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»

Группа: М8О-213Б-23

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Оценка: _____

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Постановка задачи

Вариант 13.

Наложить K раз фильтр, использующий матрицу свертки, на матрицу, состоящую из вещественных чисел. Размер окна задается пользователем.

Общий метод и алгоритм решения

Использованные системные вызовы:

- write() – записываем число байт из буфера в указанный файловый дескриптор
- read() - чтение данных из файлового дескриптора
- pthread_create() – создаем новый поток с атрибутами
- pthread_join() – ожидаем завершение потока

Создадим структуру матрицы, куда из файла будем вводить значения из матрицы. Генерируем матрицу свертки, размер которой задается ключом программы. Создаем потоки, количество которых задается ключом. В зависимости от количества потоков делим ряды матрицы между ними, каждый поток считает свой участок матрицы и записывает результат в новую матрицу. Если было введено K > 1, в изначальную матрицу копируем полученную матрицу, повторяем тот же алгоритм. После сохраняем результат в файл.

Количество потоков (K)	Производительность
1	5.93c
3	5.67c
5	5.40c

Код программы

main.c

```
#include <pthread.h>

#include <unistd.h>

#include <stdlib.h>

#include <time.h>

#include <fcntl.h>

#include <string.h>



#define EPS 0.0001
```

```
typedef struct Matrix {
    float** matrix;
    int rows;
    int columns;
} Matrix;


typedef struct ThreadData {
    float** input;
    float** kernel;
    float** output;
    int startRow;
    int endRow;
    int rows;
    int cols;
    int kernelSize;
    int id;
} ThreadData;


float** AllocateMatrix(int rows, int cols) {
    float** matrix = (float**)malloc(rows * sizeof(float*));
    for (int i = 0; i < rows; i++) {
        matrix[i] = (float*)calloc(cols, sizeof(float));
    }
    return matrix;
}
```

```
Matrix* CreateMatrix(int rows, int cols) {
    Matrix* m = (Matrix*)malloc(sizeof(Matrix));
    m->matrix = AllocateMatrix(rows + 2, cols + 2);
    m->rows = rows + 2;
    m->columns = cols + 2;
    return m;
}

void FreeMatrix(Matrix* m) {
    for (int i = 0; i < m->rows; i++) {
        free(m->matrix[i]);
    }
    free(m->matrix);
    free(m);
}

int ParseInt(const char* str, int* index) {
    int num = 0;
    while (str[*index] >= '0' && str[*index] <= '9') {
        num = num * 10 + (str[*index] - '0');
        (*index)++;
    }
    (*index)++;
    return num;
}
```

```
float ParseFloat(const char* str, int* index) {



    float num = 0;

    int sign = 1;

    if (str[*index] == '-') {

        sign = -1;

        (*index)++;

    }

    while (str[*index] >= '0' && str[*index] <= '9') {



        num = num * 10 + (str[*index] - '0');

        (*index)++;

    }

    if (str[*index] == '.') {

        (*index)++;

        float factor = 0.1;

        while (str[*index] >= '0' && str[*index] <= '9' &&
(factor > EPS)) {

            num += (str[*index] - '0') * factor;

            factor *= 0.1;

            (*index)++;

        }

    }

    (*index)++;

    return sign * num;

}
```

```
Matrix* ProcessFile(const char* filename) {
    int file = open(filename, O_RDONLY);
    if (file < 0) {
        char msg[] = "Ошибка: не удалось открыть файл.\n";
        write(STDERR_FILENO, msg, sizeof(msg) - 1);
        return NULL;
    }

    char buffer[100];
    int len = read(file, buffer, sizeof(buffer) - 1);
    if (len <= 0) {
        close(file);
        return NULL;
    }
    buffer[len] = '\0';

    int index = 0;
    int rows = ParseInt(buffer, &index);
    int cols = ParseInt(buffer, &index);

    Matrix* m = CreateMatrix(rows, cols);

     for (int i = 0; i < rows; i++) {
        for (int j = 0; j < cols; j++) {
            while (buffer[index] == ' ' || buffer[index] ==
'\n') {
```

```
                index++;
            }
            m->matrix[i+1][j+1] = ParseFloat(buffer, &index);
        }
    }
    close(file);
    return m;
}

void* ApplyConvolutionThread(void* arg) {
    ThreadData* data = (ThreadData*)arg;
    int offset = data->kernelSize / 2;

    for (int i = data->startRow; i < data->endRow; i++) {
        for (int j = offset; j < data->cols - offset; j++) {
            float sum = 0.0;
            int rowOffset = i - offset;
            int colOffset = j - offset;
            for (int ki = 0; ki < data->kernelSize; ki++) {
                for (int kj = 0; kj < data->kernelSize; kj++) {
                    sum += data->input[rowOffset + ki]
[colOffset + kj] * data->kernel[ki][kj];
                }
            }
            data->output[i][j] = sum;
        }
```

```
    }

    return NULL;
}

void FloatToStr(float num, char* buffer, int precision) {
    int i = 0;
    int integerPart = (int)num;
    float fractionalPart = num - integerPart;

    if (integerPart == 0) {
        buffer[i++] = '0';
    } else {
        if (integerPart < 0) {
            buffer[i++] = '-';
            integerPart = -integerPart;
            fractionalPart = -fractionalPart;
        }
        int start = i;
        while (integerPart > 0) {
            buffer[i++] = '0' + (integerPart % 10);
            integerPart /= 10;
        }
        for (int j = start; j < (i + start) / 2; j++) {
            char temp = buffer[j];
            buffer[j] = buffer[i - 1 - (j - start)];
            buffer[i - 1 - (j - start)] = temp;
```

```
        }
    }


    buffer[i++] = '.';


    for (int p = 0; p < precision; p++) {
        fractionalPart *= 10;
        int digit = (int)fractionalPart;
        buffer[i++] = '0' + digit;
        fractionalPart -= digit;
    }

    buffer[i] = '\0';
}

int SaveMatrixToFile(float** matrix, int rows, int cols, const
char* filename) {
    int file = open(filename, O_WRONLY | O_CREAT | O_TRUNC,
0644);
    if (file < 0) {
        char msg[] = "Ошибка: не удалось сохранить файл.\n";
        write(STDERR_FILENO, msg, sizeof(msg) - 1);
        return 0;
    }
```

```
    char buffer[50];
    for (int i = 1; i < rows - 1; i++) {
        for (int j = 1; j < cols - 1; j++) {
            FloatToStr(matrix[i][j], buffer, 2);
            int len = 0;
            while (buffer[len] != '\0') len++;
            buffer[len++] = ' ';
            write(file, buffer, len);
        }
        write(file, "\n", 1);
    }
    close(file);
    return 1;
}

void ApplyConvolution(float** input, float** kernel, float**
output, int rows, int cols, int kernelSize, int numThreads) {
    pthread_t threads[numThreads];
    ThreadData threadData[numThreads];

    int offset = kernelSize / 2;
    int rowsPerThread = (rows - 2 * offset) / numThreads;
    int extraRows = (rows - 2 * offset) % numThreads;

    for (int t = 0; t < numThreads; t++) {
        threadData[t].id = t;
        threadData[t].input = input;
```

```
        threadData[t].kernel = kernel;
        threadData[t].output = output;
        threadData[t].rows = rows;
        threadData[t].cols = cols;
        threadData[t].kernelSize = kernelSize;
        threadData[t].startRow = t * rowsPerThread + offset;
        threadData[t].endRow = (t + 1) * rowsPerThread +
offset;

        if (t == numThreads - 1) {
            threadData[t].endRow += extraRows;
        }

        pthread_create(&threads[t], NULL,
ApplyConvolutionThread, &threadData[t]);
    }

    for (int t = 0; t < numThreads; t++) {
        pthread_join(threads[t], NULL);
    }
}

int main(int argc, char* argv[]) {
    if (argc != 4) {
        char msg[] = "Usage: ./main <count> <kernel size>
<max_threads>\n";
        write(STDERR_FILENO, msg, sizeof(msg) - 1);
```

```
        return 1;
    }
    int K = atoi(argv[1]);
    int kernelSize = atoi(argv[2]);
    int countThread = atoi(argv[3]);

    Matrix* m = ProcessFile("gen.txt");

    if (kernelSize > m->rows || kernelSize > m->columns ||
kernelSize % 2 == 0) {
        char msg[] = "Некорректный размер окна свёртки.\n";
        write(STDERR_FILENO, msg, sizeof(msg) - 1);
        return -1;
    }

    float** kernel = AllocateMatrix(kernelSize, kernelSize);
    for (int i = 0; i < kernelSize; i++) {
        for (int j = 0; j < kernelSize; j++) {
            kernel[i][j] = 1.0;
        }
    }

    float** output = AllocateMatrix(m->rows, m->columns);

    for (int k = 0; k < K; k++) {
        ApplyConvolution(m->matrix, kernel, output, m->rows, m-
>columns, kernelSize, countThread);
```

```
        float** temp = m->matrix;
        m->matrix = output;
        output = temp;
    }

    if (!SaveMatrixToFile(m->matrix, m->rows, m->columns,
"output_matrix.txt")) {
        char msg[] = "Матрица не сохранена\n";
        write(STDERR_FILENO, msg, sizeof(msg) - 1);
        return 1;
    } else {
        char msg[] = "Матрица сохранена\n";
        write(STDERR_FILENO, msg, sizeof(msg) - 1);
        return 1;
    }

    FreeMatrix(m);
    free(output);
    free(kernel);

    return 0;
}
```

Протокол работы программы

Некорректный ввод:

```
traktor@traktor-MaiBook-X-series:~/OS/MAI_OS/lab02$ ./main13
Usage: ./main <count> <kernel size> <max_threads>
```

10 раз, 3x3 окно, максимум 2 потока:

```
traktor@traktor-MaiBook-X-series:~/OS/MAI_OS/lab02$ ./a.out 10 3 2
Матрица сохранена
```

Strace:

strace -f ./main 3 3 3

execve("./main", ["./main", "3", "3", "3"], 0x7fffd47b0810 /* 79 vars */) = 0
brk(NULL) = 0x5b306c263000
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x723016222000
access("/etc/ld.so.preload", R_OK) = -1 ENOENT (Нет такого файла или каталога) openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3
fstat(3, {st_mode=S_IFREG|0644, st_size=73955, ...}) = 0
mmap(NULL, 73955, PROT_READ, MAP_PRIVATE, 3, 0) = 0x72301620f000
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\0\220\243\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
fstat(3, {st_mode=S_IFREG|0755, st_size=2125328, ...}) = 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, 2170256, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x723015e00000
mmap(0x723015e28000, 1605632, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x28000) = 0x723015e28000
mmap(0x723015fb0000, 323584, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1b0000) = 0x723015fb0000
mmap(0x723015fff000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1fe000) = 0x723015fff000
mmap(0x723016005000, 52624, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x723016005000
close(3) = 0
mmap(NULL, 12288, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x72301620c000
arch_prctl(ARCH_SET_FS, 0x72301620c740) = 0
set_tid_address(0x72301620ca10) = 117489
set_robust_list(0x72301620ca20, 24) = 0
rseq(0x72301620d060, 0x20, 0, 0x53053053) = 0
mprotect(0x723015fff000, 16384, PROT_READ) = 0
mprotect(0x5b306c020000, 4096, PROT_READ) = 0
mprotect(0x72301625a000, 8192, PROT_READ) = 0
prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024, rlim_max=RLIM64_INFINITY}) = 0
munmap(0x72301620f000, 73955) = 0
openat(AT_FDCWD, "gen.txt", O_RDONLY) = 3
read(3, "10 10\n91.78 92.73 1.61 42.26 81."..., 100) = 100
getrandom("\x7d\x64\xb1\xb5\xad\x76\x73\xe4", 8, GRND_NONBLOCK) = 8
brk(NULL) = 0x5b306c263000
brk(0x5b306c284000) = 0x5b306c284000
read(3, "14.09 29.04 57.49 92.21 84.69 69"..., 100) = 100
read(3, "85.97 36.80 8.64 33.25 61.40 82."..., 100) = 100
read(3, "4.45 55.14 41.29 75.15 89.68 36."..., 100) = 100
read(3, "2.10 4.49 3.57 38.45 91.77 58.37"..., 100) = 100
read(3, ".36 55.22 59.64 67.33 6.25 88.16"..., 100) = 100
read(3, "44 24.70 88.27 68.98 20.86 14.79"..., 100) = 100

read(3, "43 46.34 82.95 11.50 38.20 83.99"..., 100) = 100
read(3, "5.30 3.78 2.23 64.23 34.72 25.77"..., 100) = 100
read(3, ".56 93.06 43.97 38.42 36.03 27.8"..., 100) = 100
read(3, "7 43.36 19.94 33.13 90.47 52.45 "..., 100) = 100
read(3, "1 94.02 81.59 23.83 99.33 25.32 "..., 100) = 100
read(3, " 93.12 62.32 24.95 65.85 12.40 3"..., 100) = 100
read(3, "17 51.31 86.01 43.94 55.14 41.37"..., 100) = 100
read(3, "0.71 15.45 25.40 55.74 31.07 17."..., 100) = 100
read(3, "8.62 72.08 23.62 43.19 22.98 5.7"..., 100) = 100
read(3, "0.26 49.67 70.84 5.96 6.11 3.00 "..., 100) = 100
read(3, " 97.25 49.46 3.03 61.06 27.51 56"..., 100) = 100
read(3, "34.09 29.80 71.68 75.75 39.30 56"..., 100) = 100
read(3, "0 91.69 54.51 81.87 67.24 55.84 "..., 100) = 100
read(3, ".55 57.72 22.14 78.47 71.36 75.6"..., 100) = 100
read(3, "35 60.53 20.03 62.93 30.82 71.72"..., 100) = 100
read(3, "9.41 41.73 90.71 57.00 46.87 82."..., 100) = 100
read(3, "20.55 14.23 95.18 3.38 71.30 64."..., 100) = 100
read(3, " 1.42 5.70 62.79 29.39 35.26 59."..., 100) = 100
read(3, "77.41 50.78 61.25 11.48 32.20 45"..., 100) = 100
read(3, " 45.60 75.09 98.57 4.57 49.58 94"..., 100) = 100
read(3, "7 10.83 14.13 32.01 69.04 20.69 "..., 100) = 100
read(3, "46 83.54 42.99 24.88 69.96 70.48"..., 100) = 100
read(3, ".46 73.95 69.52 45.82 18.29 86.2"..., 100) = 100
read(3, "6.39 28.80 21.96 39.18 50.43 21."..., 100) = 100
read(3, ".81 25.13 42.47 9.78 21.89 21.62"..., 100) = 100
read(3, ".73 19.49 40.19 13.64 22.69 86.2"..., 100) = 100
read(3, "37 28.40 67.63 7.49 65.37 0.29 8"..., 100) = 100
read(3, " 40.43 53.07 50.02 1.02 96.87 24"..., 100) = 100
read(3, " 6.21 65.79 31.02 17.03 40.24 60"..., 100) = 100
read(3, " 17.65 68.15 32.95 65.97 9.80 38"..., 100) = 100
read(3, "7 15.40 87.22 10.97 40.18 42.48 "..., 100) = 100
read(3, "22 45.86 58.99 31.10 63.69 2.03 "..., 100) = 100
read(3, "16 28.51 37.25 30.58 20.08 29.73"..., 100) = 100
read(3, "3.18 27.88 21.13 45.59 7.26 0.80"..., 100) = 100
read(3, "4 30.02 37.14 18.33 59.88 17.73 "..., 100) = 100
read(3, ".44 74.44 71.92 18.60 42.28 72.1"..., 100) = 100
read(3, "4.59 92.98 50.10 51.36 63.77 7.6"..., 100) = 100
read(3, "7.24 49.65 59.86 78.94 67.31 82."..., 100) = 100
read(3, "8.74 64.98 40.53 65.21 59.64 37."..., 100) = 100
read(3, ".91 88.23 50.06 54.97 43.37 66.5"..., 100) = 100
read(3, ".72 64.17 87.74 81.68 68.47 75.8"..., 100) = 100
read(3, "54.41 69.38 80.65 84.52 63.12 40"..., 100) = 100
read(3, "3 4.72 99.57 62.36 50.30 88.12 7"..., 100) = 100
read(3, " 29.80 63.44 83.21 52.67 3.04 70"..., 100) = 100
read(3, "5 20.38 0.81 74.57 87.53 85.28 6"..., 100) = 100
read(3, "5 84.65 90.20 92.67 99.73 42.17 "..., 100) = 100
read(3, "78.35 93.62 70.46 70.81 27.36 27"..., 100) = 100
read(3, " 45.89 37.43 13.39 27.63 30.36 1"..., 100) = 100
read(3, "37 24.16 59.35 92.72 18.36 82.98"..., 100) = 100
read(3, "3.57 3.46 4.40 37.32 25.94 64.98"..., 100) = 100
read(3, ".43 92.39 68.64 30.68 28.66 14.7"..., 100) = 100
read(3, "7.56 49.62 50.02 39.06 5.58 5.46"..., 100) = 100
read(3, "0.63 80.50 95.23 25.09 50.51 41."..., 100) = 100
read(3, " 35.24 68.58 78.28 70.80 68.49 3"..., 100) = 100
read(3, " 21.29 98.53 24.06 90.76 55.65 2"..., 100) = 100
read(3, "0 3.27 93.89 1.40 59.51 88.60 7."..., 100) = 100
read(3, " 0.82 44.91 11.18 81.28 38.32 12"..., 100) = 100

read(3, " 4.73 39.83 19.25 79.92 35.03 11"..., 100) = 100
read(3, "92.75 85.86 94.19 67.86 40.37 3."..., 100) = 100
read(3, "5.49 83.22 38.07 98.12 0.58 38.6"..., 100) = 100
read(3, "21.39 87.88 33.21 21.19 71.80 78"..., 100) = 100
read(3, "7 38.83 18.67 76.53 50.31 1.28 2"..., 100) = 100
read(3, "75 82.74 33.26 31.58 61.06 99.82"..., 100) = 100
read(3, "8 96.32 20.64 13.43 60.74 75.31 "..., 100) = 100
read(3, "0 45.55 54.94 70.44 93.28 28.31 "..., 100) = 100
read(3, "4 47.17 91.88 13.59 33.98 57.20 "..., 100) = 100
read(3, ".35 78.90 54.61 56.26 54.78 56.0"..., 100) = 100
read(3, "5.88 58.02 92.92 49.68 52.40 34."..., 100) = 100
read(3, "9.20 64.60 77.00 39.54 95.94 45."..., 100) = 100
read(3, "2.22 41.31 30.68 47.47 9.95 45.3"..., 100) = 100
read(3, "0.65 94.05 59.78 0.64 17.27 74.1"..., 100) = 100
read(3, ".02 78.57 58.85 45.79 28.52 67.8"..., 100) = 100
read(3, ".13 12.42 30.02 69.63 96.74 0.82"..., 100) = 100
read(3, "53 11.04 6.77 38.02 55.81 66.50 "..., 100) = 100
read(3, ".58 46.42 20.56 58.61 30.26 84.7"..., 100) = 100
read(3, "83.71 47.25 89.21 24.72 85.00 46"..., 100) = 100
read(3, "5.50 30.45 33.56 49.44 27.35 87."..., 100) = 100
read(3, "19.29 51.43 78.77 86.13 70.27 44"..., 100) = 100
read(3, " 92.28 1.98 77.49 39.61 6.33 42."..., 100) = 100
read(3, "3.49 74.67 24.78 43.71 53.48 15."..., 100) = 100
read(3, "32 14.84 26.15 44.67 41.46 79.66"..., 100) = 100
read(3, "2.31 16.71 33.62 80.02 77.29 36."..., 100) = 100
read(3, "41.31 83.24 89.14 72.51 94.34 16"..., 100) = 100
read(3, "2.90 2.48 89.14 44.81 96.29 70.7"..., 100) = 100
read(3, "0.54 9.54 94.93 57.22 16.85 6.90"..., 100) = 100
read(3, ".07 34.89 49.93 61.31 31.00 40.0"..., 100) = 100
read(3, "2.51 25.06 79.24 14.97 42.84 46."..., 100) = 100
read(3, "79.72 66.53 39.07 31.22 76.96 65"..., 100) = 100
read(3, " 3.29 89.44 52.00 29.20 69.37 19"..., 100) = 100
read(3, "1 68.75 70.88 92.39 83.43 47.19 "..., 100) = 100
read(3, "26 9.55 23.73 3.33 0.78 63.07 42"..., 100) = 100
read(3, "90.26 32.02 71.02 87.04 32.93 59"..., 100) = 100
read(3, " 27.52 11.42 22.47 20.16 62.97 2"..., 100) = 100
read(3, "0 45.24 3.89 56.66 50.59 63.79 9"..., 100) = 100
close(3) = 0
clock_gettime(CLOCK_PROCESS_CPUTIME_ID, {tv_sec=0, tv_nsec=2007604}) = 0
rt_sigaction(SIGRT_1, {sa_handler=0x723015e99520, sa_mask=[], sa_flags=SA_RESTORER|
SA_ONSTACK|SA_RESTART|SA_SIGINFO, sa_restorer=0x723015e45320}, 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) =
0x723015400000
mprotect(0x723015401000, 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=0x723015c00990, parent_tid=0x723015c00990, exit_signal=0, stack=0x723015400000,
stack_size=0x7fff80, tls=0x723015c006c0}strace: Process 117490 attached
=> {parent_tid=[117490]}, 88) = 117490**
[pid 117489] rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0
**[pid 117489] mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|
MAP_STACK, -1, 0 <unfinished ...>**
[pid 117490] rseq(0x723015c00fe0, 0x20, 0, 0x53053053 <unfinished ...>
[pid 117489] <... mmap resumed>) = 0x723014a00000
[pid 117490] <... rseq resumed>) = 0

[pid 117489] mprotect(0x723014a01000, 8388608, PROT_READ|PROT_WRITE <unfinished ...>
[pid 117490] set_robust_list(0x723015c009a0, 24 <unfinished ...>
[pid 117489] <... mprotect resumed>) = 0
[pid 117490] <... set_robust_list resumed>) = 0
[pid 117489] rt_sigprocmask(SIG_BLOCK, ~[], <unfinished ...>
[pid 117490] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
[pid 117489] <... rt_sigprocmask resumed>[], 8) = 0
[pid 117490] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 117489] clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x723015200990, parent_tid=0x723015200990, exit_signal=0, stack=0x723014a00000, stack_size=0x7fff80, tls=0x7230152006c0} <unfinished ...>
[pid 117490] write(1, "\320\240\320\260\320\261\320\276\321\202\320\260\320\265\321\202 0 \
320\277\320\276\321\202\320\276\320\272 \321\201"..., 49strace: Process 117491 attached
 <unfinished ...>
[pid 117489] <... clone3 resumed> => {parent_tid=[117491]}, 88) = 117491
[pid 117489] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
[pid 117491] rseq(0x723015200fe0, 0x20, 0, 0x53053053 <unfinished ...>
[pid 117489] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 117490] <... write resumed>) = 49
[pid 117489] mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0 <unfinished ...>
[pid 117491] <... rseq resumed>) = 0
[pid 117489] <... mmap resumed>) = 0x723014000000
[pid 117490] write(1, "0 \320\277\320\276\321\202\320\276\320\272 \
320\267\320\260\320\272\320\276\320\275\321\207\320\270\320\273 \321\200"..., 43 <unfinished ...>
[pid 117489] mprotect(0x723014001000, 8388608, PROT_READ|PROT_WRITE <unfinished ...>
[pid 117491] set_robust_list(0x7230152009a0, 24 <unfinished ...>
[pid 117489] <... mprotect resumed>) = 0
[pid 117490] <... write resumed>) = 43
[pid 117489] rt_sigprocmask(SIG_BLOCK, ~[], <unfinished ...>
[pid 117491] <... set_robust_list resumed>) = 0
[pid 117489] <... rt_sigprocmask resumed>[], 8) = 0
[pid 117490] rt_sigprocmask(SIG_BLOCK, ~[RT_1], <unfinished ...>
[pid 117489] clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x723014800990, parent_tid=0x723014800990, exit_signal=0, stack=0x723014000000, stack_size=0x7fff80, tls=0x7230148006c0} <unfinished ...>
[pid 117491] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
[pid 117490] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 117491] <... rt_sigprocmask resumed>NULL, 8) = 0
strace: Process 117492 attached
[pid 117489] <... clone3 resumed> => {parent_tid=[117492]}, 88) = 117492
[pid 117490] madvise(0x723015400000, 8368128, MADV_DONTNEED <unfinished ...>
[pid 117491] write(1, "\320\240\320\260\320\261\320\276\321\202\320\260\320\265\321\202 1 \
320\277\320\276\321\202\320\276\320\272 \321\201"..., 49 <unfinished ...>
[pid 117489] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
[pid 117492] rseq(0x723014800fe0, 0x20, 0, 0x53053053 <unfinished ...>
[pid 117490] <... madvise resumed>) = 0
[pid 117489] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 117492] <... rseq resumed>) = 0
[pid 117491] <... write resumed>) = 49
[pid 117489] futex(0x723015c00990, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 117490, NULL, FUTEX_BITSET_MATCH_ANY <unfinished ...>
[pid 117492] set_robust_list(0x7230148009a0, 24 <unfinished ...>
[pid 117490] exit(0 <unfinished ...>
[pid 117492] <... set_robust_list resumed>) = 0

[pid 117491] write(1, "1 \320\277\320\276\321\202\320\276\320\272 \
320\267\320\260\320\272\320\276\320\275\321\207\320\270\320\273 \321\200"..., 43 <unfinished ...>
[pid 117492] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
[pid 117490] <... exit resumed>) = ?
[pid 117492] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 117491] <... write resumed>) = 43
[pid 117492] futex(0x5b306c021040, FUTEX_WAIT_PRIVATE, 2, NULL <unfinished ...>
[pid 117489] <... futex resumed>) = 0
[pid 117491] futex(0x5b306c021040, FUTEX_WAKE_PRIVATE, 1 <unfinished ...>
[pid 117490] +++ exited with 0 +++
[pid 117489] futex(0x723015200990, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 117491, NULL, FUTEX_BITSET_MATCH_ANY <unfinished ...>
[pid 117492] <... futex resumed>) = -1 EAGAIN (Ресурс временно недоступен)
[pid 117491] <... futex resumed>) = 0
[pid 117492] write(1, "\320\240\320\260\320\261\320\276\321\202\320\260\320\265\321\202 2 \
320\277\320\276\321\202\320\276\320\272 \321\201"..., 50 <unfinished ...>
[pid 117491] rt_sigprocmask(SIG_BLOCK, ~[RT_1], <unfinished ...>
[pid 117492] <... write resumed>) = 50
[pid 117491] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 117492] futex(0x5b306c021040, FUTEX_WAKE_PRIVATE, 1 <unfinished ...>
[pid 117491] madvise(0x723014a00000, 8368128, MADV_DONTNEED <unfinished ...>
[pid 117492] <... futex resumed>) = 0
[pid 117491] <... madvise resumed>) = 0
[pid 117492] write(1, "2 \320\277\320\276\321\202\320\276\320\272 \
320\267\320\260\320\272\320\276\320\275\321\207\320\270\320\273 \321\200"..., 43 <unfinished ...>
[pid 117491] exit(0 <unfinished ...>
[pid 117492] <... write resumed>) = 43
[pid 117491] <... exit resumed>) = ?
[pid 117492] rt_sigprocmask(SIG_BLOCK, ~[RT_1], <unfinished ...>
[pid 117491] +++ exited with 0 +++
[pid 117489] <... futex resumed>) = 0
[pid 117492] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 117489] futex(0x723014800990, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 117492, NULL, FUTEX_BITSET_MATCH_ANY <unfinished ...>
[pid 117492] madvise(0x723014000000, 8368128, MADV_DONTNEED) = 0
[pid 117492] exit(0) = ?
[pid 117489] <... futex resumed>) = 0
[pid 117492] +++ exited with 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=0x723014800990, parent_tid=0x723014800990, exit_signal=0, stack=0x723014000000, stack_size=0x7fff80, tls=0x7230148006c0}strace: Process 117493 attached
=> {parent_tid=[117493]}, 88) = 117493
[pid 117493] rseq(0x723014800fe0, 0x20, 0, 0x53053053 <unfinished ...>
[pid 117489] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
[pid 117493] <... rseq resumed>) = 0
[pid 117489] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 117493] set_robust_list(0x7230148009a0, 24 <unfinished ...>
[pid 117489] rt_sigprocmask(SIG_BLOCK, ~[], <unfinished ...>
[pid 117493] <... set_robust_list resumed>) = 0
[pid 117489] <... rt_sigprocmask resumed>[], 8) = 0
[pid 117493] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
[pid 117489] clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x723015200990, parent_tid=0x723015200990, exit_signal=0, stack=0x723014a00000, stack_size=0x7fff80, tls=0x7230152006c0} <unfinished ...>

[pid 117493] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 117493] write(1, "\320\240\320\260\320\261\320\276\321\202\320\260\320\265\321\202 0 \
320\277\320\276\321\202\320\276\320\272 \321\201"..., 49strace: Process 117494 attached
 <unfinished ...>
[pid 117489] <... clone3 resumed> => {parent_tid=[117494]}, 88) = 117494
[pid 117494] rseq(0x723015200fe0, 0x20, 0, 0x53053053 <unfinished ...>
[pid 117489] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
[pid 117493] <... write resumed>)   = 49
[pid 117489] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 117494] <... rseq resumed>)   = 0
[pid 117489] rt_sigprocmask(SIG_BLOCK, ~[], <unfinished ...>
[pid 117493] write(1, "0 \320\277\320\276\321\202\320\276\320\272 \
320\267\320\260\320\272\320\276\320\275\321\207\320\270\320\273 \321\200"..., 43 <unfinished ...>
[pid 117489] <... rt_sigprocmask resumed>[], 8) = 0
[pid 117494] set_robust_list(0x7230152009a0, 24 <unfinished ...>
**[pid 117489] clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|
CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|
CLONE_CHILD_CLEARTID, child_tid=0x723015c00990, parent_tid=0x723015c00990,
exit_signal=0, stack=0x723015400000, stack_size=0x7fff80, tls=0x723015c006c0} <unfinished ...>**
[pid 117493] <... write resumed>)   = 43
[pid 117494] <... set_robust_list resumed>) = 0
[pid 117493] rt_sigprocmask(SIG_BLOCK, ~[RT_1], strace: Process 117495 attached
 <unfinished ...>
[pid 117494] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
[pid 117493] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 117489] <... clone3 resumed> => {parent_tid=[117495]}, 88) = 117495
[pid 117495] rseq(0x723015c00fe0, 0x20, 0, 0x53053053 <unfinished ...>
[pid 117494] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 117489] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
[pid 117495] <... rseq resumed>)   = 0
[pid 117493] madvise(0x723014000000, 8368128, MADV_DONTNEED <unfinished ...>
[pid 117489] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 117495] set_robust_list(0x723015c009a0, 24 <unfinished ...>
[pid 117494] write(1, "\320\240\320\260\320\261\320\276\321\202\320\260\320\265\321\202 1 \
320\277\320\276\321\202\320\276\320\272 \321\201"..., 49 <unfinished ...>
**[pid 117489] futex(0x723014800990, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME,
117493, NULL, FUTEX_BITSET_MATCH_ANY <unfinished ...>**
[pid 117495] <... set_robust_list resumed>) = 0
[pid 117493] <... madvise resumed>)   = 0
[pid 117494] <... write resumed>)   = 49
[pid 117495] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
[pid 117494] write(1, "1 \320\277\320\276\321\202\320\276\320\272 \
320\267\320\260\320\272\320\276\320\275\321\207\320\270\320\273 \321\200"..., 43 <unfinished ...>
[pid 117493] exit(0 <unfinished ...>
[pid 117495] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 117494] <... write resumed>)   = 43
[pid 117493] <... exit resumed>)   = ?
[pid 117495] futex(0x5b306c021040, FUTEX_WAIT_PRIVATE, 2, NULL <unfinished ...>
[pid 117494] futex(0x5b306c021040, FUTEX_WAKE_PRIVATE, 1 <unfinished ...>
[pid 117489] <... futex resumed>)   = 0
[pid 117495] <... futex resumed>)   = -1 EAGAIN (Ресурс временно недоступен)
[pid 117493] +++ exited with 0 +++
[pid 117494] <... futex resumed>)   = 0
**[pid 117489] futex(0x723015200990, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME,
117494, NULL, FUTEX_BITSET_MATCH_ANY <unfinished ...>**
[pid 117495] write(1, "\320\240\320\260\320\261\320\276\321\202\320\260\320\265\321\202 2 \
320\277\320\276\321\202\320\276\320\272 \321\201"..., 50 <unfinished ...>

[pid 117494] rt_sigprocmask(SIG_BLOCK, ~[RT_1], NULL, 8) = 0
[pid 117495] <... write resumed>)   = 50
[pid 117494] madvise(0x723014a00000, 8368128, MADV_DONTNEED <unfinished ...>
[pid 117495] futex(0x5b306c021040, FUTEX_WAKE_PRIVATE, 1 <unfinished ...>
[pid 117494] <... madvise resumed>)   = 0
[pid 117495] <... futex resumed>)   = 0
[pid 117494] exit(0 <unfinished ...>
[pid 117495] write(1, "2 \320\277\320\276\321\202\320\276\320\272 \
320\267\320\260\320\272\320\276\320\275\321\207\320\270\320\273 \321\200"..., 43 <unfinished ...>
[pid 117494] <... exit resumed>)   = ?
[pid 117489] <... futex resumed>)   = 0
[pid 117495] <... write resumed>)   = 43
[pid 117494] +++ exited with 0 +++
[pid 117489] futex(0x723015c00990, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME,
117495, NULL, FUTEX_BITSET_MATCH_ANY <unfinished ...>
[pid 117495] rt_sigprocmask(SIG_BLOCK, ~[RT_1], NULL, 8) = 0
[pid 117495] madvise(0x723015400000, 8368128, MADV_DONTNEED) = 0
[pid 117495] exit(0)   = ?
[pid 117489] <... futex resumed>)   = 0
[pid 117495] +++ exited with 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=0x723015c00990, parent_tid=0x723015c00990, exit_signal=0, stack=0x723015400000,
stack_size=0x7fff80, tls=0x723015c006c0}strace: Process 117496 attached
=> {parent_tid=[117496]}, 88) = 117496
[pid 117489] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
[pid 117496] rseq(0x723015c00fe0, 0x20, 0, 0x53053053 <unfinished ...>
[pid 117489] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 117496] <... rseq resumed>)   = 0
[pid 117489] rt_sigprocmask(SIG_BLOCK, ~[], <unfinished ...>
[pid 117496] set_robust_list(0x723015c009a0, 24 <unfinished ...>
[pid 117489] <... rt_sigprocmask resumed>[], 8) = 0
[pid 117496] <... set_robust_list resumed>) = 0
[pid 117489] clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|
CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|
CLONE_CHILD_CLEARTID, child_tid=0x723015200990, parent_tid=0x723015200990,
exit_signal=0, stack=0x723014a00000, stack_size=0x7fff80, tls=0x7230152006c0} <unfinished ...>
[pid 117496] rt_sigprocmask(SIG_SETMASK, [], strace: Process 117497 attached
NULL, 8) = 0
[pid 117489] <... clone3 resumed> => {parent_tid=[117497]}, 88) = 117497
[pid 117497] rseq(0x723015200fe0, 0x20, 0, 0x53053053 <unfinished ...>
[pid 117489] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
[pid 117496] write(1, "\320\240\320\260\320\261\320\276\321\202\320\260\320\265\321\202 0 \
320\277\320\276\321\202\320\276\320\272 \321\201"..., 49 <unfinished ...>
[pid 117489] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 117497] <... rseq resumed>)   = 0
[pid 117489] rt_sigprocmask(SIG_BLOCK, ~[], <unfinished ...>
[pid 117496] <... write resumed>)   = 49
[pid 117489] <... rt_sigprocmask resumed>[], 8) = 0
[pid 117497] set_robust_list(0x7230152009a0, 24 <unfinished ...>
[pid 117489] clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|
CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|
CLONE_CHILD_CLEARTID, child_tid=0x723014800990, parent_tid=0x723014800990,
exit_signal=0, stack=0x723014000000, stack_size=0x7fff80, tls=0x7230148006c0} <unfinished ...>
[pid 117496] write(1, "0 \320\277\320\276\321\202\320\276\320\272 \
320\267\320\260\320\272\320\276\320\275\321\207\320\270\320\273 \321\200"..., 43 <unfinished ...>

[pid 117497] <... set_robust_list resumed>) = 0
strace: Process 117498 attached
[pid 117497] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
[pid 117496] <... write resumed>) = 43
[pid 117489] <... clone3 resumed> => {parent_tid=[117498]}, 88) = 117498
[pid 117498] rseq(0x723014800fe0, 0x20, 0, 0x53053053 <unfinished ...>
[pid 117496] rt_sigprocmask(SIG_BLOCK, ~[RT_1], <unfinished ...>
[pid 117489] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
[pid 117498] <... rseq resumed>) = 0
[pid 117497] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 117496] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 117489] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 117498] set_robust_list(0x7230148009a0, 24 <unfinished ...>
[pid 117497] write(1, "\320\240\320\260\320\261\320\276\321\202\320\260\320\265\321\202 1 \ 320\277\320\276\321\202\320\276\320\272 \321\201"..., 49 <unfinished ...>
[pid 117489] futex(0x723015c00990, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 117496, NULL, FUTEX_BITSET_MATCH_ANY <unfinished ...>
[pid 117498] <... set_robust_list resumed>) = 0
[pid 117496] madvise(0x723015400000, 8368128, MADV_DONTNEED <unfinished ...>
[pid 117498] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>
[pid 117497] <... write resumed>) = 49
[pid 117498] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 117496] <... madvise resumed>) = 0
[pid 117498] futex(0x5b306c021040, FUTEX_WAIT_PRIVATE, 2, NULL <unfinished ...>
[pid 117497] write(1, "1 \320\277\320\276\321\202\320\276\320\272 \
320\267\320\260\320\272\320\276\320\275\321\207\320\270\320\273 \321\200"..., 43 <unfinished ...>
[pid 117496] exit(0 <unfinished ...>
[pid 117497] <... write resumed>) = 43
[pid 117496] <... exit resumed>) = ?
[pid 117497] futex(0x5b306c021040, FUTEX_WAKE_PRIVATE, 1 <unfinished ...>
[pid 117498] <... futex resumed>) = 0
[pid 117489] <... futex resumed>) = 0
[pid 117497] <... futex resumed>) = 1
[pid 117496] +++ exited with 0 +++
[pid 117489] futex(0x723015200990, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 117497, NULL, FUTEX_BITSET_MATCH_ANY <unfinished ...>
[pid 117498] write(1, "\320\240\320\260\320\261\320\276\321\202\320\260\320\265\321\202 2 \ 320\277\320\276\321\202\320\276\320\272 \321\201"..., 50 <unfinished ...>
[pid 117497] rt_sigprocmask(SIG_BLOCK, ~[RT_1], <unfinished ...>
[pid 117498] <... write resumed>) = 50
[pid 117497] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 117498] futex(0x5b306c021040, FUTEX_WAKE_PRIVATE, 1 <unfinished ...>
[pid 117497] madvise(0x723014a00000, 8368128, MADV_DONTNEED <unfinished ...>
[pid 117498] <... futex resumed>) = 0
[pid 117497] <... madvise resumed>) = 0
[pid 117498] write(1, "2 \320\277\320\276\321\202\320\276\320\272 \
320\267\320\260\320\272\320\276\320\275\321\207\320\270\320\273 \321\200"..., 43 <unfinished ...>
[pid 117497] exit(0 <unfinished ...>
[pid 117498] <... write resumed>) = 43
[pid 117497] <... exit resumed>) = ?
[pid 117498] rt_sigprocmask(SIG_BLOCK, ~[RT_1], <unfinished ...>
[pid 117497] +++ exited with 0 +++
[pid 117489] <... futex resumed>) = 0
[pid 117498] <... rt_sigprocmask resumed>NULL, 8) = 0
[pid 117489] futex(0x723014800990, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 117498, NULL, FUTEX_BITSET_MATCH_ANY <unfinished ...>
[pid 117498] madvise(0x723014000000, 8368128, MADV_DONTNEED) = 0

```
[pid 117498] exit(0)                    = ?
[pid 117498] +++ exited with 0 +++
<... futex resumed>)                    = 0
clock_gettime(CLOCK_PROCESS_CPUTIME_ID, {tv_sec=0, tv_nsec=3169522}) = 0
fstat(1, {st_mode=S_IFREG|0664, st_size=831, ...}) = 0
openat(AT_FDCWD, "output_matrix.txt", O_WRONLY|O_CREAT|O_TRUNC, 0644) = 3
write(3, "  7.57 ", 7)                 = 7
write(3, " 11.48 ", 7)                 = 7
write(3, " 11.61 ", 7)                 = 7
write(3, " 10.52 ", 7)                 = 7
write(3, " 11.20 ", 7)                 = 7
write(3, " 13.15 ", 7)                 = 7
write(3, " 13.61 ", 7)                 = 7
write(3, " 11.16 ", 7)                 = 7
write(3, "  6.73 ", 7)                 = 7
write(3, "  2.81 ", 7)                 = 7
write(3, "\n", 1)                      = 1
write(3, " 11.21 ", 7)                 = 7
write(3, " 17.49 ", 7)                 = 7
write(3, " 18.54 ", 7)                 = 7
write(3, " 17.83 ", 7)                 = 7
write(3, " 19.08 ", 7)                 = 7
write(3, " 21.68 ", 7)                 = 7
write(3, " 22.06 ", 7)                 = 7
write(3, " 18.21 ", 7)                 = 7
write(3, " 11.49 ", 7)                 = 7
write(3, "  5.07 ", 7)                 = 7
write(3, "\n", 1)                      = 1
write(3, " 10.67 ", 7)                 = 7
write(3, " 17.77 ", 7)                 = 7
write(3, " 20.51 ", 7)                 = 7
write(3, " 21.15 ", 7)                 = 7
write(3, " 22.11 ", 7)                 = 7
write(3, " 23.56 ", 7)                 = 7
write(3, " 23.41 ", 7)                 = 7
write(3, " 19.81 ", 7)                 = 7
write(3, " 13.57 ", 7)                 = 7
write(3, "  6.51 ", 7)                 = 7
write(3, "\n", 1)                      = 1
write(3, "  8.20 ", 7)                 = 7
write(3, " 15.12 ", 7)                 = 7
write(3, " 19.45 ", 7)                 = 7
write(3, " 21.66 ", 7)                 = 7
write(3, " 21.95 ", 7)                 = 7
write(3, " 21.59 ", 7)                 = 7
write(3, " 20.79 ", 7)                 = 7
write(3, " 18.52 ", 7)                 = 7
write(3, " 14.35 ", 7)                 = 7
write(3, "  7.73 ", 7)                 = 7
write(3, "\n", 1)                      = 1
write(3, "  6.52 ", 7)                 = 7
write(3, " 13.40 ", 7)                 = 7
write(3, " 18.81 ", 7)                 = 7
write(3, " 21.82 ", 7)                 = 7
write(3, " 20.95 ", 7)                 = 7
write(3, " 18.80 ", 7)                 = 7
write(3, " 17.27 ", 7)                 = 7
```

```
write(3, " 16.55 ", 7)              = 7
write(3, " 14.55 ", 7)              = 7
write(3, "  8.73 ", 7)              = 7
write(3, "\n", 1)                   = 1
write(3, "  5.94 ", 7)              = 7
write(3, " 12.61 ", 7)              = 7
write(3, " 18.27 ", 7)              = 7
write(3, " 22.03 ", 7)              = 7
write(3, " 21.08 ", 7)              = 7
write(3, " 18.44 ", 7)              = 7
write(3, " 16.15 ", 7)              = 7
write(3, " 16.28 ", 7)              = 7
write(3, " 15.33 ", 7)              = 7
write(3, "  9.91 ", 7)              = 7
write(3, "\n", 1)                   = 1
write(3, "  6.17 ", 7)              = 7
write(3, " 12.73 ", 7)              = 7
write(3, " 18.30 ", 7)              = 7
write(3, " 22.28 ", 7)              = 7
write(3, " 21.61 ", 7)              = 7
write(3, " 19.08 ", 7)              = 7
write(3, " 16.42 ", 7)              = 7
write(3, " 16.75 ", 7)              = 7
write(3, " 15.92 ", 7)              = 7
write(3, " 10.56 ", 7)              = 7
write(3, "\n", 1)                   = 1
write(3, "  6.54 ", 7)              = 7
write(3, " 12.78 ", 7)              = 7
write(3, " 18.05 ", 7)              = 7
write(3, " 21.92 ", 7)              = 7
write(3, " 22.05 ", 7)              = 7
write(3, " 20.35 ", 7)              = 7
write(3, " 18.07 ", 7)              = 7
write(3, " 18.17 ", 7)              = 7
write(3, " 16.58 ", 7)              = 7
write(3, " 10.75 ", 7)              = 7
write(3, "\n", 1)                   = 1
write(3, "  6.05 ", 7)              = 7
write(3, " 11.53 ", 7)              = 7
write(3, " 16.18 ", 7)              = 7
write(3, " 19.12 ", 7)              = 7
write(3, " 19.43 ", 7)              = 7
write(3, " 18.29 ", 7)              = 7
write(3, " 17.00 ", 7)              = 7
write(3, " 16.93 ", 7)              = 7
write(3, " 14.91 ", 7)              = 7
write(3, "  9.28 ", 7)              = 7
write(3, "\n", 1)                   = 1
write(3, "  3.86 ", 7)              = 7
write(3, "  7.26 ", 7)              = 7
write(3, " 10.13 ", 7)              = 7
write(3, " 11.77 ", 7)              = 7
write(3, " 12.05 ", 7)              = 7
write(3, " 11.54 ", 7)              = 7
write(3, " 11.07 ", 7)              = 7
write(3, " 10.94 ", 7)              = 7
write(3, "  9.36 ", 7)              = 7
```

```
write(3, "  5.64 ", 7)                = 7
write(3, "\n", 1)                     = 1
close(3)                             = 0
write(1, "0.001162\n", 9)                = 9
exit_group(0)                        = ?
+++ exited with 0 +++
```

Вывод

Язык Си с поддержкой библиотек позволяет создавать многопоточные приложения, предоставляя инструменты для работы с потоками и механизмы ограничения для обеспечения безопасности. Это делает разработку на Си более разнообразной и увлекательной.