Московский Авиационный Институт

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Институт №8 “Компьютерные науки и прикладная математика”

Кафедра №806 “Вычислительная математика и программирование”

**Лабораторная работа №1 по курсу**

**«Операционные системы»**

Группа: М8О-214БВ-25

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**Постановка задачи**

**Вариант 17.**

Родительский процесс создает два дочерних процесса. Первой строкой пользователь в консоль родительского процесса вводит имя файла, которое будет использовано для открытия File с таким именем на запись для child1. Аналогично для второй строки и процесса child2. Родительский и дочерний процесс должны быть представлены разными программами. Родительский процесс принимает от пользователя строки произвольной длины и пересылает их в pipe1 или в pipe2 в зависимости от правила фильтрации. Процесс child1 и child2 производят работу над строками. Процессы пишут результаты своей работы в стандартный вывод. Правило фильтрации: строки длины больше 10 символов отправляются в pipe2, иначе в pipe1. Дочерние процессы удаляют все гласные из строк

**Общий метод и алгоритм решения**

Использованные системные вызовы:

* **pid\_t fork(void);** – создает дочерний процесс.
* **int pipe(int \*fd);** – **создает неименованный однонаправленный канал**
* **int dup2(int oldfd, int newfd);** – **перенаправляет файловый дескриптор**.
* **int execv(const char \*path, char \*const argv[]);** – **запускает новую программу**
* **ssize\_t read(int fd, void \*buf, size\_t count);** – **чтение данных**(используется родителем для построчного чтения с консоли и дочерним процессом для чтения данных из канала)
* **ssize\_t write(int fd, const void \*buf, size\_t count);** – **запись данных** (используется родителем для записи фильтрованных строк в каналы, а также дочерним процессом для вывода обработанных строк в файл и на консоль)
* **int close(int fd);** – **закрывает файловый дескриптор**
* **pid\_t waitpid(pid\_t pid, int \*status, int options);** – **ожидает завершения дочернего процесса**

Алгоритм решения:

1. Создается родительский процесс и запрашиваются имена двух выходных файлов. Создаются два неименованных канала (pipe1 pipe2) и дважды вызывается fork(), чтобы создать два дочерних процесса. Каждый процесс закрывает ту часть канала, которую он не будет использовать.
2. Родитель читает строки, которые вводятся с консоли, разделяя их по длине, ввод пользователя разделяется на два параллельных потока.

* Короткая строка (≤10): Родитель записывает ее в pipe1[1]
* Длинная строка (>10): Родитель записывает ее в pipe2[1]

1. Каждый процесс server читает данные со своего STDIN. На каждой строке вызывается функция, которая удаляет все гласные. Результат записывается на выходной файл и на стандартный вывод.
2. Когда родитель завершает ввод, он вызывает close() для обоих концов записи (pipe1[1] и pipe2[1]) , функция read() в дочернем процессе возвращает 0 Дочерние процессы выходят из цикла чтения и завершаются. Родитель вызывает waitpid() для каждого дочернего процесса. Он блокируется, пока оба ребенка не завершатся.

**Код программы**

**client.c**

#include <unistd.h>

#include <sys/types.h>

#include <sys/wait.h>

#include <fcntl.h>

#include <stdlib.h>

#include <string.h>

#include <errno.h>

#include <stdio.h>

#define MAX\_LINE\_LEN 4096

ssize\_t read\_line(int fd, char \*buffer, size\_t max\_len) {

ssize\_t total\_read = 0;

char c;

while (total\_read < max\_len - 1 && read(fd, &c, 1) == 1) {

if (c == '\n') {

break;

}

buffer[total\_read++] = c;

}

if (total\_read == 0 && c != '\n'){

return -1;

}

buffer[total\_read] = '\0';

return total\_read;

}

int main() {

char filename1[256], filename2[256];

write(STDOUT\_FILENO, "Enter the file name for child1: ", 32);//получения названия 1txt

ssize\_t r1 = read(STDIN\_FILENO, filename1, sizeof(filename1) - 1);

if (r1 <= 0){

exit(EXIT\_FAILURE);

}

if (filename1[r1 - 1] == '\n') {

filename1[r1 - 1] = '\0';

}

write(STDOUT\_FILENO, "Enter the file name for child2: ", 32);//получения названия 2txt

ssize\_t r2 = read(STDIN\_FILENO, filename2, sizeof(filename2) - 1);

if (r2 <= 0) {

exit(EXIT\_FAILURE);

}

if (filename2[r2 - 1] == '\n'){

filename2[r2 - 1] = '\0';

}

int pipe1[2], pipe2[2];//создали каналы

if (pipe(pipe1) == -1 || pipe(pipe2) == -1) {

perror("pipe creation failed");

exit(EXIT\_FAILURE);

}

pid\_t pid1 = fork();//процесс для первого

if (pid1 == -1) {

perror("fork child1");

exit(EXIT\_FAILURE);

}

if (pid1 == 0) {

close(pipe1[1]);

dup2(pipe1[0], STDIN\_FILENO);

close(pipe1[0]);

close(pipe2[0]);

close(pipe2[1]);

char \*args[] = {"./server", filename1, NULL};

execv("./server", args);

perror("execv child1 failed");

exit(EXIT\_FAILURE);

}

pid\_t pid2 = fork();//процесс для второго

if (pid2 == -1) {

perror("fork child2");

exit(EXIT\_FAILURE);

}

if (pid2 == 0) {

close(pipe2[1]);

dup2(pipe2[0], STDIN\_FILENO);

close(pipe2[0]);

close(pipe1[0]);

close(pipe1[1]);

char \*args[] = {"./server", filename2, NULL};

execv("./server", args);

perror("execv child2 failed");

exit(EXIT\_FAILURE);

}

close(pipe1[0]);

close(pipe2[0]);

int wfd1 = pipe1[1];

int wfd2 = pipe2[1];

char line[MAX\_LINE\_LEN];

ssize\_t len;

write(STDOUT\_FILENO, "Enter the lines:\n", 17);

while ((len = read\_line(STDIN\_FILENO, line, sizeof(line))) != -1) {

if (len == 0){

break;

}

int target\_fd;

if (len > 10) { //фильтрация

target\_fd = wfd2;

} else {

target\_fd = wfd1;

}

if (write(target\_fd, line, len) == -1 || write(target\_fd, "\n", 1) == -1) {

perror("write to pipe failed");

break;

}

}

close(wfd1);

close(wfd2);

waitpid(pid1, NULL, 0);

waitpid(pid2, NULL, 0);

write(STDOUT\_FILENO, "Parent: all children finished.\n", 31);

return 0;

}

**server.c**

#include <unistd.h>

#include <fcntl.h>

#include <stdlib.h>

#include <string.h>

#include <errno.h>

#include <stdio.h>

#define MAX\_LEN 4096

void remove\_vowels(char \*s)

{

char \*src = s, \*dst = s;

while (\*src) {

char c = \*src;

if (!(c == 'a' || c == 'e' || c == 'i' || c == 'o' || c == 'u' || c == 'A' || c == 'E' || c == 'I' || c == 'O' || c == 'U' || c == 'y' || c == 'Y')) {

\*dst++ = c;

}

src++;

}

\*dst = '\0';

}

int main(int argc, char \*\*argv)

{

if (argc != 2) {

const char msg[] = "usage: server filename\n";

write(STDERR\_FILENO, msg, sizeof(msg) - 1);

exit(EXIT\_FAILURE);

}

int fd = open(argv[1], O\_WRONLY | O\_CREAT | O\_TRUNC, 0644);

if (fd == -1) {

perror("open file failed");

exit(EXIT\_FAILURE);

}

char buf[MAX\_LEN];

ssize\_t n;

while ((n = read(STDIN\_FILENO, buf, sizeof(buf) - 1)) > 0) {

if (buf[n - 1] == '\n') {

buf[n - 1] = '\0';

} else {

buf[n] = '\0';

}

remove\_vowels(buf);

size\_t len = strlen(buf);

if (write(fd, buf, len) == -1 || write(fd, "\n", 1) == -1) {

perror("write file failed");

}

if (write(STDOUT\_FILENO, buf, len) == -1 || write(STDOUT\_FILENO, "\n", 1) == -1) {

perror("write stdout failed");

}

}

if (n == -1) {

perror("read stdin failed");

}

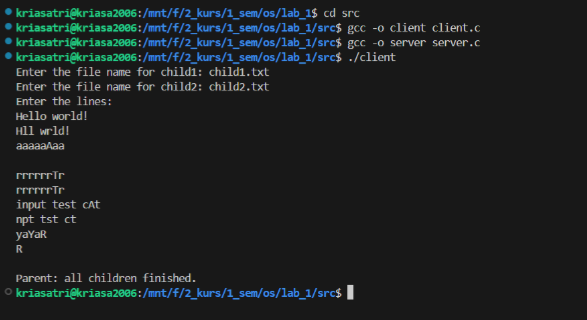
close(fd);

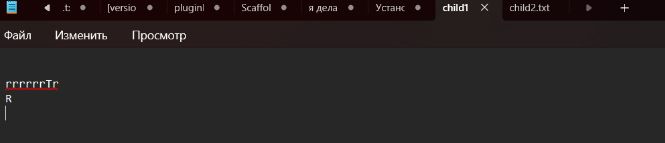
return 0;

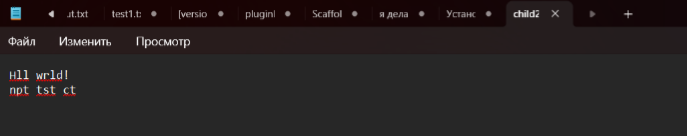
}

**Протокол работы программы**

**Тесты**

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**Strace**

kriasatri@kriasa2006:/mnt/f/2\_kurs/1\_sem/os/lab\_1/src$ strace -f ./client

execve("./client", ["./client"], 0x7ffc432d7b68 /\* 36 vars \*/) = 0

brk(NULL) = 0x5c6ec34d7000

mmap(NULL, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7ad4aca1b000

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=19711, ...}) = 0

mmap(NULL, 19711, PROT\_READ, MAP\_PRIVATE, 3, 0) = 0x7ad4aca16000

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) = 0x7ad4ac800000

mmap(0x7ad4ac828000, 1605632, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x28000) = 0x7ad4ac828000

mmap(0x7ad4ac9b0000, 323584, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1b0000) = 0x7ad4ac9b0000

mmap(0x7ad4ac9ff000, 24576, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1fe000) = 0x7ad4ac9ff000

mmap(0x7ad4aca05000, 52624, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_ANONYMOUS, -1, 0) = 0x7ad4aca05000

close(3) = 0

mmap(NULL, 12288, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7ad4aca13000

arch\_prctl(ARCH\_SET\_FS, 0x7ad4aca13740) = 0

set\_tid\_address(0x7ad4aca13a10) = 52632

set\_robust\_list(0x7ad4aca13a20, 24) = 0

rseq(0x7ad4aca14060, 0x20, 0, 0x53053053) = 0

mprotect(0x7ad4ac9ff000, 16384, PROT\_READ) = 0

mprotect(0x5c6e87717000, 4096, PROT\_READ) = 0

mprotect(0x7ad4aca53000, 8192, PROT\_READ) = 0

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

munmap(0x7ad4aca16000, 19711) = 0

**write(1, "Enter the file name for child1: ", 32Enter the file name for child1: ) = 32**

**read(0, child1.txt**

**"child1.txt\n", 255) = 11**

**write(1, "Enter the file name for child2: ", 32Enter the file name for child2: ) = 32**

**read(0, child2.txt**

**"child2.txt\n", 255) = 11**

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

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

**clone(child\_stack=NULL, flags=CLONE\_CHILD\_CLEARTID|CLONE\_CHILD\_SETTID|SIGCHLDstrace: Process 52726 attached**

**, child\_tidptr=0x7ad4aca13a10) = 52726**

[pid 52726] set\_robust\_list(0x7ad4aca13a20, 24) = 0

**[pid 52632] clone(child\_stack=NULL, flags=CLONE\_CHILD\_CLEARTID|CLONE\_CHILD\_SETTID|SIGCHLD <unfinished ...>**

**[pid 52726] close(4) = 0**

**[pid 52726] dup2(3, 0) = 0**

**[pid 52726] close(3strace: Process 52727 attached**

**) = 0**

**[pid 52632] <... clone resumed>, child\_tidptr=0x7ad4aca13a10) = 52727**

[pid 52727] set\_robust\_list(0x7ad4aca13a20, 24 <unfinished ...>

**[pid 52632] close(3 <unfinished ...>**

**[pid 52726] close(5 <unfinished ...>**

[pid 52632] <... close resumed>) = 0

[pid 52727] <... set\_robust\_list resumed>) = 0

**[pid 52632] close(5 <unfinished ...>**

[pid 52726] <... close resumed>) = 0

[pid 52632] <... close resumed>) = 0

**[pid 52727] close(6 <unfinished ...>**

**[pid 52632] write(1, "Enter the lines:\n", 17 <unfinished ...>**

**Enter the lines:**

**[pid 52726] close(6 <unfinished ...>**

[pid 52632] <... write resumed>) = 17

[pid 52727] <... close resumed>) = 0

**[pid 52632] read(0, <unfinished ...>**

[pid 52726] <... close resumed>) = 0

**[pid 52727] dup2(5, 0 <unfinished ...>**

**[pid 52726] execve("./server", ["./server", "child1.txt"], 0x7ffe57399c58 /\* 36 vars \*/ <unfinished ...>**

**[pid 52727] <... dup2 resumed>) = 0**

**[pid 52727] close(5) = 0**

**[pid 52727] close(3) = 0**

**[pid 52727] close(4) = 0**

**[pid 52727] execve("./server", ["./server", "child2.txt"], 0x7ffe57399c58 /\* 36 vars \*/) = 0**

[pid 52726] <... execve resumed>) = 0

[pid 52727] brk(NULL <unfinished ...>

[pid 52726] brk(NULL <unfinished ...>

[pid 52727] <... brk resumed>) = 0x624926023000

[pid 52726] <... brk resumed>) = 0x589376eb4000

[pid 52727] mmap(NULL, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0 <unfinished ...>

[pid 52726] mmap(NULL, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0 <unfinished ...>

[pid 52727] <... mmap resumed>) = 0x72b281063000

[pid 52727] access("/etc/ld.so.preload", R\_OK <unfinished ...>

[pid 52726] <... mmap resumed>) = 0x7b2ce50bf000

[pid 52727] <... access resumed>) = -1 ENOENT (No such file or directory)

[pid 52726] access("/etc/ld.so.preload", R\_OK <unfinished ...>

[pid 52727] openat(AT\_FDCWD, "/etc/ld.so.cache", O\_RDONLY|O\_CLOEXEC <unfinished ...>

[pid 52726] <... access resumed>) = -1 ENOENT (No such file or directory)

[pid 52727] <... openat resumed>) = 3

[pid 52727] fstat(3, <unfinished ...>

[pid 52726] openat(AT\_FDCWD, "/etc/ld.so.cache", O\_RDONLY|O\_CLOEXEC <unfinished ...>

[pid 52727] <... fstat resumed>{st\_mode=S\_IFREG|0644, st\_size=19711, ...}) = 0

[pid 52726] <... openat resumed>) = 3

[pid 52727] mmap(NULL, 19711, PROT\_READ, MAP\_PRIVATE, 3, 0 <unfinished ...>

[pid 52726] fstat(3, <unfinished ...>

[pid 52727] <... mmap resumed>) = 0x72b28105e000

[pid 52726] <... fstat resumed>{st\_mode=S\_IFREG|0644, st\_size=19711, ...}) = 0

[pid 52727] close(3 <unfinished ...>

[pid 52726] mmap(NULL, 19711, PROT\_READ, MAP\_PRIVATE, 3, 0 <unfinished ...>

[pid 52727] <... close resumed>) = 0

[pid 52726] <... mmap resumed>) = 0x7b2ce50ba000

[pid 52727] openat(AT\_FDCWD, "/lib/x86\_64-linux-gnu/libc.so.6", O\_RDONLY|O\_CLOEXEC <unfinished ...>

[pid 52726] close(3 <unfinished ...>

[pid 52727] <... openat resumed>) = 3

[pid 52726] <... close resumed>) = 0

[pid 52727] read(3, <unfinished ...>

[pid 52726] openat(AT\_FDCWD, "/lib/x86\_64-linux-gnu/libc.so.6", O\_RDONLY|O\_CLOEXEC <unfinished ...>

[pid 52727] <... read resumed>"\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 52726] <... openat resumed>) = 3

[pid 52727] pread64(3, <unfinished ...>

[pid 52726] read(3, <unfinished ...>

[pid 52727] <... pread64 resumed>"\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 52726] <... read resumed>"\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 52727] fstat(3, <unfinished ...>

[pid 52726] pread64(3, <unfinished ...>

[pid 52727] <... fstat resumed>{st\_mode=S\_IFREG|0755, st\_size=2125328, ...}) = 0

[pid 52726] <... pread64 resumed>"\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 52727] pread64(3, <unfinished ...>

[pid 52726] fstat(3, <unfinished ...>

[pid 52727] <... pread64 resumed>"\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 52726] <... fstat resumed>{st\_mode=S\_IFREG|0755, st\_size=2125328, ...}) = 0

[pid 52727] mmap(NULL, 2170256, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0 <unfinished ...>

[pid 52726] pread64(3, <unfinished ...>

[pid 52727] <... mmap resumed>) = 0x72b280e00000

[pid 52726] <... pread64 resumed>"\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 52727] mmap(0x72b280e28000, 1605632, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x28000 <unfinished ...>

[pid 52726] mmap(NULL, 2170256, PROT\_READ, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0 <unfinished ...>

[pid 52727] <... mmap resumed>) = 0x72b280e28000

[pid 52726] <... mmap resumed>) = 0x7b2ce4e00000

[pid 52727] mmap(0x72b280fb0000, 323584, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1b0000 <unfinished ...>

[pid 52726] mmap(0x7b2ce4e28000, 1605632, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x28000 <unfinished ...>

[pid 52727] <... mmap resumed>) = 0x72b280fb0000

[pid 52726] <... mmap resumed>) = 0x7b2ce4e28000

[pid 52727] mmap(0x72b280fff000, 24576, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1fe000 <unfinished ...>

[pid 52726] mmap(0x7b2ce4fb0000, 323584, PROT\_READ, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1b0000 <unfinished ...>

[pid 52727] <... mmap resumed>) = 0x72b280fff000

[pid 52726] <... mmap resumed>) = 0x7b2ce4fb0000

[pid 52727] mmap(0x72b281005000, 52624, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_ANONYMOUS, -1, 0 <unfinished ...>

[pid 52726] mmap(0x7b2ce4fff000, 24576, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1fe000 <unfinished ...>

[pid 52727] <... mmap resumed>) = 0x72b281005000

[pid 52726] <... mmap resumed>) = 0x7b2ce4fff000

[pid 52727] close(3 <unfinished ...>

[pid 52726] mmap(0x7b2ce5005000, 52624, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_ANONYMOUS, -1, 0 <unfinished ...>

[pid 52727] <... close resumed>) = 0

[pid 52726] <... mmap resumed>) = 0x7b2ce5005000

[pid 52727] mmap(NULL, 12288, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0 <unfinished ...>

[pid 52726] close(3 <unfinished ...>

[pid 52727] <... mmap resumed>) = 0x72b28105b000

[pid 52726] <... close resumed>) = 0

[pid 52727] arch\_prctl(ARCH\_SET\_FS, 0x72b28105b740) = 0

[pid 52726] mmap(NULL, 12288, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0 <unfinished ...>

[pid 52727] set\_tid\_address(0x72b28105ba10 <unfinished ...>

[pid 52726] <... mmap resumed>) = 0x7b2ce50b7000

[pid 52727] <... set\_tid\_address resumed>) = 52727

[pid 52726] arch\_prctl(ARCH\_SET\_FS, 0x7b2ce50b7740 <unfinished ...>

[pid 52727] set\_robust\_list(0x72b28105ba20, 24 <unfinished ...>

[pid 52726] <... arch\_prctl resumed>) = 0

[pid 52727] <... set\_robust\_list resumed>) = 0

[pid 52726] set\_tid\_address(0x7b2ce50b7a10 <unfinished ...>

[pid 52727] rseq(0x72b28105c060, 0x20, 0, 0x53053053 <unfinished ...>

[pid 52726] <... set\_tid\_address resumed>) = 52726

[pid 52727] <... rseq resumed>) = 0

[pid 52726] set\_robust\_list(0x7b2ce50b7a20, 24) = 0

[pid 52727] mprotect(0x72b280fff000, 16384, PROT\_READ <unfinished ...>

[pid 52726] rseq(0x7b2ce50b8060, 0x20, 0, 0x53053053 <unfinished ...>

[pid 52727] <... mprotect resumed>) = 0

[pid 52726] <... rseq resumed>) = 0

[pid 52727] mprotect(0x6248f4ed0000, 4096, PROT\_READ) = 0

[pid 52726] mprotect(0x7b2ce4fff000, 16384, PROT\_READ <unfinished ...>

[pid 52727] mprotect(0x72b28109b000, 8192, PROT\_READ <unfinished ...>

[pid 52726] <... mprotect resumed>) = 0

[pid 52727] <... mprotect resumed>) = 0

[pid 52726] mprotect(0x589366132000, 4096, PROT\_READ <unfinished ...>

[pid 52727] prlimit64(0, RLIMIT\_STACK, NULL, <unfinished ...>

[pid 52726] <... mprotect resumed>) = 0

[pid 52727] <... prlimit64 resumed>{rlim\_cur=8192\*1024, rlim\_max=RLIM64\_INFINITY}) = 0

[pid 52726] mprotect(0x7b2ce50f7000, 8192, PROT\_READ <unfinished ...>

[pid 52727] munmap(0x72b28105e000, 19711 <unfinished ...>

[pid 52726] <... mprotect resumed>) = 0

[pid 52727] <... munmap resumed>) = 0

[pid 52726] prlimit64(0, RLIMIT\_STACK, NULL, <unfinished ...>

**[pid 52727] openat(AT\_FDCWD, "child2.txt", O\_WRONLY|O\_CREAT|O\_TRUNC, 0644 <unfinished ...>**

[pid 52726] <... prlimit64 resumed>{rlim\_cur=8192\*1024, rlim\_max=RLIM64\_INFINITY}) = 0

[pid 52726] munmap(0x7b2ce50ba000, 19711) = 0

**[pid 52726] openat(AT\_FDCWD, "child1.txt", O\_WRONLY|O\_CREAT|O\_TRUNC, 0644 <unfinished ...>**

[pid 52727] <... openat resumed>) = 3

[pid 52727] read(0, <unfinished ...>

[pid 52726] <... openat resumed>) = 3

**[pid 52726] read(0, Hello world1**

**<unfinished ...>**

**[pid 52632] <... read resumed>"H", 1) = 1**

**[pid 52632] read(0, "e", 1) = 1**

**[pid 52632] read(0, "l", 1) = 1**

**[pid 52632] read(0, "l", 1) = 1**

**[pid 52632] read(0, "o", 1) = 1**

**[pid 52632] read(0, " ", 1) = 1**

**[pid 52632] read(0, "w", 1) = 1**

**[pid 52632] read(0, "o", 1) = 1**

**[pid 52632] read(0, "r", 1) = 1**

**[pid 52632] read(0, "l", 1) = 1**

**[pid 52632] read(0, "d", 1) = 1**

**[pid 52632] read(0, "1", 1) = 1**

**[pid 52632] read(0, "\n", 1) = 1**

**[pid 52632] write(6, "Hello world1", 12) = 12**

**[pid 52727] <... read resumed>"Hello world1", 4095) = 12**

[pid 52632] write(6, "\n", 1 <unfinished ...>

[pid 52727] write(3, "Hll wrld1", 9 <unfinished ...>

[pid 52632] <... write resumed>) = 1

[pid 52632] read(0, <unfinished ...>

[pid 52727] <... write resumed>) = 9

**[pid 52727] write(3, "\n", 1) = 1**

**[pid 52727] write(1, "Hll wrld1", 9Hll wrld1) = 9**

**[pid 52727] write(1, "\n", 1**

**) = 1**

**[pid 52727] read(0, "\n", 4095) = 1**

**[pid 52727] write(3, "", 0) = 0**

**[pid 52727] write(3, "\n", 1) = 1**

**[pid 52727] write(1, "", 0) = 0**

**[pid 52727] write(1, "\n", 1**

**) = 1**

**[pid 52727] read(0, aaaAaAAA!**

**<unfinished ...>**

**[pid 52632] <... read resumed>"a", 1) = 1**

**[pid 52632] read(0, "a", 1) = 1**

**[pid 52632] read(0, "a", 1) = 1**

**[pid 52632] read(0, "A", 1) = 1**

**[pid 52632] read(0, "a", 1) = 1**

**[pid 52632] read(0, "A", 1) = 1**

**[pid 52632] read(0, "A", 1) = 1**

**[pid 52632] read(0, "A", 1) = 1**

**[pid 52632] read(0, "!", 1) = 1**

**[pid 52632] read(0, "\n", 1) = 1**

**[pid 52632] write(4, "aaaAaAAA!", 9) = 9**

[pid 52726] <... read resumed>"aaaAaAAA!", 4095) = 9

[pid 52632] write(4, "\n", 1 <unfinished ...>

[pid 52726] write(3, "!", 1 <unfinished ...>

[pid 52632] <... write resumed>) = 1

[pid 52632] read(0, <unfinished ...>

[pid 52726] <... write resumed>) = 1

**[pid 52726] write(3, "\n", 1) = 1**

**[pid 52726] write(1, "!", 1!) = 1**

**[pid 52726] write(1, "\n", 1**

**) = 1**

**[pid 52726] read(0, "\n", 4095) = 1**

**[pid 52726] write(3, "", 0) = 0**

**[pid 52726] write(3, "\n", 1) = 1**

**[pid 52726] write(1, "", 0) = 0**

**[pid 52726] write(1, "\n", 1**

**) = 1**

[**pid 52726] read(0, input test cat**

**<unfinished ...>**

**[pid 52632] <... read resumed>"i", 1) = 1**

**[pid 52632] read(0, "n", 1) = 1**

**[pid 52632] read(0, "p", 1) = 1**

**[pid 52632] read(0, "u", 1) = 1**

**[pid 52632] read(0, "t", 1) = 1**

**[pid 52632] read(0, " ", 1) = 1**

**[pid 52632] read(0, "t", 1) = 1**

**[pid 52632] read(0, "e", 1) = 1**

**[pid 52632] read(0, "s", 1) = 1**

**[pid 52632] read(0, "t", 1) = 1**

**[pid 52632] read(0, " ", 1) = 1**

**[pid 52632] read(0, "c", 1) = 1**

**[pid 52632] read(0, "a", 1) = 1**

**[pid 52632] read(0, "t", 1) = 1**

**[pid 52632] read(0, "\n", 1) = 1**

**[pid 52632] write(6, "input test cat", 14) = 14**

[pid 52727] <... read resumed>"input test cat", 4095) = 14

[pid 52632] write(6, "\n", 1 <unfinished ...>

**[pid 52727] write(3, "npt tst ct", 10 <unfinished ...>**

[pid 52632] <... write resumed>) = 1

[pid 52632] read(0, <unfinished ...>

[pid 52727] <... write resumed>) = 10

**[pid 52727] write(3, "\n", 1) = 1**

**[pid 52727] write(1, "npt tst ct", 10npt tst ct) = 10**

**[pid 52727] write(1, "\n", 1**

**) = 1**

**[pid 52727] read(0, "\n", 4095) = 1**

**[pid 52727] write(3, "", 0) = 0**

**[pid 52727] write(3, "\n", 1) = 1**

**[pid 52727] write(1, "", 0) = 0**

**[pid 52727] write(1, "\n", 1**

**) = 1**

[pid 52727] read(0,

<unfinished ...>

[pid 52632] <... read resumed>"\n", 1) = 1

**[pid 52632] close(4) = 0**

[pid 52726] <... read resumed>"", 4095) = 0

[pid 52632] close(6 <unfinished ...>

[pid 52726] close(3 <unfinished ...>

[pid 52632] <... close resumed>) = 0

[pid 52727] <... read resumed>"", 4095) = 0

**[pid 52632] wait4(52726, <unfinished ...>**

[pid 52727] close(3 <unfinished ...>

[pid 52726] <... close resumed>) = 0

[pid 52727] <... close resumed>) = 0

[pid 52726] exit\_group(0) = ?

[pid 52727] exit\_group(0) = ?

[pid 52726] +++ exited with 0 +++

[**pid 52632] <... wait4 resumed>NULL, 0, NULL) = 52726**

[pid 52632] --- SIGCHLD {si\_signo=SIGCHLD, si\_code=CLD\_EXITED, si\_pid=52726, si\_uid=1000, si\_status=0, si\_utime=0, si\_stime=0} ---

[pid 52727] +++ exited with 0 +++

--- SIGCHLD {si\_signo=SIGCHLD, si\_code=CLD\_EXITED, si\_pid=52727, si\_uid=1000, si\_status=0, si\_utime=0, si\_stime=0} ---

**wait4(52727, NULL, 0, NULL) = 52727**

**write(1, "Parent: all children finished.\n", 31Parent: all children finished.**

**) = 31**

**exit\_group(0) = ?**

+++ exited with 0 +++

**Вывод**

В ходе выполнения лабораторной работы была разработана программа на языке C, демонстрирующая работу с процессами и их взаимодействие в среде Linux. Для решения поставленной задачи создаются несколько дочерних процессов, обмен данными между которыми осуществляется через каналы (pipe). В программе предусмотрена обработка возможных системных ошибок.