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: М80-206Б-22

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Оценка: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Постановка задачи**

**Вариант 18.**

Поиск наивным алгоритмом образца в строке.

**Общий метод и алгоритм решения**

Использованные системные вызовы:

* void thread\_create(pthread\_t\* thread, const pthread\_attr\_t\* attr, void \*(\*start)(void \*), void\* arg); – создает поток.
* pthread\_join(pthread\_t, void \*\_Nullable \*) – ждет завершение исполнения потока.

В наивном поиске образца в строке можно использовать многопоточность для разделения исходной строки на подстроки и обработки каждой из них параллельно. То есть, например, если пользователь предполагает использование 2 потоков, то исходная строка разделится на 2 подстроки и каждая из этих подстрок будет обработана отдельно и одновременно с отсальными, что должно сократить время работы программы, однако иногда инициализация потоков и их создание занимает больше времени, чем выполнение программы и использование нескольких потоков в таких случаях бессмысленно.

**Код программы**

**func.h**

#include <stdio.h>

#include <stdlib.h>

#include <string.h>

#include <pthread.h>

#include <time.h>

char\* def;

char\* res;

int res\_len;

int max\_threads;

int match\_count;

void thread\_create(pthread\_t\* thread, const pthread\_attr\_t\* attr, void \*(\*start)(void \*),

void\* arg);

void\* thread\_func(void\* arg);

**main.c**

#include "func.h"

#define MAXIMUM 12

void thread\_create(pthread\_t\* thread, const pthread\_attr\_t\* attr, void \*(\*start)(void \*),

void\* arg) {

if (pthread\_create(thread, attr, start, arg) != 0) {

perror("create thread\n");

exit(-1);

}

}

void\* thread\_func(void\* arg) {

int start = \*((int\*) arg);

int i, j;

for (i = start; i <= (strlen(def) - res\_len); i += max\_threads) {

for (j = 0; j < res\_len; j++) {

if (def[i + j] != res[j]) {

break;

}

}

if (j == res\_len) {

match\_count++;

}

}

pthread\_exit(NULL);

}

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

if (argc != 4) {

printf("Некорректный ввод аргументов\n");

return 1;

}

def = argv[1];

res = argv[2];

res\_len = strlen(res);

max\_threads = atoi(argv[3]);

if (max\_threads > MAXIMUM) {

printf("Нельзя вводить больше потоков, чем допустимо\n");

return 1;

}

pthread\_t\* threads = (pthread\_t\*)malloc(max\_threads \* sizeof(pthread\_t));

int\* thread\_args = (int\*)malloc(max\_threads \* sizeof(int));

int i;

for (i = 0; i < max\_threads; i++) {

thread\_args[i] = i;

thread\_create(&threads[i], NULL, thread\_func, &thread\_args[i]);

}

for (i = 0; i < max\_threads; i++) {

pthread\_join(threads[i], NULL);

}

printf("Общее количество совпадений: %d\n", match\_count);

free(thread\_args);

free(threads);

return 0;

**Протокол работы программы**

**Тестирование:**

**(в качестве входных данных использовалась строка длиной 65000 символов)**

stepan@stepan-ASUS:~/Рабочий стол/учеба/prog 3 sem/OSI/laba2/src$ time ./a.out boevbcj….. naj a 1

Общее количество совпадений: 2553

real 0m0,064s

user 0m0,047s

sys 0m0,004s

stepan@stepan-ASUS:~/Рабочий стол/учеба/prog 3 sem/OSI/laba2/src$ time ./a.out boevbcj….. naj a 2

Общее количество совпадений: 2553

real 0m0,037s

user 0m0,046s

sys 0m0,008s

stepan@stepan-ASUS:~/Рабочий стол/учеба/prog 3 sem/OSI/laba2/src$ time ./a.out boevbcj….. naj a 3

Общее количество совпадений: 2553

real 0m0,031s

user 0m0,044s

sys 0m0,011s

stepan@stepan-ASUS:~/Рабочий стол/учеба/prog 3 sem/OSI/laba2/src$ time ./a.out boevbcj….. naj a 4

Общее количество совпадений: 2553

real 0m0,030s

user 0m0,058s

sys 0m0,004s

|  |  |  |  |
| --- | --- | --- | --- |
| Кол-во потоков | Время (мc) | Ускорение | Эффективность |
| 1 | 64 | 1 | 1 |
| 2 | 37 | 1.72 | 0.86 |
| 3 | 31 | 2.06 | 0.68 |
| 4 | 30 | 2.13 | 0.53 |

**Strace:**

**strace -f ./a.out abababab b 5**

execve("./lab2", ["./lab2", "abababab", "b", "5"], 0x7fff49bc4c30 /\* 60 vars \*/) = 0

brk(NULL) = 0x56395400a000

arch\_prctl(0x3001 /\* ARCH\_??? \*/, 0x7ffd838c5510) = -1 EINVAL (Недопустимый аргумент)

mmap(NULL, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7f6d5e20b000

access("/etc/ld.so.preload", R\_OK) = -1 ENOENT (Нет такого файла или каталога)

openat(AT\_FDCWD, "/etc/ld.so.cache", O\_RDONLY|O\_CLOEXEC) = 3

newfstatat(3, "", {st\_mode=S\_IFREG|0644, st\_size=88411, ...}, AT\_EMPTY\_PATH) = 0

mmap(NULL, 88411, PROT\_READ, MAP\_PRIVATE, 3, 0) = 0x7f6d5e1f5000

close(3) = 0

openat(AT\_FDCWD, "/lib/x86\_64-linux-gnu/libc.so.6", O\_RDONLY|O\_CLOEXEC) = 3

read(3, "\177ELF\2\1\1\3\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0P\237\2\0\0\0\0\0"..., 832) = 832

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

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

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

newfstatat(3, "", {st\_mode=S\_IFREG|0755, st\_size=2216304, ...}, AT\_EMPTY\_PATH) = 0

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

mmap(NULL, 2260560, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f6d5de00000

mmap(0x7f6d5de28000, 1658880, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x28000) = 0x7f6d5de28000

mmap(0x7f6d5dfbd000, 360448, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1bd000) = 0x7f6d5dfbd000

mmap(0x7f6d5e015000, 24576, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x214000) = 0x7f6d5e015000

mmap(0x7f6d5e01b000, 52816, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_ANONYMOUS, -1, 0) = 0x7f6d5e01b000

close(3) = 0

mmap(NULL, 12288, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7f6d5e1f2000

arch\_prctl(ARCH\_SET\_FS, 0x7f6d5e1f2740) = 0

set\_tid\_address(0x7f6d5e1f2a10) = 3462

set\_robust\_list(0x7f6d5e1f2a20, 24) = 0

rseq(0x7f6d5e1f30e0, 0x20, 0, 0x53053053) = 0

mprotect(0x7f6d5e015000, 16384, PROT\_READ) = 0

mprotect(0x5639524c9000, 4096, PROT\_READ) = 0

mprotect(0x7f6d5e245000, 8192, PROT\_READ) = 0

prlimit64(0, RLIMIT\_STACK, NULL, {rlim\_cur=8192\*1024, rlim\_max=RLIM64\_INFINITY}) = 0

munmap(0x7f6d5e1f5000, 88411) = 0

getrandom("\x3f\x46\xa9\xe3\x66\x8c\xfc\x79", 8, GRND\_NONBLOCK) = 8

brk(NULL) = 0x56395400a000

brk(0x56395402b000) = 0x56395402b000

rt\_sigaction(SIGRT\_1, {sa\_handler=0x7f6d5de91870, sa\_mask=[], sa\_flags=SA\_RESTORER|SA\_ONSTACK|SA\_RESTART|SA\_SIGINFO, sa\_restorer=0x7f6d5de42520}, 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) = 0x7f6d5d5ff000

mprotect(0x7f6d5d600000, 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=0x7f6d5ddff910, parent\_tid=0x7f6d5ddff910, exit\_signal=0, stack=0x7f6d5d5ff000, stack\_size=0x7fff00, tls=0x7f6d5ddff640}strace: **Process 3463 attached**

=> {parent\_tid=[3463]}, 88) = 3463

[pid 3463] rseq(0x7f6d5ddfffe0, 0x20, 0, 0x53053053 <unfinished ...>

[pid 3462] rt\_sigprocmask(SIG\_SETMASK, [], <unfinished ...>

[pid 3463] <... rseq resumed>) = 0

[pid 3462] <... rt\_sigprocmask resumed>NULL, 8) = 0

[pid 3463] set\_robust\_list(0x7f6d5ddff920, 24 <unfinished ...>

[pid 3462] mmap(NULL, 8392704, PROT\_NONE, MAP\_PRIVATE|MAP\_ANONYMOUS|MAP\_STACK, -1, 0 <unfinished ...>

[pid 3463] <... set\_robust\_list resumed>) = 0

[pid 3462] <... mmap resumed>) = 0x7f6d5cdfe000

[pid 3463] rt\_sigprocmask(SIG\_SETMASK, [], <unfinished ...>

[pid 3462] mprotect(0x7f6d5cdff000, 8388608, PROT\_READ|PROT\_WRITE <unfinished ...>

[pid 3463] <... rt\_sigprocmask resumed>NULL, 8) = 0

[pid 3462] <... mprotect resumed>) = 0

[pid 3463] openat(AT\_FDCWD, "/etc/ld.so.cache", O\_RDONLY|O\_CLOEXEC <unfinished ...>

[pid 3462] futex(0x7f6d5e247a98, FUTEX\_WAIT\_PRIVATE, 2, NULL <unfinished ...>

[pid 3463] <... openat resumed>) = 3

[pid 3463] newfstatat(3, "", {st\_mode=S\_IFREG|0644, st\_size=88411, ...}, AT\_EMPTY\_PATH) = 0

[pid 3463] mmap(NULL, 88411, PROT\_READ, MAP\_PRIVATE, 3, 0) = 0x7f6d5e1f5000

[pid 3463] close(3) = 0

[pid 3463] mmap(NULL, 134217728, PROT\_NONE, MAP\_PRIVATE|MAP\_ANONYMOUS|MAP\_NORESERVE, -1, 0) = 0x7f6d54dfe000

[pid 3463] munmap(0x7f6d54dfe000, 52436992) = 0

[pid 3463] munmap(0x7f6d5c000000, 14671872) = 0

[pid 3463] mprotect(0x7f6d58000000, 135168, PROT\_READ|PROT\_WRITE) = 0

[pid 3463] openat(AT\_FDCWD, "/lib/x86\_64-linux-gnu/libgcc\_s.so.1", O\_RDONLY|O\_CLOEXEC) = 3

[pid 3463] 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

[pid 3463] newfstatat(3, "", {st\_mode=S\_IFREG|0644, st\_size=125488, ...}, AT\_EMPTY\_PATH) = 0

[pid 3463] mmap(NULL, 127720, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f6d5e1d2000

[pid 3463] mmap(0x7f6d5e1d5000, 94208, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x3000) = 0x7f6d5e1d5000

[pid 3463] mmap(0x7f6d5e1ec000, 16384, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1a000) = 0x7f6d5e1ec000

[pid 3463] mmap(0x7f6d5e1f0000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1d000) = 0x7f6d5e1f0000

[pid 3463] close(3) = 0

[pid 3463] mprotect(0x7f6d5e1f0000, 4096, PROT\_READ) = 0

[pid 3463] futex(0x7f6d5e247a98, FUTEX\_WAKE\_PRIVATE, 1) = 1

[pid 3462] <... futex resumed>) = 0

[pid 3462] futex(0x7f6d5e247a98, FUTEX\_WAKE\_PRIVATE, 1 <unfinished ...>

[pid 3463] munmap(0x7f6d5e1f5000, 88411 <unfinished ...>

[pid 3462] <... futex resumed>) = 0

[pid 3462] rt\_sigprocmask(SIG\_BLOCK, ~[], <unfinished ...>

[pid 3463] <... munmap resumed>) = 0

[pid 3462] <... rt\_sigprocmask resumed>[], 8) = 0

[pid 3463] futex(0x7f6d5e1f1210, FUTEX\_WAKE\_PRIVATE, 2147483647 <unfinished ...>

[pid 3462] **clone3**({flags=CLONE\_VM|CLONE\_FS|CLONE\_FILES|CLONE\_SIGHAND|CLONE\_THREAD|CLONE\_SYSVSEM|CLONE\_SETTLS|CLONE\_PARENT\_SETTID|CLONE\_CHILD\_CLEARTID, child\_tid=0x7f6d5d5fe910, parent\_tid=0x7f6d5d5fe910, exit\_signal=0, stack=0x7f6d5cdfe000, stack\_size=0x7fff00, tls=0x7f6d5d5fe640} <unfinished ...>

[pid 3463] <... futex resumed>) = 0

**strace: Process 3464 attached**

[pid 3463] rt\_sigprocmask(SIG\_BLOCK, ~[RT\_1], <unfinished ...>

[pid 3462] <... clone3 resumed> => {parent\_tid=[3464]}, 88) = 3464

[pid 3464] rseq(0x7f6d5d5fefe0, 0x20, 0, 0x53053053 <unfinished ...>

[pid 3462] rt\_sigprocmask(SIG\_SETMASK, [], <unfinished ...>

[pid 3463] <... rt\_sigprocmask resumed>NULL, 8) = 0

[pid 3462] <... rt\_sigprocmask resumed>NULL, 8) = 0

[pid 3464] <... rseq resumed>) = 0

[pid 3462] mmap(NULL, 8392704, PROT\_NONE, MAP\_PRIVATE|MAP\_ANONYMOUS|MAP\_STACK, -1, 0 <unfinished ...>

[pid 3463] madvise(0x7f6d5d5ff000, 8368128, MADV\_DONTNEED <unfinished ...>

[pid 3462] <... mmap resumed>) = 0x7f6d5c5fd000

[pid 3464] set\_robust\_list(0x7f6d5d5fe920, 24 <unfinished ...>

[pid 3462] mprotect(0x7f6d5c5fe000, 8388608, PROT\_READ|PROT\_WRITE <unfinished ...>

[pid 3463] <... madvise resumed>) = 0

[pid 3464] <... set\_robust\_list resumed>) = 0

[pid 3462] <... mprotect resumed>) = 0

[pid 3463] exit(0 <unfinished ...>

[pid 3464] rt\_sigprocmask(SIG\_SETMASK, [], <unfinished ...>

[pid 3462] rt\_sigprocmask(SIG\_BLOCK, ~[], <unfinished ...>

[pid 3463] <... exit resumed>) = ?

[pid 3462] <... rt\_sigprocmask resumed>[], 8) = 0

[pid 3464] <... rt\_sigprocmask resumed>NULL, 8) = 0

[pid 3462] **clone3**({flags=CLONE\_VM|CLONE\_FS|CLONE\_FILES|CLONE\_SIGHAND|CLONE\_THREAD|CLONE\_SYSVSEM|CLONE\_SETTLS|CLONE\_PARENT\_SETTID|CLONE\_CHILD\_CLEARTID, child\_tid=0x7f6d5cdfd910, parent\_tid=0x7f6d5cdfd910, exit\_signal=0, stack=0x7f6d5c5fd000, stack\_size=0x7fff00, tls=0x7f6d5cdfd640} <unfinished ...>

[pid 3463] +++ exited with 0 +++

[pid 3464] rt\_sigprocmask(SIG\_BLOCK, ~[RT\_1], NULL, 8) = 0

**strace: Process 3465 attached**

[pid 3464] madvise(0x7f6d5cdfe000, 8368128, MADV\_DONTNEED <unfinished ...>

[pid 3462] <... clone3 resumed> => {parent\_tid=[3465]}, 88) = 3465

[pid 3465] rseq(0x7f6d5cdfdfe0, 0x20, 0, 0x53053053 <unfinished ...>

[pid 3462] rt\_sigprocmask(SIG\_SETMASK, [], <unfinished ...>

[pid 3464] <... madvise resumed>) = 0

[pid 3462] <... rt\_sigprocmask resumed>NULL, 8) = 0

[pid 3465] <... rseq resumed>) = 0

[pid 3462] mmap(NULL, 8392704, PROT\_NONE, MAP\_PRIVATE|MAP\_ANONYMOUS|MAP\_STACK, -1, 0 <unfinished ...>

[pid 3464] exit(0 <unfinished ...>

[pid 3462] <... mmap resumed>) = 0x7f6d577ff000

[pid 3465] set\_robust\_list(0x7f6d5cdfd920, 24 <unfinished ...>

[pid 3462] mprotect(0x7f6d57800000, 8388608, PROT\_READ|PROT\_WRITE <unfinished ...>

[pid 3464] <... exit resumed>) = ?

[pid 3462] <... mprotect resumed>) = 0

[pid 3465] <... set\_robust\_list resumed>) = 0

[pid 3462] rt\_sigprocmask(SIG\_BLOCK, ~[], <unfinished ...>

[pid 3464] +++ exited with 0 +++

[pid 3462] <... rt\_sigprocmask resumed>[], 8) = 0

[pid 3465] rt\_sigprocmask(SIG\_SETMASK, [], <unfinished ...>

[pid 3462] **clone3**({flags=CLONE\_VM|CLONE\_FS|CLONE\_FILES|CLONE\_SIGHAND|CLONE\_THREAD|CLONE\_SYSVSEM|CLONE\_SETTLS|CLONE\_PARENT\_SETTID|CLONE\_CHILD\_CLEARTID, child\_tid=0x7f6d57fff910, parent\_tid=0x7f6d57fff910, exit\_signal=0, stack=0x7f6d577ff000, stack\_size=0x7fff00, tls=0x7f6d57fff640} <unfinished ...>

[pid 3465] <... rt\_sigprocmask resumed>NULL, 8) = 0

**strace: Process 3466 attached**

[pid 3465] rt\_sigprocmask(SIG\_BLOCK, ~[RT\_1], <unfinished ...>

[pid 3462] <... clone3 resumed> => {parent\_tid=[3466]}, 88) = 3466

[pid 3466] rseq(0x7f6d57ffffe0, 0x20, 0, 0x53053053 <unfinished ...>

[pid 3462] rt\_sigprocmask(SIG\_SETMASK, [], <unfinished ...>

[pid 3465] <... rt\_sigprocmask resumed>NULL, 8) = 0

[pid 3462] <... rt\_sigprocmask resumed>NULL, 8) = 0

[pid 3466] <... rseq resumed>) = 0

[pid 3462] mmap(NULL, 8392704, PROT\_NONE, MAP\_PRIVATE|MAP\_ANONYMOUS|MAP\_STACK, -1, 0 <unfinished ...>

[pid 3465] madvise(0x7f6d5c5fd000, 8368128, MADV\_DONTNEED <unfinished ...>

[pid 3462] <... mmap resumed>) = 0x7f6d56ffe000

[pid 3466] set\_robust\_list(0x7f6d57fff920, 24 <unfinished ...>

[pid 3462] mprotect(0x7f6d56fff000, 8388608, PROT\_READ|PROT\_WRITE <unfinished ...>

[pid 3465] <... madvise resumed>) = 0

[pid 3462] <... mprotect resumed>) = 0

[pid 3466] <... set\_robust\_list resumed>) = 0

[pid 3465] exit(0 <unfinished ...>

[pid 3462] rt\_sigprocmask(SIG\_BLOCK, ~[], <unfinished ...>

[pid 3466] rt\_sigprocmask(SIG\_SETMASK, [], <unfinished ...>

[pid 3462] <... rt\_sigprocmask resumed>[], 8) = 0

[pid 3465] <... exit resumed>) = ?

[pid 3462] **clone3**({flags=CLONE\_VM|CLONE\_FS|CLONE\_FILES|CLONE\_SIGHAND|CLONE\_THREAD|CLONE\_SYSVSEM|CLONE\_SETTLS|CLONE\_PARENT\_SETTID|CLONE\_CHILD\_CLEARTID, child\_tid=0x7f6d577fe910, parent\_tid=0x7f6d577fe910, exit\_signal=0, stack=0x7f6d56ffe000, stack\_size=0x7fff00, tls=0x7f6d577fe640} <unfinished ...>

[pid 3466] <... rt\_sigprocmask resumed>NULL, 8) = 0

[pid 3465] +++ exited with 0 +++

[pid 3466] rt\_sigprocmask(SIG\_BLOCK, ~[RT\_1], **strace: Process 3467 attached**

NULL, 8) = 0

[pid 3462] <... clone3 resumed> => {parent\_tid=[3467]}, 88) = 3467

[pid 3467] rseq(0x7f6d577fefe0, 0x20, 0, 0x53053053 <unfinished ...>

[pid 3466] madvise(0x7f6d577ff000, 8368128, MADV\_DONTNEED <unfinished ...>

[pid 3462] rt\_sigprocmask(SIG\_SETMASK, [], <unfinished ...>

[pid 3467] <... rseq resumed>) = 0

[pid 3462] <... rt\_sigprocmask resumed>NULL, 8) = 0

[pid 3466] <... madvise resumed>) = 0

[pid 3467] set\_robust\_list(0x7f6d577fe920, 24 <unfinished ...>

[pid 3462] futex(0x7f6d57fff910, FUTEX\_WAIT\_BITSET|FUTEX\_CLOCK\_REALTIME, 3466, NULL, FUTEX\_BITSET\_MATCH\_ANY <unfinished ...>

[pid 3467] <... set\_robust\_list resumed>) = 0

[pid 3466] exit(0 <unfinished ...>

[pid 3467] rt\_sigprocmask(SIG\_SETMASK, [], <unfinished ...>

[pid 3466] <... exit resumed>) = ?

[pid 3467] <... rt\_sigprocmask resumed>NULL, 8) = 0

[pid 3462] <... futex resumed>) = 0

[pid 3467] rt\_sigprocmask(SIG\_BLOCK, ~[RT\_1], <unfinished ...>

[pid 3466] +++ exited with 0 +++

[pid 3462] futex(0x7f6d577fe910, FUTEX\_WAIT\_BITSET|FUTEX\_CLOCK\_REALTIME, 3467, NULL, FUTEX\_BITSET\_MATCH\_ANY <unfinished ...>

[pid 3467] <... rt\_sigprocmask resumed>NULL, 8) = 0

[pid 3467] madvise(0x7f6d56ffe000, 8368128, MADV\_DONTNEED) = 0

[pid 3467] exit(0) = ?

[pid 3462] <... futex resumed>) = 0

[pid 3467] +++ exited with 0 +++

munmap(0x7f6d5d5ff000, 8392704) = 0

newfstatat(1, "", {st\_mode=S\_IFCHR|0620, st\_rdev=makedev(0x88, 0), ...}, AT\_EMPTY\_PATH) = 0

write(1, "\320\236\320\261\321\211\320\265\320\265 \320\272\320\276\320\273\320\270\321\207\320\265\321\201\321\202\320\262\320\276 "..., 56Общее количество совпадений: 4

) = 56

exit\_group(0) = ?

+++ exited with 0 +++

**Вывод**

Я реализовал многопоточность в своей программе и теперь могу использовать эту фишку в следующих своих программах. Когда происходит работа с гигантскими объемами данных, многопотность в программе — это очень выгодная вещь, позволяющая сократить время выполнения программы. Однако, нужно уметь грамотно описывать многопотность в коде, понимать, когда она требуется, а когда она бессмысленная.