
        sprintf(buffer, "Use: ./%s <PTH_NUMBER> <ARR_NUMBER> <ARRAY_SIZE>\n",
argv[0]);
        write(STDOUT_FILENO, message, strlen(message));
        write(STDOUT_FILENO, buffer, strlen(buffer));
        exit(EXIT_FAILURE);
    }
```

```
// Checking the value of constants
const int PTH_NUMBER = atoi(argv[1]);
const int ARR_NUMBER = atoi(argv[2]);
const int ARRAY_SIZE = atoi(argv[3]);

if (ARRAY_SIZE <= 0 || PTH_NUMBER <= 0 || ARR_NUMBER <= 0)
{
   char* message = "Error: All args must be positive.\n";
   write(STDIN_FILENO, message, strlen(message));
   exit(EXIT_FAILURE);
}

int** arrays = (int**)malloc(ARR_NUMBER * sizeof(int*));

if (arrays == NULL)
{
   char* message = "Error: unable to allocate memory for arrays\n";
   write(STDOUT_FILENO, message, strlen(message));
   exit(EXIT_FAILURE);
}

// Fill arrays
char temp_buffer[ARRAY_SIZE];
long long inter_sum = 0;
srand(time(NULL));

for (int i = 0; i < ARR_NUMBER; ++i)
{
   arrays[i] = (int*)malloc(ARRAY_SIZE * sizeof(int));
```

```
    if (arrays[i] == NULL)
    {
        char* message = "Error: unable to allocate memory for numbers of arrays\n";
        write(STDOUT_FILENO, message, strlen(message));
        exit(EXIT_FAILURE);
    }

    for (int j = 0; j < ARRAY_SIZE; ++j)
    {
        arrays[i][j] = rand() % 100 + 1;
        inter_sum += arrays[i][j];
    }
}


// Determines the program's wall-time
struct timespec start_time, end_time;
if (clock_gettime(CLOCK_MONOTONIC, &start_time) != 0)
{
    char* message = "Error: unable to get time for start_time.\n";
    write(STDIN_FILENO, message, strlen(message));
    exit(EXIT_FAILURE);
}

// Create threads and ThreadInfo for each thread
pthread_t thread[PTH_NUMBER];
ThreadInfo* threads = malloc(PTH_NUMBER * sizeof(ThreadInfo));

for (int i = 0; i < PTH_NUMBER; ++i)
{
    threads[i] = (ThreadInfo)
    {
```

```
        .thread_id = i,
        .PTH_NUMBER = PTH_NUMBER,
        .ARR_NUMBER = ARR_NUMBER,
        .ARRAY_SIZE = ARRAY_SIZE,
        .arrays = arrays,
    };

    if (pthread_create(thread + i, NULL, computing, (void*)(threads + i)) != 0)
    {
        char* message = "Error: unable to create pthread\n";
        write(STDOUT_FILENO, message, strlen(message));
        exit(EXIT_FAILURE);
    }
}


// Receive intermediate sum from threads and calculate globalSum
long long* result;
long long globalSum = 0;

for (int i = 0; i < PTH_NUMBER; ++i)
{
    if (pthread_join(thread[i], (void**)&result) != 0)
    {
        char* message = "Error: unable to join pthread\n";
        write(STDOUT_FILENO, message, strlen(message));
        exit(EXIT_FAILURE);
    }
    globalSum += *result;
    free((void*)result);    // Memory was allocated in void* computing(void* args)
}
```

```
    if (clock_gettime(CLOCK_MONOTONIC, &end_time) != 0)
    {
        char* message = "Error: unable to get time for end_time.\n";
        write(STDIN_FILENO, message, strlen(message));
        exit(EXIT_FAILURE);
    }
    double time_taken = (end_time.tv_sec - start_time.tv_sec) +
                        (end_time.tv_nsec - start_time.tv_nsec) / 1000000000.0;

    // Output globalSum
    if (sprintf(temp_buffer, "Global sum is: %lld == %lld :inter_sum\nExecution time is: %.5f\n",
globalSum, inter_sum, time_taken) >= 0)
    {
        write(STDOUT_FILENO, temp_buffer, strlen(temp_buffer));
    }




    // Free allocated memory
    for (int i = 0; i < ARR_NUMBER; ++i)
    {
        free((void*)arrays[i]);
    }

    free((void*)arrays);
    free((void*) threads);

    return 0;
}
```

Протокол работы программы

Тестирование:

```
❯ ./build/program.out 1 200 1000000
Thread (id: 0) is working...
Global sum is: 10099332106 == 10099332106 :inter_sum
Execution time is: 2.96737
❯ ./build/program.out 15 200 1000000
Thread (id: 0) is working...
Thread (id: 1) is working...
Thread (id: 2) is working...
Thread (id: 3) is working...
Thread (id: 4) is working...
Thread (id: 5) is working...
Thread (id: 6) is working...
Thread (id: 7) is working...
Thread (id: 8) is working...
Thread (id: 9) is working...
Thread (id: 10) is working...
Thread (id: 11) is working...
Thread (id: 12) is working...
Thread (id: 13) is working...
Thread (id: 14) is working...
Global sum is: 10100052940 == 10100052940 :inter_sum
Execution time is: 0.39660
```

```
❯ ./build/program.out 1 10000 1500
Thread (id: 0) is working...
Global sum is: 757621107 == 757621107 :inter_sum
Execution time is: 0.45538
❯ ./build/program.out 16 10000 1500
Thread (id: 0) is working...
Thread (id: 1) is working...
Thread (id: 2) is working...
Thread (id: 3) is working...
Thread (id: 4) is working...
Thread (id: 5) is working...
Thread (id: 6) is working...
Thread (id: 7) is working...
Thread (id: 8) is working...
Thread (id: 9) is working...
Thread (id: 10) is working...
Thread (id: 11) is working...
Thread (id: 12) is working...
Thread (id: 13) is working...
Thread (id: 14) is working...
Thread (id: 15) is working...
Global sum is: 757689489 == 757689489 :inter_sum
Execution time is: 0.07956
```

Strace:

❯ strace -f ./build/program.out 5 5 5

execve("./build/program.out", ["./build/program.out", "5", "5", "5"], 0x7ffdc9d68090 /* 61 vars */) = 0

brk(NULL) = 0x560ba840e000

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

fstat(3, {st_mode=S_IFREG|0644, st_size=161395, ...}) = 0

mmap(NULL, 161395, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7f79f49d7000

close(3) = 0

openat(AT_FDCWD, "/usr/lib/libtsan.so.2", 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"..., 832) = 832

fstat(3, {st_mode=S_IFREG|0755, st_size=9434840, ...}) = 0

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f79f49d5000

mmap(NULL, 17511656, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f79f3800000

mmap(0x7f79f3838000, 921600, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x38000) = 0x7f79f3838000

mmap(0x7f79f3919000, 274432, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x119000) = 0x7f79f3919000

mmap(0x7f79f395c000, 49152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x15c000) = 0x7f79f395c000

mmap(0x7f79f3968000, 16037096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7f79f3968000

close(3) = 0

openat(AT_FDCWD, "/usr/lib/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\0000x\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"..., 896, 64) = 896

fstat(3, {st_mode=S_IFREG|0755, st_size=2149728, ...}) = 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"..., 896, 64) = 896

mmap(NULL, 2174000, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f79f3400000

mmap(0x7f79f3424000, 1515520, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x24000) = 0x7f79f3424000

mmap(0x7f79f3596000, 454656, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x196000) = 0x7f79f3596000

mmap(0x7f79f3605000, 24576, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x204000) = 0x7f79f3605000

mmap(0x7f79f360b000, 31792, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7f79f360b000

close(3) = 0

openat(AT_FDCWD, "/usr/lib/../lib/glibc-hwcaps/x86-64-v4/libstdc++.so.6",
O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)

newfstatat(AT_FDCWD, "/usr/lib/../lib/glibc-hwcaps/x86-64-v4/", 0x7ffe9c028100, 0) = -1 ENOENT
(No such file or directory)

openat(AT_FDCWD, "/usr/lib/../lib/glibc-hwcaps/x86-64-v3/libstdc++.so.6",
O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)

newfstatat(AT_FDCWD, "/usr/lib/../lib/glibc-hwcaps/x86-64-v3/", 0x7ffe9c028100, 0) = -1 ENOENT
(No such file or directory)

openat(AT_FDCWD, "/usr/lib/../lib/glibc-hwcaps/x86-64-v2/libstdc++.so.6",
O_RDONLY|O_CLOEXEC) = -1 ENOENT (No such file or directory)

newfstatat(AT_FDCWD, "/usr/lib/../lib/glibc-hwcaps/x86-64-v2/", 0x7ffe9c028100, 0) = -1 ENOENT
(No such file or directory)

openat(AT_FDCWD, "/usr/lib/../lib/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\0"..., 832) = 832

fstat(3, {st_mode=S_IFREG|0755, st_size=22480456, ...}) = 0

mmap(NULL, 2699336, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f79f3000000

mmap(0x7f79f3097000, 1396736, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x97000) = 0x7f79f3097000

mmap(0x7f79f31ec000, 598016, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x1ec000) = 0x7f79f31ec000

mmap(0x7f79f327e000, 73728, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x27e000) = 0x7f79f327e000

mmap(0x7f79f3290000, 12360, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7f79f3290000

close(3) = 0

openat(AT_FDCWD, "/usr/lib/../lib/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

fstat(3, {st_mode=S_IFREG|0755, st_size=1100400, ...}) = 0

mmap(NULL, 1102152, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f79f48c7000

mmap(0x7f79f48d6000, 569344, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0xf000) = 0x7f79f48d6000

mmap(0x7f79f4961000, 466944, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE,
3, 0x9a000) = 0x7f79f4961000

mmap(0x7f79f49d3000, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x10b000) = 0x7f79f49d3000

close(3)   = 0

openat(AT_FDCWD, "/usr/lib/../lib/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

fstat(3, {st_mode=S_IFREG|0644, st_size=906056, ...}) = 0

mmap(NULL, 180712, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7f79f37d3000

mmap(0x7f79f37d7000, 143360, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x4000) = 0x7f79f37d7000

mmap(0x7f79f37fa000, 16384, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x27000) = 0x7f79f37fa000

mmap(0x7f79f37fe000, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x2a000) = 0x7f79f37fe000

close(3)   = 0

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f48c5000

mmap(NULL, 12288, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f48c2000

arch_prctl(ARCH_SET_FS, 0x7f79f48c2f00) = 0

set_tid_address(0x7f79f48c31d0)   = 10719

set_robust_list(0x7f79f48c31e0, 24)   = 0

rseq(0x7f79f48c2680, 0x20, 0, 0x53053053) = 0

mprotect(0x7f79f3605000, 16384, PROT_READ) = 0

mprotect(0x7f79f37fe000, 4096, PROT_READ) = 0

mprotect(0x7f79f49d3000, 4096, PROT_READ) = 0

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f48c0000

mprotect(0x7f79f327e000, 69632, PROT_READ) = 0

mprotect(0x7f79f395c000, 20480, PROT_READ) = 0

mprotect(0x560b95ca6000, 4096, PROT_READ) = 0

mprotect(0x7f79f4a3e000, 8192, PROT_READ) = 0

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

getrandom("\x31\xa7\x25\xa8\xe9\x1d\x34\x90", 8, GRND_NONBLOCK) = 8

munmap(0x7f79f49d7000, 161395)   = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49fe000

```
mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49fd000

openat(AT_FDCWD, "/proc/self/environ", O_RDONLY) = 3

read(3, "ALACRITTY_LOG=/tmp/Alacritty-419"..., 4096) = 2184

read(3, "", 1912)                       = 0

close(3)                                = 0

readlinkat(AT_FDCWD, "/proc/self/exe", "/home/avgu5kov/Projects/MAI-OS-L"..., 4096) = 56

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49fc000

openat(AT_FDCWD, "/proc/self/cmdline", O_RDONLY) = 3

read(3, "./build/program.out\0005\0005\0005\0", 4096) = 26

read(3, "", 4070)                       = 0

close(3)                                = 0

munmap(0x7f79f49fc000, 4096)            = 0

mmap(NULL, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49ed000

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) =
0x7f79f49ec000

openat(AT_FDCWD, "/proc/self/maps", O_RDONLY) = 3

read(3, "560b95ca3000-560b95ca4000 r--p 0"..., 4096) = 4073

read(3, "7ffe9c00a000-7ffe9c02b0", 23)  = 23

close(3)                                = 0

munmap(0x7f79f49ec000, 4096)            = 0

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49eb000

openat(AT_FDCWD, "/proc/self/maps", O_RDONLY) = 3

read(3, "560b95ca3000-560b95ca4000 r--p 0"..., 8192) = 4073

read(3, "7ffe9c00a000-7ffe9c02b000 rw-p 0"..., 4119) = 165

read(3, "", 3954)                       = 0

close(3)                                = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49ea000
```

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

read(3, "560b95ca3000-560b95ca4000 r--p 0"..., 4096) = 4073

read(3, "7ffe9c00a000-7ffe9c02b0", 23)  = 23

close(3)                                = 0

munmap(0x7f79f49ea000, 4096)            = 0

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49e9000

openat(AT_FDCWD, "/proc/self/maps", O_RDONLY) = 3

read(3, "560b95ca3000-560b95ca4000 r--p 0"..., 8192) = 4073

read(3, "7ffe9c00a000-7ffe9c02b000 rw-p 0"..., 4119) = 165

read(3, "", 3954)                       = 0

close(3)                                = 0

munmap(0x7f79f49e9000, 8192)            = 0

mmap(0x720000000000, 1099511635968, PROT_NONE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x720000000000

mmap(0x730000000000, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x730000000000

mmap(NULL, 8388608, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_NORESERVE,
-1, 0) = 0x7f79f2800000

mmap(NULL, 4263936, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0)
= 0x7f79f23ef000

mmap(NULL, 2097152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0)
= 0x7f79f2000000

munmap(0x7f79f2100000, 1048576)         = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49ea000

mmap(NULL, 3727360, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0)
= 0x7f79f1c72000

mmap(NULL, 2097152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0)
= 0x7f79f1a00000

munmap(0x7f79f1b00000, 1048576)         = 0

mmap(NULL, 2097152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0)
= 0x7f79f1800000

munmap(0x7f79f1900000, 1048576)         = 0

mmap(NULL, 2097152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0)
= 0x7f79f1600000

munmap(0x7f79f1700000, 1048576)         = 0
```

```
mmap(NULL, 2097152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0)
= 0x7f79f1400000

munmap(0x7f79f1500000, 1048576)         = 0

mmap(NULL, 2097152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0)
= 0x7f79f1200000

munmap(0x7f79f1300000, 1048576)         = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49e9000

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

prlimit64(0, RLIMIT_CORE, {rlim_cur=1, 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) =
0x7f79f49e8000

openat(AT_FDCWD, "/proc/self/maps", O_RDONLY) = 3

read(3, "560b95ca3000-560b95ca4000 r--p 0"..., 4096) = 3999

read(3, "7f79f4a05000-7f79f4a06000 r--p 0"..., 97) = 97

close(3)                                = 0

munmap(0x7f79f49e8000, 4096)            = 0

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49e7000

openat(AT_FDCWD, "/proc/self/maps", O_RDONLY) = 3

read(3, "560b95ca3000-560b95ca4000 r--p 0"..., 8192) = 3999

read(3, "7f79f4a05000-7f79f4a06000 r--p 0"..., 4193) = 729

read(3, "", 3464)                       = 0

close(3)                                = 0

munmap(0x7f79f49eb000, 8192)            = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49ec000

openat(AT_FDCWD, "/proc/self/maps", O_RDONLY) = 3

read(3, "560b95ca3000-560b95ca4000 r--p 0"..., 4096) = 4048

read(3, "7f79f4a05000-7f79f4a06000 r--p 0"..., 48) = 48

close(3)                                = 0

munmap(0x7f79f49ec000, 4096)            = 0
```

```
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49eb000

openat(AT_FDCWD, "/proc/self/maps", O_RDONLY) = 3

read(3, "560b95ca3000-560b95ca4000 r--p 0"..., 8192) = 3999

read(3, "7f79f4a05000-7f79f4a06000 r--p 0"..., 4193) = 729

read(3, "", 3464)                       = 0

close(3)                                = 0

munmap(0x7f79f49eb000, 8192)            = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49ec000

openat(AT_FDCWD, "/proc/self/maps", O_RDONLY) = 3

read(3, "560b95ca3000-560b95ca4000 r--p 0"..., 4096) = 4048

read(3, "7f79f4a05000-7f79f4a06000 r--p 0"..., 48) = 48

close(3)                                = 0

munmap(0x7f79f49ec000, 4096)            = 0

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49eb000

openat(AT_FDCWD, "/proc/self/maps", O_RDONLY) = 3

read(3, "560b95ca3000-560b95ca4000 r--p 0"..., 8192) = 3999

read(3, "7f79f4a05000-7f79f4a06000 r--p 0"..., 4193) = 729

read(3, "", 3464)                       = 0

close(3)                                = 0

munmap(0x7f79f49e7000, 8192)            = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49e8000

openat(AT_FDCWD, "/proc/self/maps", O_RDONLY) = 3

read(3, "560b95ca3000-560b95ca4000 r--p 0"..., 4096) = 3999

read(3, "7f79f4a05000-7f79f4a06000 r--p 0"..., 97) = 97

close(3)                                = 0

munmap(0x7f79f49e8000, 4096)            = 0

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49e7000

openat(AT_FDCWD, "/proc/self/maps", O_RDONLY) = 3

read(3, "560b95ca3000-560b95ca4000 r--p 0"..., 8192) = 3999
```

read(3, "7f79f4a05000-7f79f4a06000 r--p 0"..., 4193) = 729

read(3, "", 3464) = 0

close(3) = 0

mmap(0x20000000000, 15393162788864, PROT_NONE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x20000000000

mmap(0x380000000000, 31885837205504, PROT_NONE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x380000000000

mmap(0x5a0000000000, 26388279066624, PROT_NONE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x5a0000000000

mmap(0x730000002000, 7696581386240, PROT_NONE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x730000002000

munmap(0x7f79f49e7000, 8192) = 0

mmap(0x100000000000, 35184372088832, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x100000000000

madvise(0x100000000000, 35184372088832, MADV_NOHUGEPAGE) = 0

madvise(0x100000000000, 35184372088832, MADV_DONTDUMP) = 0

mmap(0x300000000000, 8796093022208, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x300000000000

madvise(0x300000000000, 8796093022208, MADV_NOHUGEPAGE) = 0

madvise(0x300000000000, 8796093022208, MADV_DONTDUMP) = 0

getpid() = 10719

openat(AT_FDCWD, "/tmp/tsan.rodata.10719", O_RDWR|O_CREAT|O_EXCL, 0600) = 3

unlinkat(AT_FDCWD, "/tmp/tsan.rodata.10719", 0) = 0

mmap(NULL, 524288, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f3753000

write(3, "\0\0\0@\0\0\0@\0\0\0@\0\0\0@\0\0\0@\0\0\0@\0\0\0@\0\0\0@"..., 524288) = 524288

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, 3, 0) =
0x7f79f49e8000

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49e7000

openat(AT_FDCWD, "/proc/self/maps", O_RDONLY) = 4

read(4, "20000000000-100000000000 ---p 00"..., 4096) = 4083

read(4, "7f79f49ff000-", 13) = 13

close(4) = 0

munmap(0x7f79f49e7000, 4096) = 0

```
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49e6000

openat(AT_FDCWD, "/proc/self/maps", O_RDONLY) = 4

read(4, "20000000000-100000000000 ---p 00"..., 8192) = 4083

read(4, "7f79f49ff000-7f79f4a03000 r--p 0"..., 4109) = 889

read(4, "", 3220)                       = 0

close(4)                                = 0

munmap(0x7f79f49eb000, 8192)            = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49ec000

openat(AT_FDCWD, "/proc/self/maps", O_RDONLY) = 4

read(4, "20000000000-100000000000 ---p 00"..., 4096) = 4083

read(4, "7f79f49ec000-", 13)            = 13

close(4)                                = 0

munmap(0x7f79f49ec000, 4096)            = 0

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49eb000

openat(AT_FDCWD, "/proc/self/maps", O_RDONLY) = 4

read(4, "20000000000-100000000000 ---p 00"..., 8192) = 4083

read(4, "7f79f49ff000-7f79f4a03000 r--p 0"..., 4109) = 889

read(4, "", 3220)                       = 0

close(4)                                = 0

mmap(0x1c172b948000, 8192, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0x1c172b948000

mmap(0x2ef3e612e000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) =
0x2ef3e612e000

mmap(0x2ef3e61ae000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) =
0x2ef3e61ae000

mmap(0x2ef3e622e000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) =
0x2ef3e622e000

mmap(0x2ef3e62ae000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) =
0x2ef3e62ae000

mmap(0x2ef3e632e000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) =
0x2ef3e632e000

mmap(0x2ef3e63ae000, 172032, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) =
0x2ef3e63ae000
```

```
mmap(0x2ef3e6848000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) =
0x2ef3e6848000

mmap(0x2ef3e68c8000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) =
0x2ef3e68c8000

mmap(0x2ef3e6948000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) =
0x2ef3e6948000

mmap(0x2ef3e69c8000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) =
0x2ef3e69c8000

mmap(0x2ef3e6a48000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) =
0x2ef3e6a48000

mmap(0x2ef3e6ac8000, 409600, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) =
0x2ef3e6ac8000

mmap(0x2ef3e6fae000, 286720, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0x2ef3e6fae000

mmap(0x2ef3e7070000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) =
0x2ef3e7070000

mmap(0x2ef3e70f0000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0x2ef3e70f0000

mmap(0x2ef3e7170000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) =
0x2ef3e7170000

mmap(0x2ef3e71f0000, 270336, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0x2ef3e71f0000

mmap(0x2ef3e91ac000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) =
0x2ef3e91ac000

mmap(0x2ef3e922c000, 524288, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) =
0x2ef3e922c000

mmap(0x2ef3e92ac000, 90112, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) = 0x2ef3e92ac000

mmap(0x2ef3e940c000, 344064, PROT_READ, MAP_PRIVATE|MAP_FIXED, 3, 0) =
0x2ef3e940c000

close(3)                        = 0

munmap(0x7f79f49eb000, 8192)            = 0

munmap(0x7f79f3753000, 524288)          = 0

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

mmap(NULL, 57344, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49d8000

sigaltstack({ss_sp=0x7f79f49d8000, ss_flags=0, ss_size=54016}, NULL) = 0

rt_sigaction(SIGSEGV, {sa_handler=0x7f79f38b2380, sa_mask=[],
sa_flags=SA_RESTORER|SA_ONSTACK|SA_NODEFER|SA_SIGINFO,
sa_restorer=0x7f79f343e540}, NULL, 8) = 0

rt_sigaction(SIGBUS, {sa_handler=0x7f79f38b2380, sa_mask=[],
sa_flags=SA_RESTORER|SA_ONSTACK|SA_NODEFER|SA_SIGINFO,
sa_restorer=0x7f79f343e540}, NULL, 8) = 0
```

rt_sigaction(SIGFPE, {sa_handler=0x7f79f38b2380, sa_mask=[],
sa_flags=SA_RESTORER|SA_ONSTACK|SA_NODEFER|SA_SIGINFO,
sa_restorer=0x7f79f343e540}, NULL, 8) = 0

mmap(NULL, 2097152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0)
= 0x7f79f1000000

munmap(0x7f79f1100000, 1048576) = 0

mmap(NULL, 2097152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0)
= 0x7f79f0e00000

munmap(0x7f79f0f00000, 1048576) = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49ec000

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49eb000

mmap(NULL, 1703936, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0)
= 0x7f79f3633000

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49d7000

munmap(0x7f79f49d7000, 4096) = 0

munmap(0x7f79f49eb000, 4096) = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49eb000

mmap(NULL, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f3623000

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f48be000

mmap(NULL, 2097152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0)
= 0x7f79f0c00000

munmap(0x7f79f0d00000, 1048576) = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x7f79f49d7000

gettid() = 10719

mmap(NULL, 524288, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x7f79f3380000

madvise(0x7f79f3380000, 524288, MADV_NOHUGEPAGE) = 0

mmap(NULL, 2097152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0)
= 0x7f79f0a00000

munmap(0x7f79f0b00000, 1048576) = 0

mmap(NULL, 2097152, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0)
= 0x7f79f0800000

munmap(0x7f79f0900000, 1048576)   = 0

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) = 0x7f79f48bd000

openat(AT_FDCWD, "/proc/self/maps", O_RDONLY) = 3

read(3, "20000000000-100000000000 ---p 00"..., 4096) = 4059

read(3, "7f79f1a00000-7f79f1b00000 rw-p 0"..., 37) = 37

close(3)   = 0

munmap(0x7f79f48bd000, 4096)   = 0

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f79f48bc000

openat(AT_FDCWD, "/proc/self/maps", O_RDONLY) = 3

read(3, "20000000000-100000000000 ---p 00"..., 8192) = 4059

read(3, "7f79f1a00000-7f79f1b00000 rw-p 0"..., 4133) = 3882

read(3, "", 251)   = 0

close(3)   = 0

munmap(0x7f79f49e6000, 8192)   = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f79f49e7000

openat(AT_FDCWD, "/proc/self/maps", O_RDONLY) = 3

read(3, "20000000000-100000000000 ---p 00"..., 4096) = 4059

read(3, "7f79f1a00000-7f79f1b00000 rw-p 0"..., 37) = 37

close(3)   = 0

munmap(0x7f79f49e7000, 4096)   = 0

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f79f49e6000

openat(AT_FDCWD, "/proc/self/maps", O_RDONLY) = 3

read(3, "20000000000-100000000000 ---p 00"..., 8192) = 4059

read(3, "7f79f1a00000-7f79f1b00000 rw-p 0"..., 4133) = 3882

read(3, "", 251)   = 0

close(3)   = 0

munmap(0x7f79f49e6000, 8192)   = 0

mmap(NULL, 262144, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f79f3340000

mmap(NULL, 90112, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f79f332a000

mmap(NULL, 1048576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f79f22ef000

mmap(NULL, 8388608, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x7f79f0000000

mmap(0x72c400000000, 262144, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x72c400000000

mmap(0x72c780000000, 262144, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x72c780000000

mmap(NULL, 65536, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f79f3613000

mmap(0x158800001000, 143360, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x158800001000

madvise(0x158800001000, 143360, MADV_NOHUGEPAGE) = 0

mmap(0x720c00000000, 262144, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x720c00000000

mmap(0x720f80000000, 262144, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x720f80000000

mmap(0x720800000000, 262144, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x720800000000

mmap(0x720b80000000, 262144, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x720b80000000

mmap(0x722000000000, 262144, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x722000000000

mmap(0x722380000000, 262144, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x722380000000

rt_sigprocmask(SIG_SETMASK, ~[ILL TRAP ABRT BUS FPE SEGV PIPE SYS RT_1], [], 8) = 0

rt_sigaction(SIGRT_1, {sa_handler=0x7f79f34940b0, sa_mask=[], sa_flags=SA_RESTORER|SA_ONSTACK|SA_RESTART|SA_SIGINFO, sa_restorer=0x7f79f343e540}, NULL, 8) = 0

rt_sigprocmask(SIG_UNBLOCK, [RTMIN RT_1], NULL, 8) = 0

mmap(NULL, 8392704, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0) = 0x7f79ef7ff000

madvise(0x7f79ef7ff000, 4096, MADV_GUARD_INSTALL) = -1 EINVAL (Invalid argument)

mprotect(0x7f79ef7ff000, 4096, PROT_NONE) = 0

mmap(0x724400000000, 262144, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x724400000000

mmap(0x724780000000, 262144, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x724780000000

rt_sigprocmask(SIG_BLOCK, ~[], ~[ILL TRAP ABRT BUS FPE KILL SEGV PIPE STOP SYS 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=0x7f79effff990, parent_tid=0x7f79effff990, exit_signal=0, stack=0x7f79ef7ff000, stack_size=0x7ff7c0, tls=0x7f79effff6c0}strace: Process 10720 attached

 => {parent_tid=[10720]}, 88) = 10720

[pid 10719] rt_sigprocmask(SIG_SETMASK, ~[ILL TRAP ABRT BUS FPE KILL SEGV PIPE STOP SYS RTMIN RT_1] <unfinished ...>

[pid 10720] rseq(0x7f79efffee40, 0x20, 0, 0x53053053 <unfinished ...>

[pid 10719] <... rt_sigprocmask resumed>, NULL, 8) = 0

[pid 10720] <... rseq resumed>)   = 0

[pid 10719] rt_sigprocmask(SIG_SETMASK, [] <unfinished ...>

[pid 10720] set_robust_list(0x7f79effff9a0, 24 <unfinished ...>

[pid 10719] <... rt_sigprocmask resumed>, NULL, 8) = 0

[pid 10720] <... set_robust_list resumed>) = 0

[pid 10719] mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0 <unfinished ...>

[pid 10720] rt_sigprocmask(SIG_SETMASK, ~[ILL TRAP ABRT BUS FPE KILL SEGV PIPE STOP SYS RTMIN RT_1] <unfinished ...>

[pid 10719] <... mmap resumed>)   = 0x7f79eeffe000

[pid 10720] <... rt_sigprocmask resumed>, NULL, 8) = 0

[pid 10719] mprotect(0x7f79eefff000, 8388608, PROT_READ|PROT_WRITE <unfinished ...>

[pid 10720] gettimeofday(<unfinished ...>

[pid 10719] <... mprotect resumed>)   = 0

[pid 10720] <... gettimeofday resumed>{tv_sec=1759849915, tv_usec=861305}, NULL) = 0

[pid 10719] rt_sigprocmask(SIG_BLOCK, ~[] <unfinished ...>

[pid 10720] nanosleep({tv_sec=0, tv_nsec=100000000} <unfinished ...>

[pid 10719] <... rt_sigprocmask resumed>, [], 8) = 0

[pid 10719] **clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7f79ef7fe990, parent_tid=0x7f79ef7fe990, exit_signal=0, stack=0x7f79eeffe000, stack_size=0x7ff7c0, tls=0x7f79ef7fe6c0}strace: Process 10721 attached**

=> {parent_tid=[10721]}, 88) = 10721

[pid 10721] rseq(0x7f79ef7fde40, 0x20, 0, 0x53053053 <unfinished ...>

[pid 10719] rt_sigprocmask(SIG_SETMASK, [] <unfinished ...>

[pid 10721] <... rseq resumed>)   = 0

[pid 10719] <... rt_sigprocmask resumed>, NULL, 8) = 0

[pid 10721] set_robust_list(0x7f79ef7fe9a0, 24 <unfinished ...>

[pid 10719] mmap(NULL, 4096, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0 <unfinished ...>

[pid 10721] <... set_robust_list resumed>) = 0

[pid 10719] <... mmap resumed>)   = 0x7f79f49e7000

[pid 10721] rt_sigprocmask(SIG_SETMASK, [] <unfinished ...>

[pid 10719] futex(0x7ffe9c028cd4, FUTEX_WAKE_PRIVATE, 1 <unfinished ...>

[pid 10721] <... rt_sigprocmask resumed>, NULL, 8) = 0

[pid 10719] <... futex resumed>)   = 0

[pid 10719] futex(0x7ffe9c028cd8, FUTEX_WAIT_PRIVATE, 0, NULL <unfinished ...>

[pid 10721] gettid()   = 10721

[pid 10721] mmap(NULL, 524288, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x7f79f32aa000

[pid 10721] madvise(0x7f79f32aa000, 524288, MADV_NOHUGEPAGE) = 0

[pid 10721] sched_getaffinity(10721, 32, [0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15]) = 8

[pid 10721] mmap(0x722800000000, 262144, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x722800000000

[pid 10721] mmap(0x722b80000000, 262144, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x722b80000000

[pid 10721] mmap(NULL, 262144, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f79f22af000

[pid 10721] mmap(0x2ef3ddfff000, 16756736, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x2ef3ddfff000

[pid 10721] madvise(0x2ef3ddfff000, 16756736, MADV_NOHUGEPAGE) = 0

[pid 10721] futex(0x7ffe9c028cd8, FUTEX_WAKE_PRIVATE, 1) = 1

[pid 10719] <... futex resumed>)   = 0

[pid 10721] mmap(0x720400000000, 262144, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0 <unfinished ...>

[pid 10719] mmap(NULL, 8392704, PROT_NONE,
MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0 <unfinished ...>

[pid 10721] <... mmap resumed>)   = 0x720400000000

[pid 10719] <... mmap resumed>)   = 0x7f79ee7fd000

[pid 10721] mmap(0x720780000000, 262144, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0 <unfinished ...>

[pid 10719] mprotect(0x7f79ee7fe000, 8388608, PROT_READ|PROT_WRITE <unfinished ...>

[pid 10721] <... mmap resumed>)   = 0x720780000000

[pid 10719] <... mprotect resumed>)   = 0

[pid 10719] rt_sigprocmask(SIG_BLOCK, ~[], [], 8) = 0

[pid 10719]
clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7f79eeffd990, parent_tid=0x7f79eeffd990, exit_signal=0, stack=0x7f79ee7fd000, stack_size=0x7ff7c0, tls=0x7f79eeffd6c0} <unfinished ...>

[pid 10721] mmap(0x72b000000000, 262144, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x72b000000000

strace: Process 10722 attached

[pid 10719] <... clone3 resumed> => {parent_tid=[10722]}, 88) = 10722

[pid 10721] mmap(0x72b380000000, 262144, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0 <unfinished ...>

[pid 10719] rt_sigprocmask(SIG_SETMASK, [] <unfinished ...>

[pid 10722] rseq(0x7f79eeffce40, 0x20, 0, 0x53053053 <unfinished ...>

[pid 10721] <... mmap resumed>)   = 0x72b380000000

[pid 10719] <... rt_sigprocmask resumed>, NULL, 8) = 0

[pid 10722] <... rseq resumed>)   = 0

[pid 10719] futex(0x7ffe9c028cd4, FUTEX_WAKE_PRIVATE, 1 <unfinished ...>

[pid 10722] set_robust_list(0x7f79eeffd9a0, 24 <unfinished ...>

[pid 10719] <... futex resumed>)   = 0

[pid 10722] <... set_robust_list resumed>) = 0

[pid 10719] futex(0x7ffe9c028cd8, FUTEX_WAIT_PRIVATE, 0, NULL <unfinished ...>

[pid 10722] rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0

[pid 10721] write(1, "Thread (id: 0) is working...\n", 29Thread (id: 0) is working...

) = 29

[pid 10721] madvise(0x2ef3ddffe000, 16760832, MADV_DONTNEED) = 0

[pid 10721] madvise(0x2ef3deffb000, 12288, MADV_DONTNEED <unfinished ...>

[pid 10722] gettid(<unfinished ...>

[pid 10721] <... madvise resumed>)   = 0

[pid 10722] <... gettid resumed>)   = 10722

[pid 10721] munmap(0x7f79f32aa000, 524288 <unfinished ...>

[pid 10722] mmap(NULL, 524288, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0 <unfinished ...>

[pid 10721] <... munmap resumed>) = 0

[pid 10722] <... mmap resumed>) = 0x7f79f32aa000

[pid 10722] madvise(0x7f79f32aa000, 524288, MADV_NOHUGEPAGE <unfinished ...>

[pid 10721] futex(0x7f79f437bfe8, FUTEX_WAIT_PRIVATE, 0, NULL <unfinished ...>

[pid 10722] <... madvise resumed>) = 0

[pid 10722] futex(0x7f79f437bfe8, FUTEX_WAKE_PRIVATE, 1) = 1

[pid 10721] <... futex resumed>) = 0

[pid 10721] clock_gettime(CLOCK_MONOTONIC <unfinished ...>

[pid 10722] sched_getaffinity(10722, 32 <unfinished ...>

[pid 10721] <... clock_gettime resumed>, {tv_sec=5613, tv_nsec=683097041}) = 0

[pid 10722] <... sched_getaffinity resumed>, [0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15]) = 8

[pid 10721] clock_gettime(CLOCK_MONOTONIC <unfinished ...>

[pid 10722] futex(0x730000000508, FUTEX_WAIT_PRIVATE, 0, NULL <unfinished ...>

[pid 10721] <... clock_gettime resumed>, {tv_sec=5613, tv_nsec=683142015}) = 0

[pid 10721] futex(0x730000000508, FUTEX_WAKE_PRIVATE, 1 <unfinished ...>

[pid 10722] <... futex resumed>) = 0

[pid 10721] <... futex resumed>) = 1

[pid 10722] mmap(NULL, 262144, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0 <unfinished ...>

[pid 10721] clock_gettime(CLOCK_MONOTONIC <unfinished ...>

[pid 10722] <... mmap resumed>) = 0x7f79f226f000

[pid 10721] <... clock_gettime resumed>, {tv_sec=5613, tv_nsec=683246820}) = 0

[pid 10722] mmap(0x2ef3dcffd000, 16756736, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0 <unfinished ...>

[pid 10721] rt_sigprocmask(SIG_BLOCK, ~[RT_1] <unfinished ...>

[pid 10722] <... mmap resumed>) = 0x2ef3dcffd000

[pid 10721] <... rt_sigprocmask resumed>, NULL, 8) = 0

[pid 10722] madvise(0x2ef3dcffd000, 16756736, MADV_NOHUGEPAGE <unfinished ...>

[pid 10721] madvise(0x7f79eeffe000, 8368128, MADV_DONTNEED <unfinished ...>

[pid 10722] <... madvise resumed>) = 0

[pid 10721] <... madvise resumed>) = 0

[pid 10721] exit(0 <unfinished ...>

[pid 10722] futex(0x7ffe9c028cd8, FUTEX_WAKE_PRIVATE, 1 <unfinished ...>

[pid 10721] <... exit resumed>)   = ?

[pid 10719] <... futex resumed>)   = 0

[pid 10722] <... futex resumed>)   = 1

[pid 10719] mmap(NULL, 8392704, PROT_NONE,
MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0 <unfinished ...>

[pid 10722] write(1, "Thread (id: 1) is working...\n", 29 <unfinished ...>

[pid 10721] +++ exited with 0 +++

Thread (id: 1) is working...

[pid 10719] <... mmap resumed>)   = 0x7f79edffc000

[pid 10722] <... write resumed>)   = 29

[pid 10719] mprotect(0x7f79edffd000, 8388608, PROT_READ|PROT_WRITE <unfinished ...>

[pid 10722] madvise(0x2ef3dcffc000, 16760832, MADV_DONTNEED <unfinished ...>

[pid 10719] <... mprotect resumed>)   = 0

[pid 10722] <... madvise resumed>)   = 0

[pid 10719] rt_sigprocmask(SIG_BLOCK, ~[] <unfinished ...>

[pid 10722] madvise(0x2ef3ddff9000, 12288, MADV_DONTNEED <unfinished ...>

[pid 10719] <... rt_sigprocmask resumed>, [], 8) = 0

[pid 10722] <... madvise resumed>)   = 0

[pid 10719]
**clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|
CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTI
D, child_tid=0x7f79ee7fc990, parent_tid=0x7f79ee7fc990, exit_signal=0, stack=0x7f79edffc000,
stack_size=0x7ff7c0, tls=0x7f79ee7fc6c0} <unfinished ...>**

[pid 10722] munmap(0x7f79f32aa000, 524288) = 0

strace: Process 10723 attached

[pid 10722] clock_gettime(CLOCK_MONOTONIC <unfinished ...>

[pid 10719] <... clone3 resumed> => {parent_tid=[10723]}, 88) = 10723

[pid 10723] rseq(0x7f79ee7fbe40, 0x20, 0, 0x53053053 <unfinished ...>

[pid 10722] <... clock_gettime resumed>, {tv_sec=5613, tv_nsec=683692300}) = 0

[pid 10719] rt_sigprocmask(SIG_SETMASK, [] <unfinished ...>

[pid 10723] <... rseq resumed>)   = 0

[pid 10719] <... rt_sigprocmask resumed>, NULL, 8) = 0

[pid 10722] clock_gettime(CLOCK_MONOTONIC <unfinished ...>

[pid 10723] set_robust_list(0x7f79ee7fc9a0, 24 <unfinished ...>

[pid 10719] futex(0x7ffe9c028cd4, FUTEX_WAKE_PRIVATE, 1 <unfinished ...>

[pid 10722] <... clock_gettime resumed>, {tv_sec=5613, tv_nsec=683764164}) = 0

[pid 10719] <... futex resumed>) = 0

[pid 10723] <... set_robust_list resumed>) = 0

[pid 10719] futex(0x7ffe9c028cd8, FUTEX_WAIT_PRIVATE, 0, NULL <unfinished ...>

[pid 10722] rt_sigprocmask(SIG_BLOCK, ~[RT_1] <unfinished ...>

[pid 10723] rt_sigprocmask(SIG_SETMASK, [] <unfinished ...>

[pid 10722] <... rt_sigprocmask resumed>, NULL, 8) = 0

[pid 10723] <... rt_sigprocmask resumed>, NULL, 8) = 0

[pid 10722] madvise(0x7f79ee7fd000, 8368128, MADV_DONTNEED <unfinished ...>

[pid 10723] gettid(<unfinished ...>

[pid 10722] <... madvise resumed>) = 0

[pid 10723] <... gettid resumed>) = 10723

[pid 10722] exit(0 <unfinished ...>

[pid 10723] mmap(NULL, 524288, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0 <unfinished ...>

[pid 10722] <... exit resumed>) = ?

[pid 10723] <... mmap resumed>) = 0x7f79f32aa000

[pid 10723] madvise(0x7f79f32aa000, 524288, MADV_NOHUGEPAGE <unfinished ...>

[pid 10722] +++ exited with 0 +++

[pid 10723] <... madvise resumed>) = 0

[pid 10723] sched_getaffinity(10723, 32, [0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15]) = 8

[pid 10723] mmap(NULL, 262144, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f79f222f000

[pid 10723] mmap(0x2ef3dbffb000, 16756736, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x2ef3dbffb000

[pid 10723] madvise(0x2ef3dbffb000, 16756736, MADV_NOHUGEPAGE) = 0

[pid 10723] futex(0x7ffe9c028cd8, FUTEX_WAKE_PRIVATE, 1 <unfinished ...>

[pid 10719] <... futex resumed>) = 0

[pid 10723] <... futex resumed>) = 1

[pid 10719] mmap(NULL, 8392704, PROT_NONE,
MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0 <unfinished ...>

[pid 10723] write(1, "Thread (id: 2) is working...\n", 29 <unfinished ...>

Thread (id: 2) is working...

[pid 10719] <... mmap resumed>) = 0x7f79ed7fb000

[pid 10723] <... write resumed>) = 29

[pid 10719] mprotect(0x7f79ed7fc000, 8388608, PROT_READ|PROT_WRITE <unfinished ...>

[pid 10723] madvise(0x2ef3dbffa000, 16760832, MADV_DONTNEED <unfinished ...>

[pid 10719] <... mprotect resumed>) = 0

[pid 10723] <... madvise resumed>) = 0

[pid 10723] madvise(0x2ef3dcff7000, 12288, MADV_DONTNEED) = 0

[pid 10719] rt_sigprocmask(SIG_BLOCK, ~[] <unfinished ...>

[pid 10723] munmap(0x7f79f32aa000, 524288 <unfinished ...>

[pid 10719] <... rt_sigprocmask resumed>, [], 8) = 0

[pid 10723] <... munmap resumed>) = 0

[pid 10719] clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7f79edffb990, parent_tid=0x7f79edffb990, exit_signal=0, stack=0x7f79ed7fb000, stack_size=0x7ff7c0, tls=0x7f79edffb6c0} <unfinished ...>

[pid 10723] clock_gettime(CLOCK_MONOTONIC, {tv_sec=5613, tv_nsec=684439132}) = 0

strace: Process 10724 attached

[pid 10723] clock_gettime(CLOCK_MONOTONIC <unfinished ...>

[pid 10719] <... clone3 resumed> => {parent_tid=[10724]}, 88) = 10724

[pid 10724] rseq(0x7f79edffae40, 0x20, 0, 0x53053053 <unfinished ...>

[pid 10723] <... clock_gettime resumed>, {tv_sec=5613, tv_nsec=684482323}) = 0

[pid 10719] rt_sigprocmask(SIG_SETMASK, [] <unfinished ...>

[pid 10724] <... rseq resumed>) = 0

[pid 10719] <... rt_sigprocmask resumed>, NULL, 8) = 0

[pid 10723] clock_gettime(CLOCK_MONOTONIC <unfinished ...>

[pid 10724] set_robust_list(0x7f79edffb9a0, 24 <unfinished ...>

[pid 10719] futex(0x7ffe9c028cd4, FUTEX_WAKE_PRIVATE, 1 <unfinished ...>

[pid 10724] <... set_robust_list resumed>) = 0

[pid 10723] <... clock_gettime resumed>, {tv_sec=5613, tv_nsec=684553104}) = 0

[pid 10719] <... futex resumed>) = 0

[pid 10724] rt_sigprocmask(SIG_SETMASK, [] <unfinished ...>

[pid 10719] futex(0x7ffe9c028cd8, FUTEX_WAIT_PRIVATE, 0, NULL <unfinished ...>

[pid 10723] rt_sigprocmask(SIG_BLOCK, ~[RT_1] <unfinished ...>

[pid 10724] <... rt_sigprocmask resumed>, NULL, 8) = 0

[pid 10723] <... rt_sigprocmask resumed>, NULL, 8) = 0

[pid 10724] gettid(<unfinished ...>

[pid 10723] madvise(0x7f79edffc000, 8368128, MADV_DONTNEED <unfinished ...>

[pid 10724] <... gettid resumed>)   = 10724

[pid 10723] <... madvise resumed>)   = 0

[pid 10724] mmap(NULL, 524288, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0 <unfinished ...>

[pid 10723] exit(0 <unfinished ...>

[pid 10724] <... mmap resumed>)   = 0x7f79f32aa000

[pid 10723] <... exit resumed>)   = ?

[pid 10724] madvise(0x7f79f32aa000, 524288, MADV_NOHUGEPAGE) = 0

[pid 10723] +++ exited with 0 +++

[pid 10724] sched_getaffinity(10724, 32, [0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15]) = 8

[pid 10724] mmap(NULL, 262144, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f79f21ef000

[pid 10724] mmap(0x2ef3daff9000, 16756736, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0) = 0x2ef3daff9000

[pid 10724] madvise(0x2ef3daff9000, 16756736, MADV_NOHUGEPAGE) = 0

[pid 10724] futex(0x7ffe9c028cd8, FUTEX_WAKE_PRIVATE, 1) = 1

[pid 10719] <... futex resumed>)   = 0

[pid 10719] mmap(NULL, 8392704, PROT_NONE,
MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0 <unfinished ...>

[pid 10724] write(1, "Thread (id: 3) is working...\n", 29 <unfinished ...>

Thread (id: 3) is working...

[pid 10719] <... mmap resumed>)   = 0x7f79ecffa000

[pid 10724] <... write resumed>)   = 29

[pid 10719] mprotect(0x7f79ecffb000, 8388608, PROT_READ|PROT_WRITE <unfinished ...>

[pid 10724] madvise(0x2ef3daff8000, 16760832, MADV_DONTNEED <unfinished ...>

[pid 10719] <... mprotect resumed>)   = 0

[pid 10724] <... madvise resumed>)   = 0

[pid 10719] rt_sigprocmask(SIG_BLOCK, ~[] <unfinished ...>

[pid 10724] madvise(0x2ef3dbff5000, 12288, MADV_DONTNEED <unfinished ...>

[pid 10719] <... rt_sigprocmask resumed>, [], 8) = 0

[pid 10724] <... madvise resumed>)   = 0

[pid 10719] clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x7f79ed7fa990, parent_tid=0x7f79ed7fa990, exit_signal=0, stack=0x7f79ecffa000, stack_size=0x7ff7c0, tls=0x7f79ed7fa6c0} <unfinished ...>

[pid 10724] munmap(0x7f79f32aa000, 524288strace: Process 10725 attached

) = 0

[pid 10719] <... clone3 resumed> => {parent_tid=[10725]}, 88) = 10725

[pid 10725] rseq(0x7f79ed7f9e40, 0x20, 0, 0x53053053 <unfinished ...>

[pid 10724] clock_gettime(CLOCK_MONOTONIC <unfinished ...>

[pid 10719] rt_sigprocmask(SIG_SETMASK, [] <unfinished ...>

[pid 10725] <... rseq resumed>)   = 0

[pid 10719] <... rt_sigprocmask resumed>, NULL, 8) = 0

[pid 10724] <... clock_gettime resumed>, {tv_sec=5613, tv_nsec=685263358}) = 0

[pid 10719] futex(0x7ffe9c028cd4, FUTEX_WAKE_PRIVATE, 1 <unfinished ...>

[pid 10725] set_robust_list(0x7f79ed7fa9a0, 24 <unfinished ...>

[pid 10719] <... futex resumed>)   = 0

[pid 10725] <... set_robust_list resumed>) = 0

[pid 10719] futex(0x7ffe9c028cd8, FUTEX_WAIT_PRIVATE, 0, NULL <unfinished ...>

[pid 10725] rt_sigprocmask(SIG_SETMASK, [] <unfinished ...>

[pid 10724] clock_gettime(CLOCK_MONOTONIC <unfinished ...>

[pid 10725] <... rt_sigprocmask resumed>, NULL, 8) = 0

[pid 10724] <... clock_gettime resumed>, {tv_sec=5613, tv_nsec=685371990}) = 0

[pid 10725] gettid(<unfinished ...>

[pid 10724] clock_gettime(CLOCK_MONOTONIC <unfinished ...>

[pid 10725] <... gettid resumed>)   = 10725

[pid 10724] <... clock_gettime resumed>, {tv_sec=5613, tv_nsec=685417145}) = 0

[pid 10725] mmap(NULL, 524288, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0 <unfinished ...>

[pid 10724] rt_sigprocmask(SIG_BLOCK, ~[RT_1] <unfinished ...>

[pid 10725] <... mmap resumed>)   = 0x7f79f32aa000

[pid 10725] madvise(0x7f79f32aa000, 524288, MADV_NOHUGEPAGE <unfinished ...>

[pid 10724] <... rt_sigprocmask resumed>, NULL, 8) = 0

[pid 10725] <... madvise resumed>)   = 0

[pid 10724] madvise(0x7f79ed7fb000, 8368128, MADV_DONTNEED <unfinished ...>

[pid 10725] sched_getaffinity(10725, 32, [0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15]) = 8

[pid 10724] <... madvise resumed>)   = 0

[pid 10725] mmap(NULL, 262144, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0 <unfinished ...>

[pid 10724] exit(0 <unfinished ...>

[pid 10725] <... mmap resumed>)   = 0x7f79f21af000

[pid 10724] <... exit resumed>)   = ?

[pid 10725] mmap(0x2ef3d9ff7000, 16756736, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS|MAP_NORESERVE, -1, 0 <unfinished ...>

[pid 10724] +++ exited with 0 +++

[pid 10725] <... mmap resumed>)   = 0x2ef3d9ff7000

[pid 10725] madvise(0x2ef3d9ff7000, 16756736, MADV_NOHUGEPAGE) = 0

[pid 10725] futex(0x7ffe9c028cd8, FUTEX_WAKE_PRIVATE, 1 <unfinished ...>

[pid 10719] <... futex resumed>)   = 0

[pid 10725] <... futex resumed>)   = 1

[pid 10719] futex(0x7f79ed7fa990, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 10725, NULL, FUTEX_BITSET_MATCH_ANY <unfinished ...>

[pid 10725] write(1, "Thread (id: 4) is working...\n", 29Thread (id: 4) is working...

) = 29

[pid 10725] madvise(0x2ef3d9ff6000, 16760832, MADV_DONTNEED) = 0

[pid 10725] madvise(0x2ef3daff3000, 12288, MADV_DONTNEED) = 0

[pid 10725] munmap(0x7f79f32aa000, 524288) = 0

[pid 10725] clock_gettime(CLOCK_MONOTONIC, {tv_sec=5613, tv_nsec=685971067}) = 0

[pid 10725] clock_gettime(CLOCK_MONOTONIC, {tv_sec=5613, tv_nsec=686008867}) = 0

[pid 10725] clock_gettime(CLOCK_MONOTONIC, {tv_sec=5613, tv_nsec=686045516}) = 0

[pid 10725] rt_sigprocmask(SIG_BLOCK, ~[RT_1], NULL, 8) = 0

[pid 10725] madvise(0x7f79ecffa000, 8368128, MADV_DONTNEED) = 0

[pid 10725] exit(0)   = ?

[pid 10719] <... futex resumed>)   = 0

[pid 10725] +++ exited with 0 +++

[pid 10719] munmap(0x7f79eeffe000, 8392704) = 0

[pid 10719] write(1, "Global sum is: 1190 == 1190 :int"..., 66Global sum is: 1190 == 1190 :inter_sum

Execution time is: 0.00616

) = 66

[pid 10719] mmap(NULL, 4096, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7f79f49e6000

[pid 10719] exit_group(0) = ?

[pid 10720] <... nanosleep resumed> <unfinished ...>) = ?

[pid 10720] +++ exited with 0 +++

+++ exited with 0 +++

Вывод

В ходе выполнения лабораторной работы были успешно изучены и применены основные системные вызовы для работы с потоками в ОС Linux. Была реализована программа, демонстрирующая создание потоков и вычисление суммы чисел в массивах.

Столкнулся с проблемой передачи аргументов в функцию, которая выполняется потоками.