Московский Авиационный Институт

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Институт №8 “Компьютерные науки и прикладная математика”

Кафедра №806 “Вычислительная математика и программирование”

Лабораторная работа №5 по курсу

«Операционные системы»

Группа: М8О-209БВ-24

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Оценка: _____

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Постановка задачи

Цель работы:

Приобретение практических навыков диагностики работы программного обеспечения.

Задание:

Продемонстрировать ключевые системные вызовы, которые используются в лабораторных работах и то, что их использование соответствует варианту ЛР.

Общий метод и алгоритм решения

Для наблюдения за системными вызовами использовалась утилита strace в операционной системе Linux. Это диагностическая и отладочная утилита, которая позволяет отслеживать взаимодействие между процессом и ядром операционной системы. Она перехватывает и записывает все системные вызовы, которые выполняет программа, а также сигналы, которые она получает. Это особенно полезно, когда программа работает непредсказуемо, завершается с ошибками или требуется понять её логику работы на низком уровне.

Для более детального анализа в strace используются различные флаги. Ключевым является флаг -f, который позволяет отслеживать не только основной процесс, но и все создаваемые им дочерние процессы и потоки, что критически важно для анализа сложных многопоточных приложений или программ, запускающих другие процессы. Помимо этого, полезными являются флаги для фильтрации вывода, такие как -e trace=file для просмотра только операций с файлами или -e trace=network для сетевых вызовов. Для анализа производительности применяются флаги -T, показывающий время выполнения каждого вызова, и -c, который по завершении работы программы выводит сводную статистику по всем системным вызовам с количеством, ошибками и затраченным временем. Флаг -s увеличивает длину выводимых строк аргументов, предотвращая их обрезание, а -o позволяет сохранить весь вывод трассировки в файл для последующего глубокого изучения.

Протокол работы программы

Лабораторная работа №1

```
execve("./parent", ["./parent"], 0x7ffd238f4448 /* 29 vars */) = 0

brk(NULL)                               = 0x616ff6485000

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1,
0) = 0x73e1371b9000

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=19871, ...}) = 0
mmap(NULL, 19871, PROT_READ, MAP_PRIVATE, 3, 0) = 0x73e1371b4000
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) =
0x73e136e00000
mmap(0x73e136e28000, 1605632, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x28000) = 0x73e136e28000
mmap(0x73e136fb0000, 323584, PROT_READ,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1b0000) = 0x73e136fb0000
mmap(0x73e136fff000, 24576, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1fe000) = 0x73e136fff000
mmap(0x73e137005000, 52624, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x73e137005000
close(3)                                = 0
mmap(NULL, 12288, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1,
0) = 0x73e1371b1000
arch_prctl(ARCH_SET_FS, 0x73e1371b1740) = 0
set_tid_address(0x73e1371b1a10)         = 94847
set_robust_list(0x73e1371b1a20, 24)     = 0
rseq(0x73e1371b2060, 0x20, 0, 0x53053053) = 0
mprotect(0x73e136fff000, 16384, PROT_READ) = 0
```

mprotect(0x616fd583e000, 4096, PROT_READ) = 0

mprotect(0x73e1371f1000, 8192, PROT_READ) = 0

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

munmap(0x73e1371b4000, 19871) = 0

fstat(1, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0x4), ...}) = 0

getrandom("\x72\x0e\x1d\xa4\xbb\xe8\x81\x30", 8, GRND_NONBLOCK) = 8

brk(NULL) = 0x616ff6485000

brk(0x616ff64a6000) = 0x616ff64a6000

fstat(0, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0x4), ...}) = 0

write(1, "\320\222\320\262\320\265\320\264\320\270\321\202\320\265 \320\270\320\274\321\217 \321\204\320\260\320\271\320\273\320\260"..., 34Введите имя файла:) = 34

read(0, result

"result\n", 1024) = 7

openat(AT_FDCWD, "result", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 3

close(3) = 0

pipe2([3, 4], 0) = 0

pipe2([5, 6], 0) = 0

clone(child_stack=NULL, flags=CLONE_CHILD_CLEARTID|CLONE_CHILD_SETTID|SIGCHLDstrace: Process 94860 attached

, child_tidptr=0x73e1371b1a10) = 94860

[pid 94860] set_robust_list(0x73e1371b1a20, 24 <unfinished ...>

[pid 94847] close(3 <unfinished ...>

[pid 94860] <... set_robust_list resumed>) = 0

[pid 94847] <... close resumed>) = 0

[pid 94847] close(6 <unfinished ...>

[pid 94860] close(4 <unfinished ...>

[pid 94847] <... close resumed>) = 0

[pid 94860] <... close resumed>) = 0

[pid 94860] close(5 <unfinished ...>

[pid 94847] write(1, "\320\222\320\262\320\265\320\264\320\270\321\202\320\265 \321\207\320\270\321\201\320\273\320\260 \321\207\320\265\321\200"..., 51 <unfinished ...>

Введите числа через пробел:

[pid 94860] <... close resumed>) = 0

[pid 94847] <... write resumed>) = 51

[pid 94860] dup2(3, 0 <unfinished ...>

[pid 94847] read(0, <unfinished ...>

[pid 94860] <... dup2 resumed>) = 0

[pid 94860] close(3) = 0

[pid 94860] dup2(6, 1) = 1

[pid 94860] close(6) = 0

[pid 94860] execve("./child", ["child", "result"], 0x7ffd377692b8 /* 29 vars */) = 0

[pid 94860] brk(NULL) = 0x5792563e1000

[pid 94860] mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7bac81e75000

[pid 94860] access("/etc/ld.so.preload", R_OK) = -1 ENOENT (No such file or directory)

[pid 94860] openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 3

[pid 94860] fstat(3, {st_mode=S_IFREG|0644, st_size=19871, ...}) = 0

[pid 94860] mmap(NULL, 19871, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7bac81e70000

[pid 94860] close(3) = 0

[pid 94860] openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC) = 3

[pid 94860] 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

[pid 94860] 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

[pid 94860] fstat(3, {st_mode=S_IFREG|0755, st_size=2125328, ...}) = 0

[pid 94860] 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

[pid 94860] mmap(NULL, 2170256, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7bac81c00000

[pid 94860] mmap(0x7bac81c28000, 1605632, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x28000) = 0x7bac81c28000

[pid 94860] mmap(0x7bac81db0000, 323584, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1b0000) = 0x7bac81db0000

[pid 94860] mmap(0x7bac81dff000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1fe000) = 0x7bac81dff000

[pid 94860] mmap(0x7bac81e05000, 52624, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7bac81e05000

[pid 94860] close(3)   = 0

[pid 94860] mmap(NULL, 12288, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7bac81e6d000

[pid 94860] arch_prctl(ARCH_SET_FS, 0x7bac81e6d740) = 0

[pid 94860] set_tid_address(0x7bac81e6da10) = 94860

[pid 94860] set_robust_list(0x7bac81e6da20, 24) = 0

[pid 94860] rseq(0x7bac81e6e060, 0x20, 0, 0x53053053) = 0

[pid 94860] mprotect(0x7bac81dff000, 16384, PROT_READ) = 0

[pid 94860] mprotect(0x579227295000, 4096, PROT_READ) = 0

[pid 94860] mprotect(0x7bac81ead000, 8192, PROT_READ) = 0

[pid 94860] prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024, rlim_max=RLIM64_INFINITY}) = 0

[pid 94860] munmap(0x7bac81e70000, 19871) = 0

[pid 94860] getrandom("\x0f\xe0\x16\x15\x6a\x60\xfa\xe8", 8, GRND_NONBLOCK) = 8

[pid 94860] brk(NULL) = 0x5792563e1000

[pid 94860] brk(0x579256402000) = 0x579256402000

[pid 94860] openat(AT_FDCWD, "result", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 3

[pid 94860] fstat(0, {st_mode=S_IFIFO|0600, st_size=0, ...}) = 0

[pid 94860] read(0, 100 2 5 5

<unfinished ...>

[pid 94847] <... read resumed>"100 2 5 5\n", 1024) = 10

[pid 94847] write(4, "100 2 5 5\n", 10) = 10

[pid 94847] wait4(94860, <unfinished ...>

[pid 94860] <... read resumed>"100 2 5 5\n", 4096) = 10

[pid 94847] <... wait4 resumed>0x7ffd37768cdc, WNOHANG, NULL) = 0

[pid 94847] read(0, <unfinished ...>

[pid 94860] fstat(3, {st_mode=S_IFREG|0644, st_size=0, ...}) = 0

[pid 94860] write(3, "100 / 2 / 2 / 5 / 5 = 1\n", 24) = 24

[pid 94860] read(0, <unfinished ...>

[pid 94847] <... read resumed>"", 1024) = 0

[pid 94847] close(4) = 0

[pid 94860] <... read resumed>"", 4096) = 0

[pid 94847] close(5 <unfinished ...>

[pid 94860] close(3 <unfinished ...>

[pid 94847] <... close resumed>) = 0

[pid 94860] <... close resumed>) = 0

[pid 94847] wait4(-1, <unfinished ...>

[pid 94860] exit_group(0) = ?

[pid 94860] +++ exited with 0 +++

<... wait4 resumed>NULL, 0, NULL) = 94860

--- SIGCHLD {si_signo=SIGCHLD, si_code=CLD_EXITED, si_pid=94860, si_uid=1000, si_status=0, si_utime=0, si_stime=0} ---

exit_group(0) = ?

+++ exited with 0 +++

Лабораторная работа № 2

$ strace -f ./dice_game 1000 1 0 0 1000000 4

execve("./dice_game", ["./dice_game", "10000", "1", "0", "0", "1000000", "4"], 0x7ffdc4a6db88 /* 29 vars */) = 0

brk(NULL) = 0x5c453ffe2000

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x70c865f98000

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=37043, ...}) = 0

mmap(NULL, 37043, PROT_READ, MAP_PRIVATE, 3, 0) = 0x70c865f8e000

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) = 0x70c865c00000

mmap(0x70c865c28000, 1605632, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x28000) = 0x70c865c28000

mmap(0x70c865db0000, 323584, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1b0000) = 0x70c865db0000

mmap(0x70c865dff000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1fe000) = 0x70c865dff000

mmap(0x70c865e05000, 52624, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x70c865e05000

close(3) = 0

mmap(NULL, 12288, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x70c865f8b000

arch_prctl(ARCH_SET_FS, 0x70c865f8b740) = 0

set_tid_address(0x70c865f8ba10) = 27451

set_robust_list(0x70c865f8ba20, 24) = 0

rseq(0x70c865f8c060, 0x20, 0, 0x53053053) = 0

mprotect(0x70c865dff000, 16384, PROT_READ) = 0

mprotect(0x5c4508f1a000, 4096, PROT_READ) = 0

mprotect(0x70c865fd0000, 8192, PROT_READ) = 0

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

munmap(0x70c865f8e000, 37043) = 0

rt_sigaction(SIGRT_1, {sa_handler=0x70c865c99530, sa_mask=[], sa_flags=SA_RESTORER|SA_ONSTACK|SA_RESTART|SA_SIGINFO, sa_restorer=0x70c865c45330}, 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) = 0x70c8653ff000

mprotect(0x70c865400000, 8388608, PROT_READ|PROT_WRITE) = 0

getrandom("\x66\xe1\x87\x05\x80\x8f\x65\xbc", 8, GRND_NONBLOCK) = 8

brk(NULL) = 0x5c453ffe2000

brk(0x5c4540003000) = 0x5c4540003000

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=0x70c865bff990, parent_tid=0x70c865bff990, exit_signal=0, stack=0x70c8653ff000, stack_size=0x7fff80, tls=0x70c865bff6c0}strace: Process 27452 attached

=> {parent_tid=[27452]}, 88) = 27452

[pid 27452] rseq(0x70c865bfffe0, 0x20, 0, 0x53053053 <unfinished ...>

[pid 27451] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>

[pid 27452] <... rseq resumed>) = 0

[pid 27451] <... rt_sigprocmask resumed>NULL, 8) = 0

[pid 27452] set_robust_list(0x70c865bff9a0, 24 <unfinished ...>

[pid 27451] mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0 <unfinished ...>

[pid 27452] <... set_robust_list resumed>) = 0

[pid 27451] <... mmap resumed>) = 0x70c864bfe000

[pid 27452] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>

[pid 27451] mprotect(0x70c864bff000, 8388608, PROT_READ|PROT_WRITE <unfinished ...>

[pid 27452] <... rt_sigprocmask resumed>NULL, 8) = 0

[pid 27451] <... mprotect resumed>) = 0

[pid 27451] rt_sigprocmask(SIG_BLOCK, ~[], [], 8) = 0

[pid 27451] **clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x70c8653fe990, parent_tid=0x70c8653fe990, exit_signal=0, stack=0x70c864bfe000, stack_size=0x7fff80, tls=0x70c8653fe6c0}strace: Process 27453 attached**

=> {parent_tid=[27453]}, 88) = 27453

[pid 27451] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>

[pid 27453] rseq(0x70c8653fefe0, 0x20, 0, 0x53053053 <unfinished ...>

[pid 27451] <... rt_sigprocmask resumed>NULL, 8) = 0

[pid 27451] mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0 <unfinished ...>

[pid 27453] <... rseq resumed>) = 0

[pid 27451] <... mmap resumed>) = 0x70c8643fd000

[pid 27453] set_robust_list(0x70c8653fe9a0, 24 <unfinished ...>

[pid 27451] mprotect(0x70c8643fe000, 8388608, PROT_READ|PROT_WRITE <unfinished ...>

[pid 27453] <... set_robust_list resumed>) = 0

[pid 27451] <... mprotect resumed>) = 0

[pid 27453] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>

[pid 27451] rt_sigprocmask(SIG_BLOCK, ~[], <unfinished ...>

[pid 27453] <... rt_sigprocmask resumed>NULL, 8) = 0

[pid 27451] <... rt_sigprocmask resumed>[], 8) = 0

[pid 27451] **clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x70c864bfd990, parent_tid=0x70c864bfd990, exit_signal=0, stack=0x70c8643fd000, stack_size=0x7fff80, tls=0x70c864bfd6c0}strace: Process 27454 attached**

=> {parent_tid=[27454]}, 88) = 27454

[pid 27454] rseq(0x70c864bfdfe0, 0x20, 0, 0x53053053 <unfinished ...>

[pid 27451] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>

[pid 27454] <... rseq resumed>) = 0

[pid 27451] <... rt_sigprocmask resumed>NULL, 8) = 0

[pid 27454] set_robust_list(0x70c864bfd9a0, 24 <unfinished ...>

[pid 27451] mmap(NULL, 8392704, PROT_NONE, MAP_PRIVATE|MAP_ANONYMOUS|MAP_STACK, -1, 0 <unfinished ...>

[pid 27454] <... set_robust_list resumed>) = 0

[pid 27451] <... mmap resumed>) = 0x70c863bfc000

[pid 27451] mprotect(0x70c863bfd000, 8388608, PROT_READ|PROT_WRITE <unfinished ...>

[pid 27454] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>

[pid 27451] <... mprotect resumed>) = 0

[pid 27454] <... rt_sigprocmask resumed>NULL, 8) = 0

[pid 27451] rt_sigprocmask(SIG_BLOCK, ~[], [], 8) = 0

[pid 27451] **clone3({flags=CLONE_VM|CLONE_FS|CLONE_FILES|CLONE_SIGHAND|CLONE_THREAD|CLONE_SYSVSEM|CLONE_SETTLS|CLONE_PARENT_SETTID|CLONE_CHILD_CLEARTID, child_tid=0x70c8643fc990, parent_tid=0x70c8643fc990, exit_signal=0, stack=0x70c863bfc000, stack_size=0x7fff80, tls=0x70c8643fc6c0}strace: Process 27455 attached**

=> {parent_tid=[27455]}, 88) = 27455

[pid 27455] rseq(0x70c8643fcfe0, 0x20, 0, 0x53053053 <unfinished ...>

[pid 27451] rt_sigprocmask(SIG_SETMASK, [], <unfinished ...>

[pid 27455] <... rseq resumed>) = 0

[pid 27451] <... rt_sigprocmask resumed>NULL, 8) = 0

[pid 27455] set_robust_list(0x70c8643fc9a0, 24 <unfinished ...>

[pid 27451] futex(0x70c865bff990, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 27452, NULL, FUTEX_BITSET_MATCH_ANY <unfinished ...>

[pid 27455] <... set_robust_list resumed>) = 0

[pid 27455] rt_sigprocmask(SIG_SETMASK, [], NULL, 8) = 0

[pid 27455] rt_sigprocmask(SIG_BLOCK, ~[RT_1], NULL, 8) = 0

[pid 27455] madvise(0x70c863bfc000, 8368128, MADV_DONTNEED) = 0

[pid 27455] exit(0)   = ?

[pid 27455] +++ exited with 0 +++

[pid 27452] rt_sigprocmask(SIG_BLOCK, ~[RT_1], NULL, 8) = 0

[pid 27452] madvise(0x70c8653ff000, 8368128, MADV_DONTNEED) = 0

[pid 27452] exit(0)   = ?

[pid 27451] <... futex resumed>)   = 0

[pid 27453] rt_sigprocmask(SIG_BLOCK, ~[RT_1], <unfinished ...>

[pid 27452] +++ exited with 0 +++

[pid 27451] futex(0x70c8653fe990, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 27453, NULL, FUTEX_BITSET_MATCH_ANY <unfinished ...>

[pid 27453] <... rt_sigprocmask resumed>NULL, 8) = 0

[pid 27453] madvise(0x70c864bfe000, 8368128, MADV_DONTNEED) = 0

[pid 27453] exit(0)   = ?

[pid 27451] <... futex resumed>)   = 0

[pid 27453] +++ exited with 0 +++

[pid 27451] futex(0x70c864bfd990, FUTEX_WAIT_BITSET|FUTEX_CLOCK_REALTIME, 27454, NULL, FUTEX_BITSET_MATCH_ANY <unfinished ...>

[pid 27454] rt_sigprocmask(SIG_BLOCK, ~[RT_1], NULL, 8) = 0

[pid 27454] madvise(0x70c8643fd000, 8368128, MADV_DONTNEED) = 0

[pid 27454] exit(0)   = ?

[pid 27451] <... futex resumed>)   = 0

[pid 27454] +++ exited with 0 +++

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

write(1, "=== \320\240\320\225\320\227\320\243\320\233\320\254\320\242\320\220\320\242\320\253 ===\n", 29=== РЕЗУЛЬТАТЫ ===

) = 29

write(1, "\320\232\320\276\320\273\320\270\321\207\320\265\321\201\321\202\320\262\320\276\320\277\320\276\321\202\320\276\320\272\320"..., 39Количество потоков: 4

) = 39

write(1, "\320\222\321\201\320\265\320\263\320\276\321\215\320\272\321\201\320\277\320\265\321\200\320\270\320\274\320\265\320\275\321"..., 47Всего экспериментов: 1000000

) = 47

write(1, "\320\237\320\276\320\261\320\265\320\264 \320\270\320\263\321\200\320\276\320\272\320\260 1: 49933"..., 43Побед игрока 1: 499330 (49.93%)

) = 43

write(1, "\320\237\320\276\320\261\320\265\320\264 \320\270\320\263\321\200\320\276\320\272\320\260 2: 49947"..., 43Побед игрока 2: 499473 (49.95%)

) = 43

write(1, "\320\235\320\270\321\207\321\214\320\270\321\205: 1197 (0.12%)\n", 27Ничьих: 1197 (0.12%)

) = 27

write(1, "\320\222\321\200\320\265\320\274\321\217 \320\262\321\213\320\277\320\276\320\273\320\275\320\265\320\275\320\270\321\217:"..., 53Время выполнения: 32.595 секунд

) = 53

exit_group(0) = ?

+++ exited with 0 +++

Лабораторная работа №3

kishaki@416:~/lab_OS3$ strace -f ./parent

execve("./parent", ["./parent"], 0x7ffd7d08b1e8 /* 29 vars */) = 0

brk(NULL) = 0x5b716582a000

mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7b5cc87b4000

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=37043, ...}) = 0

mmap(NULL, 37043, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7b5cc87aa000

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) = 0x7b5cc8400000

mmap(0x7b5cc8428000, 1605632, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x28000) = 0x7b5cc8428000

mmap(0x7b5cc85b0000, 323584, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1b0000) = 0x7b5cc85b0000

mmap(0x7b5cc85ff000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1fe000) = 0x7b5cc85ff000

mmap(0x7b5cc8605000, 52624, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7b5cc8605000

close(3) = 0

mmap(NULL, 12288, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7b5cc87a7000

arch_prctl(ARCH_SET_FS, 0x7b5cc87a7740) = 0

set_tid_address(0x7b5cc87a7a10) = 42807

set_robust_list(0x7b5cc87a7a20, 24) = 0

rseq(0x7b5cc87a8060, 0x20, 0, 0x53053053) = 0

mprotect(0x7b5cc85ff000, 16384, PROT_READ) = 0

mprotect(0x5b715801c000, 4096, PROT_READ) = 0

mprotect(0x7b5cc87ec000, 8192, PROT_READ) = 0

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

munmap(0x7b5cc87aa000, 37043) = 0

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

getrandom("\x1a\x0f\x29\x27\x64\xb5\xe1\x80", 8, GRND_NONBLOCK) = 8

brk(NULL) = 0x5b716582a000

brk(0x5b716584b000) = 0x5b716584b000

fstat(0, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0x5), ...}) = 0

write(1, "\320\222\320\262\320\265\320\264\320\270\321\202\320\265 \320\270\320\274\321\217 \321\204\320\260\320\271\320\273\320\260"..., 64Введите имя файла для результатов:) = 64

read(0, result.txt

"result.txt\n", 1024) = 11

openat(AT_FDCWD, "result.txt", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 3

close(3) = 0

openat(AT_FDCWD, "shared.dat", O_RDWR|O_CREAT, 0666) = 3

ftruncate(3, 4096) = 0

mmap(NULL, 4096, PROT_READ|PROT_WRITE, MAP_SHARED, 3, 0) = 0x7b5cc87b3000

clone(child_stack=NULL, flags=CLONE_CHILD_CLEARTID|CLONE_CHILD_SETTID|SIGCHLDstrace: Process 42820 attached

, child_tidptr=0x7b5cc87a7a10) = 42820

[pid 42807] write(1, "\320\222\320\262\320\265\320\264\320\270\321\202\320\265 \321\207\320\270\321\201\320\273\320\260:\n", 27 <unfinished ...>

[pid 42820] set_robust_list(0x7b5cc87a7a20, 24Введите числа:

<unfinished ...>

[pid 42807] <... write resumed>) = 27

[pid 42807] read(0, <unfinished ...>

[pid 42820] <... set_robust_list resumed>) = 0

[pid 42820] getppid() = 42807

[pid 42820] execve("./child", ["child", "shared.dat", "result.txt", "42807"], 0x7ffde6380d58 /* 29 vars */) = 0

[pid 42820] brk(NULL) = 0x5c0d74601000

[pid 42820] mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7e19795da000

[pid 42820] access("/etc/ld.so.preload", R_OK) = -1 ENOENT (No such file or directory)

[pid 42820] openat(AT_FDCWD, "/etc/ld.so.cache", O_RDONLY|O_CLOEXEC) = 4

[pid 42820] fstat(4, {st_mode=S_IFREG|0644, st_size=37043, ...}) = 0

[pid 42820] mmap(NULL, 37043, PROT_READ, MAP_PRIVATE, 4, 0) = 0x7e19795d0000

[pid 42820] close(4) = 0

[pid 42820] openat(AT_FDCWD, "/lib/x86_64-linux-gnu/libc.so.6", O_RDONLY|O_CLOEXEC) = 4

[pid 42820] read(4, "\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

[pid 42820] pread64(4, "\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

[pid 42820] fstat(4, {st_mode=S_IFREG|0755, st_size=2125328, ...}) = 0

[pid 42820] pread64(4, "\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

[pid 42820] mmap(NULL, 2170256, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 4, 0) = 0x7e1979200000

[pid 42820] mmap(0x7e1979228000, 1605632, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 4, 0x28000) = 0x7e1979228000

[pid 42820] mmap(0x7e19793b0000, 323584, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 4, 0x1b0000) = 0x7e19793b0000

[pid 42820] mmap(0x7e19793ff000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 4, 0x1fe000) = 0x7e19793ff000

[pid 42820] mmap(0x7e1979405000, 52624, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7e1979405000

[pid 42820] close(4) = 0

[pid 42820] mmap(NULL, 12288, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7e19795cd000

[pid 42820] arch_prctl(ARCH_SET_FS, 0x7e19795cd740) = 0

[pid 42820] set_tid_address(0x7e19795cda10) = 42820

[pid 42820] set_robust_list(0x7e19795cda20, 24) = 0

[pid 42820] rseq(0x7e19795ce060, 0x20, 0, 0x53053053) = 0

[pid 42820] mprotect(0x7e19793ff000, 16384, PROT_READ) = 0

[pid 42820] mprotect(0x5c0d63ee0000, 4096, PROT_READ) = 0

[pid 42820] mprotect(0x7e1979612000, 8192, PROT_READ) = 0

[pid 42820] prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024, rlim_max=RLIM64_INFINITY}) = 0

[pid 42820] munmap(0x7e19795d0000, 37043) = 0

[pid 42820] getrandom("\x97\xc7\xc1\x9d\x32\x77\x08\xcc", 8, GRND_NONBLOCK) = 8

[pid 42820] brk(NULL) = 0x5c0d74601000

[pid 42820] brk(0x5c0d74622000) = 0x5c0d74622000

[pid 42820] openat(AT_FDCWD, "result.txt", O_WRONLY|O_CREAT|O_TRUNC, 0666) = 4

[pid 42820] openat(AT_FDCWD, "shared.dat", O_RDONLY) = 5

[pid 42820] mmap(NULL, 4096, PROT_READ, MAP_SHARED, 5, 0) = 0x7e19795d9000

[pid 42820] close(5) = 0

[pid 42820] rt_sigaction(SIGUSR1, {sa_handler=0x5c0d63ede369, sa_mask=[USR1], sa_flags=SA_RESTORER|SA_RESTART, sa_restorer=0x7e1979245330}, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=0}, 8) = 0

[pid 42820] rt_sigaction(SIGTERM, {sa_handler=0x5c0d63ede369, sa_mask=[TERM], sa_flags=SA_RESTORER|SA_RESTART, sa_restorer=0x7e1979245330}, {sa_handler=SIG_DFL, sa_mask=[], sa_flags=0}, 8) = 0

[pid 42820] pause(100 2 5

<unfinished ...>

[pid 42807] <... read resumed>"100 2 5\n", 1024) = 8

[pid 42807] kill(42820, SIGUSR1) = 0

[pid 42820] <... pause resumed>) = ? ERESTARTNOHAND (To be restarted if no handler)

[pid 42807] wait4(42820, <unfinished ...>

```
[pid 42820] --- SIGUSR1 {si_signo=SIGUSR1, si_code=SI_USER, si_pid=42807, si_uid=1000} -
--
[pid 42807] <... wait4 resumed>0x7ffde6380780, WNOHANG, NULL) = 0
[pid 42807] read(0,  <unfinished ...>
[pid 42820] fstat(4, {st_mode=S_IFREG|0644, st_size=0, ...}) = 0
[pid 42820] write(4, "100 / 2 / 5 = 10\n", 17) = 17
[pid 42820] rt_sigreturn({mask=[]})     = -1 EINTR (Interrupted system call)
[pid 42820] pause(10 2 5
 <unfinished ...>
[pid 42807] <... read resumed>"10 2 5\n", 1024) = 7
[pid 42807] kill(42820, SIGUSR1)        = 0
[pid 42820] <... pause resumed>)        = ? ERESTARTNOHAND (To be restarted if no handler)
[pid 42807] wait4(42820, 0x7ffde6380780, WNOHANG, NULL) = 0
[pid 42820] --- SIGUSR1 {si_signo=SIGUSR1, si_code=SI_USER, si_pid=42807, si_uid=1000} -
--
[pid 42807] read(0,  <unfinished ...>
[pid 42820] write(4, "10 / 2 / 5 = 1\n", 15) = 15
[pid 42820] rt_sigreturn({mask=[]})     = -1 EINTR (Interrupted system call)
[pid 42820] pause(10 0
 <unfinished ...>
[pid 42807] <... read resumed>"10 0\n", 1024) = 5
[pid 42807] kill(42820, SIGUSR1)        = 0
[pid 42820] <... pause resumed>)        = ? ERESTARTNOHAND (To be restarted if no handler)
[pid 42807] wait4(42820, 0x7ffde6380780, WNOHANG, NULL) = 0
[pid 42820] --- SIGUSR1 {si_signo=SIGUSR1, si_code=SI_USER, si_pid=42807, si_uid=1000} -
--
[pid 42807] read(0,  <unfinished ...>
[pid 42820] write(4, "10 / 0 - \320\224\320\265\320\273\320\265\320\275\320\270\320\265
\320\275\320\260 0! "..., 67) = 67
[pid 42820] kill(42807, SIGTERM <unfinished ...>
[pid 42807] <... read resumed>0x5b716582a6b0, 1024) = ? ERESTARTSYS (To be restarted if
SA_RESTART is set)
[pid 42820] <... kill resumed>)         = 0
[pid 42807] --- SIGTERM {si_signo=SIGTERM, si_code=SI_USER, si_pid=42820, si_uid=1000}
---
```

[pid 42820] rt_sigreturn({mask=[]}) = -1 EINTR (Interrupted system call)

[pid 42807] +++ killed by SIGTERM +++

munmap(0x7e19795d9000, 4096) = 0

close(4) = 0

exit_group(0) = ?

+++ exited with 0 +++

Terminated

Лабораторная работа №4

strace -f ./static

execve("./static", ["./static"], 0x7ffe3eab2388 /* 29 vars */) = 0
brk(NULL) = 0x5fc304274000
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7d765e9a5000
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=37043, ...}) = 0
mmap(NULL, 37043, PROT_READ, MAP_PRIVATE, 3, 0) = 0x7d765e99b000
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"..., 832) = 832
pread64(3, "\6\0\0\0\4\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0\0@\0\0\0\0\0\0"..., 784, 64) = 784
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"..., 784, 64) = 784
mmap(NULL, 2170256, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x7d765e600000
mmap(0x7d765e628000, 1605632, PROT_READ|PROT_EXEC, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x28000) = 0x7d765e628000
mmap(0x7d765e7b0000, 323584, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1b0000) = 0x7d765e7b0000
mmap(0x7d765e7ff000, 24576, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1fe000) = 0x7d765e7ff000
mmap(0x7d765e805000, 52624, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x7d765e805000
close(3) = 0
mmap(NULL, 12288, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x7d765e998000
arch_prctl(ARCH_SET_FS, 0x7d765e998740) = 0
set_tid_address(0x7d765e998a10) = 42005
set_robust_list(0x7d765e998a20, 24) = 0
rseq(0x7d765e999060, 0x20, 0, 0x53053053) = 0
mprotect(0x7d765e7ff000, 16384, PROT_READ) = 0
mprotect(0x5fc2e5247000, 4096, PROT_READ) = 0
mprotect(0x7d765e9dd000, 8192, PROT_READ) = 0

prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024, rlim_max=RLIM64_INFINITY}) = 0
munmap(0x7d765e99b000, 37043) = 0
fstat(1, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) = 0
getrandom("\xdd\x13\xfa\x28\x57\x5f\x31\x24", 8, GRND_NONBLOCK) = 8
brk(NULL) = 0x5fc304274000
brk(0x5fc304295000) = 0x5fc304295000
write(1, " 1 K - \320\262\321\213\321\207\320\270\321\201\320\273\320\270\321\202"..., 38 1 K - вычислить Pi
) = 38
write(1, " 2 a1 a2 ... - \320\276\321\202\321\201\320\276\321\200\321\202\320\270\321\200"..., 54 2 a1 a2 ... - отсортировать числа
) = 54
write(1, " -1 - \320\262\321\213\321\205\320\276\320\264\n", 27 -1 - выход
) = 27
fstat(0, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) = 0
write(1, "\320\222\320\262\320\265\320\264\320\270\321\202\320\265
\320\272\320\276\320\274\320\260\320\275\320\264\321\203: ", 31Введите команду:) = 31
read(0, 1 1000
"1 1000\n", 1024) = 7
write(1, "Pi = 3.140593\n", 14Pi = 3.140593
) = 14
read(0, 2 52 42 67 7
"2 52 42 67 7\n", 1024) = 13
write(1, "\320\230\321\201\321\205\320\276\320\264\320\275\321\213\320\271: 52 42 67 7 \n", 30Исходный: 52 42 67 7
) = 30
write(1, "\320\236\321\202\321\201\320\276\321\200\321\202\320\270\321\200\320\276\320\262\320\260\320\275\320\275\321\213\320\271: "..., 44Отсортированный: 7 42 52 67
) = 44
read(0, -1
"-1\n", 1024) = 3
write(1, "\320\222\321\213\321\205\320\276\320\264\n", 11Выход
) = 11
lseek(0, -1, SEEK_CUR) = -1 ESPIPE (Illegal seek)
exit_group(0) = ?
+++ exited with 0 +++

Динамическая версия (dynamic):
strace -f ./dynamic
execve("./dynamic", ["./dynamic"], 0x7ffdd8e1e428 /* 29 vars */) = 0
brk(NULL) = 0x5ad00f6fc000
mmap(NULL, 8192, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) = 0x72a69cba7000
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=37043, ...}) = 0

mmap(NULL, 37043, PROT_READ, MAP_PRIVATE, 3, 0) = 0x72a69cb9d000
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) = 0x72a69c800000
mmap(0x72a69c828000, 1605632, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x28000) = 0x72a69c828000
mmap(0x72a69c9b0000, 323584, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x1b0000) = 0x72a69c9b0000
mmap(0x72a69c9ff000, 24576, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1fe000) = 0x72a69c9ff000
mmap(0x72a69ca05000, 52624, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_ANONYMOUS, -1, 0) = 0x72a69ca05000
close(3) = 0
mmap(NULL, 12288, PROT_READ|PROT_WRITE, MAP_PRIVATE|MAP_ANONYMOUS, -1, 0) =
0x72a69cb9a000
arch_prctl(ARCH_SET_FS, 0x72a69cb9a740) = 0
set_tid_address(0x72a69cb9aa10) = 486
set_robust_list(0x72a69cb9aa20, 24) = 0
rseq(0x72a69cb9b060, 0x20, 0, 0x53053053) = 0
mprotect(0x72a69c9ff000, 16384, PROT_READ) = 0
mprotect(0x5acfe5de5000, 4096, PROT_READ) = 0
mprotect(0x72a69cbdf000, 8192, PROT_READ) = 0
prlimit64(0, RLIMIT_STACK, NULL, {rlim_cur=8192*1024, rlim_max=RLIM64_INFINITY}) = 0
munmap(0x72a69cb9d000, 37043) = 0
getrandom("\x02\x90\xfb\x2c\x5e\x1c\x7e\x34", 8, GRND_NONBLOCK) = 8
brk(NULL) = 0x5ad00f6fc000
brk(0x5ad00f71d000) = 0x5ad00f71d000
openat(AT_FDCWD, "./lib1.so", O_RDONLY|O_CLOEXEC) = 3
read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\0\0\0\0\0\0"..., 832) = 832
fstat(3, {st_mode=S_IFREG|0755, st_size=15576, ...}) = 0
getcwd("/home/kishaki/lab_OS4", 128) = 22
mmap(NULL, 16408, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x72a69cba2000
**mmap(0x72a69cba3000, 4096, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1000) = 0x72a69cba3000**
**mmap(0x72a69cba4000, 4096, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3,
0x2000) = 0x72a69cba4000**
**mmap(0x72a69cba5000, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x2000) = 0x72a69cba5000**
close(3) = 0
mprotect(0x72a69cba5000, 4096, PROT_READ) = 0
fstat(1, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) = 0
write(1, " 0 - \320\277\320\265\321\200\320\265\320\272\320\273\321\216\321\207"..., 60 0 -
переключить библиотеку
) = 60

write(1, " 1 K   - \320\262\321\213\321\207\320\270\321\201\320\273\320\270\321\202"..., 38 1 K   - вычислить Pi
) = 38
write(1, " 2 a1 a2 ... - \320\276\321\202\321\201\320\276\321\200\321\202\320\270\321\200"..., 54 2 a1 a2 ... - отсортировать числа
) = 54
write(1, " -1   - \320\262\321\213\321\205\320\276\320\264\n", 27 -1   - выход
) = 27
fstat(0, {st_mode=S_IFCHR|0620, st_rdev=makedev(0x88, 0), ...}) = 0
write(1, "\320\222\320\262\320\265\320\264\320\270\321\202\320\265
\320\272\320\276\320\274\320\260\320\275\320\264\321\203: ", 31Введите команду:) = 31
read(0, 1 1000
"1 1000\n", 1024)   = 7
write(1, "Pi = 3.140593 (\320\261\320\270\320\261\320\273\320\270\320\276\321\202\320\265\320"..., 39Pi = 3.140593 (библиотека 1)
) = 39
read(0, 2 52 42 67 7
"2 52 42 67 7\n", 1024)   = 13
write(1, "\320\230\321\201\321\205\320\276\320\264\320\275\321\213\320\271: 52 42 67 7 \n", 30Исходный: 52 42 67 7
) = 30
write(1,
"\320\236\321\202\321\201\320\276\321\200\321\202\320\270\321\200\320\276\320\262\320\260\320\275\
320\275\321\213\320\271: "..., 69Отсортированный: 7 42 52 67 (библиотека 1)
) = 69
read(0, 0
"0\n", 1024)   = 2
munmap(0x72a69cba2000, 16408)   = 0
openat(AT_FDCWD, "./lib2.so", 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=15664, ...}) = 0
getcwd("/home/kishaki/lab_OS4", 128)   = 22
mmap(NULL, 16416, PROT_READ, MAP_PRIVATE|MAP_DENYWRITE, 3, 0) = 0x72a69cba2000
**mmap(0x72a69cba3000, 4096, PROT_READ|PROT_EXEC,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x1000) = 0x72a69cba3000**
mmap(0x72a69cba4000, 4096, PROT_READ, MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x2000) = 0x72a69cba4000
**mmap(0x72a69cba5000, 8192, PROT_READ|PROT_WRITE,
MAP_PRIVATE|MAP_FIXED|MAP_DENYWRITE, 3, 0x2000) = 0x72a69cba5000**
close(3)   = 0
mprotect(0x72a69cba5000, 4096, PROT_READ) = 0
write(1, "\320\221\320\270\320\261\320\273\320\270\320\276\321\202\320\265\320\272\320\260
\320\277\320\265\321\200\320\265\320\272\320"..., 72Библиотека переключена на реализацию 2
) = 72
read(0, 1 1000
"1 1000\n", 1024)   = 7
write(1, "Pi = 3.140806 (\320\261\320\270\320\261\320\273\320\270\320\276\321\202\320\265\320"..., 39Pi = 3.140806 (библиотека 2)
) = 39

```
read(0, 2 52 42 67 7
"2 52 42 67 7\n", 1024)         = 13
write(1, "\320\230\321\201\321\205\320\276\320\264\320\275\321\213\320\271: 52 42 67 7 \n",
30Исходный: 52 42 67 7
) = 30
write(1,
"\320\236\321\202\321\201\320\276\321\200\321\202\320\270\321\200\320\276\320\262\320\260\320\275\
320\275\321\213\320\271: "..., 69Отсортированный: 7 42 52 67  (библиотека 2)
) = 69
read(0, -1
"-1\n", 1024)                   = 3
write(1, "\320\222\321\213\321\205\320\276\320\264\n", 11Выход
) = 11
munmap(0x72a69cba2000, 16416)           = 0
lseek(0, -1, SEEK_CUR)                  = -1 ESPIPE (Illegal seek)
exit_group(0)                           = ?
+++ exited with 0 +++
```

Вывод

В ходе выполнения лабораторной работы были получены навыки в использовании утилиты strace с её широким набором флагов предоставляет глубокий и наглядный механизм анализа взаимодействия программы с ядром операционной системы.