**CS342**

**HOMEWORK 1**

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**Section 1**

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**INSTALLATION CHOICES AND EXPERIENCES:**

I chose installing Ubuntu Desktop 64-bit 18.04 LTS on a virtual machine using VirtualBox 6.1 for MacOS. The reason for this decision was that I rarely use Ubuntu (due to the availability of Bash terminal in MacOS) and wanted this installation to be a temporary thing. Also, I have had trouble with the boot order in a dual-boot installation previously and didn’t want to risk such a scenario again. I chose VirtualBox because I was acquainted to its usage. I chose to make a virtual hard drive of 50GB size (not dynamic) because I thought that would be the necessary size.

As far as the experience is concerned, I had a pretty straightforward experience installing the OS and setting it up to run. Contrary to what I believed, virtual machines, given enough RAM (4GB in my case), perform quite well.

**10 LINUX COMMANDS:**

1. cat
2. cd
3. ls
4. chmod
5. curl
6. echo
7. exit
8. grep
9. gzip
10. mkdir

**PATH/ VERSION OF KERNEL EXECUTABLE:**

Location: /boot/vmlinuz-5.3.0-28-generic

Version: 5.3.0-28-generic

**SUBDIRECTORIES IN KERNEL SOURCE CODE:**

COPYING MAINTAINERS crypto kernel security

CREDITS Makefile drivers lib sound

Documentation README fs mm tools

Kbuild arch include net usr

Kconfig block init samples virt

LICENSES certs ipc scripts

**DEFINITION OF SYSTEM CALL TABLE:**

Location: arch/x86/entry/syscalls/syscall\_64.tbl

5: fstat

43: accept

123: setfsgid

220: semtimedop

**STRACE COMMAND:**

ls: strace ls

execve("/bin/ls", ["ls"], 0x7ffda365b1e0 /\* 64 vars \*/) = 0

brk(NULL) = 0x55737ed99000

access("/etc/ld.so.nohwcap", F\_OK) = -1 ENOENT (No such file or directory)

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=84201, ...}) = 0

mmap(NULL, 84201, PROT\_READ, MAP\_PRIVATE, 3, 0) = 0x7f372903a000

close(3) = 0

access("/etc/ld.so.nohwcap", F\_OK) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "/lib/x86\_64-linux-gnu/libselinux.so.1", O\_RDONLY|O\_CLOEXEC) = 3

read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\20b\0\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=154832, ...}) = 0

mmap(NULL, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7f3729038000

mmap(NULL, 2259152, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f3728c00000

mprotect(0x7f3728c25000, 2093056, PROT\_NONE) = 0

mmap(0x7f3728e24000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x24000) = 0x7f3728e24000

mmap(0x7f3728e26000, 6352, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_ANONYMOUS, -1, 0) = 0x7f3728e26000

close(3) = 0

access("/etc/ld.so.nohwcap", F\_OK) = -1 ENOENT (No such file or directory)

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\260\34\2\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0755, st\_size=2030544, ...}) = 0

mmap(NULL, 4131552, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f372880f000

mprotect(0x7f37289f6000, 2097152, PROT\_NONE) = 0

mmap(0x7f3728bf6000, 24576, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1e7000) = 0x7f3728bf6000

mmap(0x7f3728bfc000, 15072, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_ANONYMOUS, -1, 0) = 0x7f3728bfc000

close(3) = 0

access("/etc/ld.so.nohwcap", F\_OK) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "/lib/x86\_64-linux-gnu/libpcre.so.3", 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 \25\0\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=464824, ...}) = 0

mmap(NULL, 2560264, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f372859d000

mprotect(0x7f372860d000, 2097152, PROT\_NONE) = 0

mmap(0x7f372880d000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x70000) = 0x7f372880d000

close(3) = 0

access("/etc/ld.so.nohwcap", F\_OK) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "/lib/x86\_64-linux-gnu/libdl.so.2", O\_RDONLY|O\_CLOEXEC) = 3

read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0P\16\0\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=14560, ...}) = 0

mmap(NULL, 2109712, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f3728399000

mprotect(0x7f372839c000, 2093056, PROT\_NONE) = 0

mmap(0x7f372859b000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x2000) = 0x7f372859b000

close(3) = 0

access("/etc/ld.so.nohwcap", F\_OK) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "/lib/x86\_64-linux-gnu/libpthread.so.0", 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\0000b\0\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0755, st\_size=144976, ...}) = 0

mmap(NULL, 2221184, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f372817a000

mprotect(0x7f3728194000, 2093056, PROT\_NONE) = 0

mmap(0x7f3728393000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x19000) = 0x7f3728393000

mmap(0x7f3728395000, 13440, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_ANONYMOUS, -1, 0) = 0x7f3728395000

close(3) = 0

mmap(NULL, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7f3729036000

arch\_prctl(ARCH\_SET\_FS, 0x7f3729037040) = 0

mprotect(0x7f3728bf6000, 16384, PROT\_READ) = 0

mprotect(0x7f3728393000, 4096, PROT\_READ) = 0

mprotect(0x7f372859b000, 4096, PROT\_READ) = 0

mprotect(0x7f372880d000, 4096, PROT\_READ) = 0

mprotect(0x7f3728e24000, 4096, PROT\_READ) = 0

mprotect(0x55737e7d8000, 8192, PROT\_READ) = 0

mprotect(0x7f372904f000, 4096, PROT\_READ) = 0

munmap(0x7f372903a000, 84201) = 0

set\_tid\_address(0x7f3729037310) = 18718

set\_robust\_list(0x7f3729037320, 24) = 0

rt\_sigaction(SIGRTMIN, {sa\_handler=0x7f372817fcb0, sa\_mask=[], sa\_flags=SA\_RESTORER|SA\_SIGINFO, sa\_restorer=0x7f372818c890}, NULL, 8) = 0

rt\_sigaction(SIGRT\_1, {sa\_handler=0x7f372817fd50, sa\_mask=[], sa\_flags=SA\_RESTORER|SA\_RESTART|SA\_SIGINFO, sa\_restorer=0x7f372818c890}, NULL, 8) = 0

rt\_sigprocmask(SIG\_UNBLOCK, [RTMIN RT\_1], NULL, 8) = 0

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

statfs("/sys/fs/selinux", 0x7fff3db6ec70) = -1 ENOENT (No such file or directory)

statfs("/selinux", 0x7fff3db6ec70) = -1 ENOENT (No such file or directory)

brk(NULL) = 0x55737ed99000

brk(0x55737edba000) = 0x55737edba000

openat(AT\_FDCWD, "/proc/filesystems", O\_RDONLY|O\_CLOEXEC) = 3

fstat(3, {st\_mode=S\_IFREG|0444, st\_size=0, ...}) = 0

read(3, "nodev\tsysfs\nnodev\ttmpfs\nnodev\tbd"..., 1024) = 360

read(3, "", 1024) = 0

close(3) = 0

access("/etc/selinux/config", F\_OK) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "/usr/lib/locale/locale-archive", O\_RDONLY|O\_CLOEXEC) = 3

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=11731760, ...}) = 0

mmap(NULL, 11731760, PROT\_READ, MAP\_PRIVATE, 3, 0) = 0x7f3727649000

close(3) = 0

ioctl(1, TCGETS, {B38400 opost isig icanon echo ...}) = 0

ioctl(1, TIOCGWINSZ, {ws\_row=24, ws\_col=80, ws\_xpixel=0, ws\_ypixel=0}) = 0

openat(AT\_FDCWD, ".", O\_RDONLY|O\_NONBLOCK|O\_CLOEXEC|O\_DIRECTORY) = 3

fstat(3, {st\_mode=S\_IFDIR|0755, st\_size=4096, ...}) = 0

getdents(3, /\* 28 entries \*/, 32768) = 960

getdents(3, /\* 0 entries \*/, 32768) = 0

close(3) = 0

fstat(1, {st\_mode=S\_IFCHR|0620, st\_rdev=makedev(136, 1), ...}) = 0

write(1, "cs342hw1.c Documents examples."..., 69cs342hw1.c Documents examples.desktop Music Public Templates

) = 69

write(1, "Desktop Downloads hw1\t\t Pic"..., 55Desktop Downloads hw1 Pictures tempDir Videos

) = 55

close(1) = 0

close(2) = 0

exit\_group(0) = ?

+++ exited with 0 +++

mkdir: strace mkdir tempDir

execve("/bin/mkdir", ["mkdir", "tempDir"], 0x7ffd559c5508 /\* 64 vars \*/) = 0

brk(NULL) = 0x55c969b36000

access("/etc/ld.so.nohwcap", F\_OK) = -1 ENOENT (No such file or directory)

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=84201, ...}) = 0

mmap(NULL, 84201, PROT\_READ, MAP\_PRIVATE, 3, 0) = 0x7f52bd12d000

close(3) = 0

access("/etc/ld.so.nohwcap", F\_OK) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "/lib/x86\_64-linux-gnu/libselinux.so.1", O\_RDONLY|O\_CLOEXEC) = 3

read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0\20b\0\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=154832, ...}) = 0

mmap(NULL, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7f52bd12b000

mmap(NULL, 2259152, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f52bccf3000

mprotect(0x7f52bcd18000, 2093056, PROT\_NONE) = 0

mmap(0x7f52bcf17000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x24000) = 0x7f52bcf17000

mmap(0x7f52bcf19000, 6352, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_ANONYMOUS, -1, 0) = 0x7f52bcf19000

close(3) = 0

access("/etc/ld.so.nohwcap", F\_OK) = -1 ENOENT (No such file or directory)

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\260\34\2\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0755, st\_size=2030544, ...}) = 0

mmap(NULL, 4131552, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f52bc902000

mprotect(0x7f52bcae9000, 2097152, PROT\_NONE) = 0

mmap(0x7f52bcce9000, 24576, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x1e7000) = 0x7f52bcce9000

mmap(0x7f52bccef000, 15072, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_ANONYMOUS, -1, 0) = 0x7f52bccef000

close(3) = 0

access("/etc/ld.so.nohwcap", F\_OK) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "/lib/x86\_64-linux-gnu/libpcre.so.3", 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 \25\0\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=464824, ...}) = 0

mmap(NULL, 2560264, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f52bc690000

mprotect(0x7f52bc700000, 2097152, PROT\_NONE) = 0

mmap(0x7f52bc900000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x70000) = 0x7f52bc900000

close(3) = 0

access("/etc/ld.so.nohwcap", F\_OK) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "/lib/x86\_64-linux-gnu/libdl.so.2", O\_RDONLY|O\_CLOEXEC) = 3

read(3, "\177ELF\2\1\1\0\0\0\0\0\0\0\0\0\3\0>\0\1\0\0\0P\16\0\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=14560, ...}) = 0

mmap(NULL, 2109712, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f52bc48c000

mprotect(0x7f52bc48f000, 2093056, PROT\_NONE) = 0

mmap(0x7f52bc68e000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x2000) = 0x7f52bc68e000

close(3) = 0

access("/etc/ld.so.nohwcap", F\_OK) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "/lib/x86\_64-linux-gnu/libpthread.so.0", 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\0000b\0\0\0\0\0\0"..., 832) = 832

fstat(3, {st\_mode=S\_IFREG|0755, st\_size=144976, ...}) = 0

mmap(NULL, 2221184, PROT\_READ|PROT\_EXEC, MAP\_PRIVATE|MAP\_DENYWRITE, 3, 0) = 0x7f52bc26d000

mprotect(0x7f52bc287000, 2093056, PROT\_NONE) = 0

mmap(0x7f52bc486000, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_DENYWRITE, 3, 0x19000) = 0x7f52bc486000

mmap(0x7f52bc488000, 13440, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_FIXED|MAP\_ANONYMOUS, -1, 0) = 0x7f52bc488000

close(3) = 0

mmap(NULL, 8192, PROT\_READ|PROT\_WRITE, MAP\_PRIVATE|MAP\_ANONYMOUS, -1, 0) = 0x7f52bd129000

arch\_prctl(ARCH\_SET\_FS, 0x7f52bd12a040) = 0

mprotect(0x7f52bcce9000, 16384, PROT\_READ) = 0

mprotect(0x7f52bc486000, 4096, PROT\_READ) = 0

mprotect(0x7f52bc68e000, 4096, PROT\_READ) = 0

mprotect(0x7f52bc900000, 4096, PROT\_READ) = 0

mprotect(0x7f52bcf17000, 4096, PROT\_READ) = 0

mprotect(0x55c9698f6000, 4096, PROT\_READ) = 0

mprotect(0x7f52bd142000, 4096, PROT\_READ) = 0

munmap(0x7f52bd12d000, 84201) = 0

set\_tid\_address(0x7f52bd12a310) = 18710

set\_robust\_list(0x7f52bd12a320, 24) = 0

rt\_sigaction(SIGRTMIN, {sa\_handler=0x7f52bc272cb0, sa\_mask=[], sa\_flags=SA\_RESTORER|SA\_SIGINFO, sa\_restorer=0x7f52bc27f890}, NULL, 8) = 0

rt\_sigaction(SIGRT\_1, {sa\_handler=0x7f52bc272d50, sa\_mask=[], sa\_flags=SA\_RESTORER|SA\_RESTART|SA\_SIGINFO, sa\_restorer=0x7f52bc27f890}, NULL, 8) = 0

rt\_sigprocmask(SIG\_UNBLOCK, [RTMIN RT\_1], NULL, 8) = 0

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

statfs("/sys/fs/selinux", 0x7ffef3226c00) = -1 ENOENT (No such file or directory)

statfs("/selinux", 0x7ffef3226c00) = -1 ENOENT (No such file or directory)

brk(NULL) = 0x55c969b36000

brk(0x55c969b57000) = 0x55c969b57000

openat(AT\_FDCWD, "/proc/filesystems", O\_RDONLY|O\_CLOEXEC) = 3

fstat(3, {st\_mode=S\_IFREG|0444, st\_size=0, ...}) = 0

read(3, "nodev\tsysfs\nnodev\ttmpfs\nnodev\tbd"..., 1024) = 360

read(3, "", 1024) = 0

close(3) = 0

access("/etc/selinux/config", F\_OK) = -1 ENOENT (No such file or directory)

openat(AT\_FDCWD, "/usr/lib/locale/locale-archive", O\_RDONLY|O\_CLOEXEC) = 3

fstat(3, {st\_mode=S\_IFREG|0644, st\_size=11731760, ...}) = 0

mmap(NULL, 11731760, PROT\_READ, MAP\_PRIVATE, 3, 0) = 0x7f52bb73c000

close(3) = 0

mkdir("tempDir", 0777) = 0

close(1) = 0

close(2) = 0

exit\_group(0) = ?

+++ exited with 0 +++

**TIME COMMAND:**

Command: time cp test.txt test2.txt

Output:

real 0m0,003s

user 0m0,002s

sys 0m0,000

Command: time ls

Output:

real 0m0,002s

user 0m0,001s

sys 0m0,000s

Explanation:

Time command outputs the timings statistics to run a command in three different ways. The “real” values means the real time between when the command was invoked and when it terminated. The “user” values refers to the CPU time difference in user mode (ie: sum of tms\_utime and tms\_cutime values in the struct tms as the value that is returned by times(2). Finally, the “sys” time refers to the system CPU time difference values in kernel mode (ie: sum of tms\_stime and tms\_cstime values in the struct tms as the value that is returned by times(2).

**COST.C CODE:**

#include <stdio.h>

#include <sys/time.h>

#include <stdlib.h>

#include <unistd.h>

#include <fcntl.h>

//function to calculate the time difference

int getMicroSecondsElapsed( const struct timeval \*a, const struct timeval \*b){

long microseconds = b->tv\_usec - a->tv\_usec;

//converting seconds to microseconds

long seconds = (b->tv\_sec - a->tv\_sec) \* 1000000;

return (microseconds + seconds);

}

int main()

{

struct timeval a, b;

//getpid() command

gettimeofday(&a, NULL);

getpid();

gettimeofday(&b, NULL);

printf("getpid: %d microseconds\n", getMicroSecondsElapsed(&a, &b));

//making a new directory called test

gettimeofday(&a, NULL);

mkdir("test", 0777);

gettimeofday(&b, NULL);

printf("mkdir: %d microseconds\n", getMicroSecondsElapsed(&a, &b));

//changing directory to the new directory created

gettimeofday(&a, NULL);

chdir("test");

gettimeofday(&b, NULL);

printf("cd: %d microseconds\n", getMicroSecondsElapsed(&a, &b));

//creating a new file in the directory (test.txt)

gettimeofday(&a, NULL);

open("test.txt", O\_RDWR|O\_CREAT, 0777);

gettimeofday(&b, NULL);

printf("create: %d microseconds\n", getMicroSecondsElapsed(&a, &b));

//writing to the new file we just created

int writeInt = open("test.txt", O\_RDWR, 0777);

char\* dataInput = "Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Scelerisque mauris pellentesque pulvinar pellentesque habitant morbi tristique senectus. Nunc congue nisi vitae suscipit tellus mauris a diam maecenas. Augue neque gravida in fermentum et sollicitudin ac orci. Dui id ornare arcu odio ut sem nulla pharetra. In nibh mauris cursus mattis molestie a iaculis at. Elit eget gravida cum sociis natoque. Ut enim blandit volutpat maecenas volutpat blandit aliquam. Odio aenean sed adipiscing diam donec adipiscing. Vel orci porta non pulvinar neque. Enim ut sem viverra aliquet. Sit amet cursus sit amet dictum. Quisque id diam vel quam elementum pulvinar. Eu nisl nunc mi ipsum. Arcu ac tortor dignissim convallis aenean et. Vel pharetra vel turpis nunc eget. Vulputate enim nulla aliquet porttitor lacus luctus accumsan. Amet porttitor eget dolor morbi non arcu risus quis. Nulla pharetra diam sit amet nisl suscipit adipiscing bibendum est. Sed vulputate odio ut enim. Erat pellentesque adipiscing commodo elit at imperdiet dui accumsan sit. Porttitor eget dolor morbi non arcu risus quis varius. Dignissim enim sit amet venenatis urna cursus eget nunc scelerisque. Tincidunt dui ut ornare lectus sit amet. Ac feugiat sed lectus vestibulum mattis ullamcorper velit sed ullamcorper. Consequat semper viverra nam libero justo laoreet sit. Eget dolor morbi non arcu risus quis varius quam quisque. Dictum fusce ut placerat orci nulla pellentesque dignissim enim. Leo in vitae turpis massa sed elementum tempus egestas. Quam adipiscing vitae proin sagittis nisl rhoncus. Id consectetur purus ut faucibus pulvinar. Urna porttitor rhoncus dolor purus non enim praesent. Sed felis eget velit aliquet sagittis. Tortor at auctor urna nunc. Amet est placerat in egestas erat imperdiet.";

gettimeofday(&a, NULL);

write( writeInt, dataInput, 777);

gettimeofday(&b, NULL);

printf("write: %d microseconds\n", getMicroSecondsElapsed(&a, &b));

//reading from the file with different buffer parameters

char buffer[100000];

//with parameter value: 100

writeInt = open("test.txt", O\_RDWR, 0777);

gettimeofday(&a, NULL);

read( writeInt, buffer, 100);

gettimeofday(&b, NULL);

printf("read(100): %d microseconds\n", getMicroSecondsElapsed(&a, &b));

//with parameter value: 1000

writeInt = open("test.txt", O\_RDWR, 0777);

gettimeofday(&a, NULL);

read( writeInt, buffer, 1000);

gettimeofday(&b, NULL);

printf("read(1000): %d microseconds\n", getMicroSecondsElapsed(&a, &b));

//with parameter value: 100000

writeInt = open("test.txt", O\_RDWR, 0777);

gettimeofday(&a, NULL);

read( writeInt, buffer, 100000);

gettimeofday(&b, NULL);

printf("read(100000): %d microseconds\n", getMicroSecondsElapsed(&a, &b));

return 0;

}

**COST.C OUTPUT:**

getpid: 4 microseconds

mkdir: 1073 microseconds

cd: 5 microseconds

create: 37 microseconds

write: 26 microseconds

read(100): 3 microseconds

read(1000): 1 microseconds

read(100000): 1 microseconds