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