

C Programs by using UNIX File System Calls

7a. Develop a C program to emulate the UNIX ls -li command, which lists all the attributes of the files in a specified directory.

C Program:

```
#include<unistd.h>
#include<fcntl.h>
#include<dirent.h>
#include<time.h>

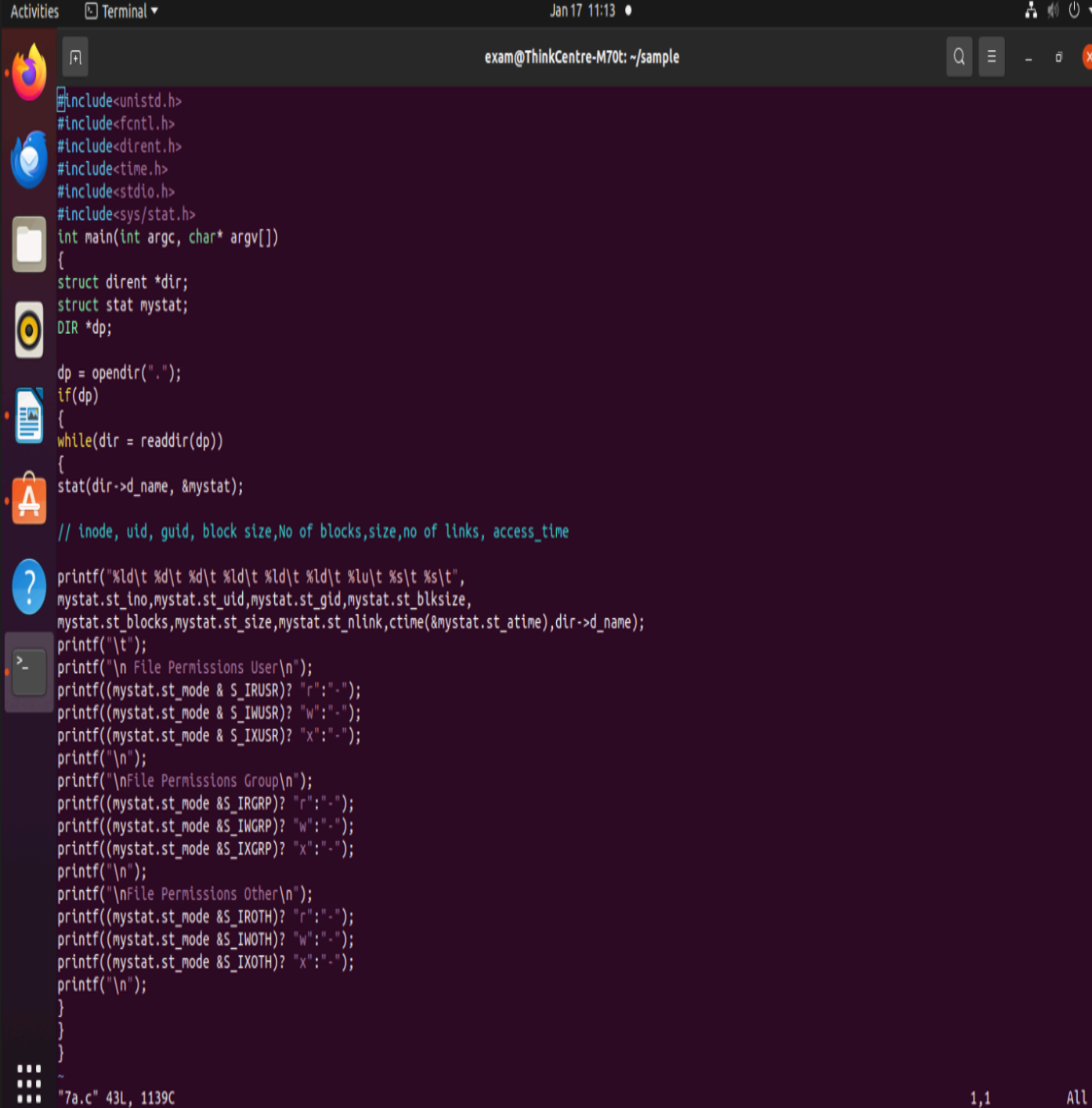
int main(int argc,char* argv[])
{
    struct dirent *dir;
    struct stat mystat;
    DIR *dp;

    dp = opendir(".");
    if(dp)
    {
        while(dir = readdir(dp))
        {
            stat(dir->d_name, &mystat);
            // inode, uid, guid, block size,No of blocks,size,no of links, access_time
            printf("%ld\t %d\t %d\t %ld\t %ld\t %ld\t %lu\t %s\t %s\t",
                mystat.st_ino,mystat.st_uid,mystat.st_gid,mystat.st_blksize,
                mystat.st_blocks,mystat.st_size,mystat.st_nlink,ctime(&mystat.st_atime),di
                r->d_name);
```

```
printf("\t");
printf("\n File Permissions User\n");
printf((mystat.st_mode & S_IRUSR)? "r":"-");
printf((mystat.st_mode & S_IWUSR)? "w":"-");
printf((mystat.st_mode & S_IXUSR)? "x":"-");
printf("\n");
printf("\nFile Permissions Group\n");
printf((mystat.st_mode & S_IRGRP)? "r":"-");
printf((mystat.st_mode & S_IWGRP)? "w":"-");
printf((mystat.st_mode & S_IXGRP)? "x":"-");
printf("\n");
printf("\nFile Permissions Other\n");
printf((mystat.st_mode & S_IROTH)? "r":"-");
printf((mystat.st_mode & S_IWOTH)? "w":"-");
printf((mystat.st_mode & S_IXOTH)? "x":"-");
printf("\n");
}
}

}
```

vi 7a.c



```
exam@ThinkCentre-M70t: ~/sample
#include<unistd.h>
#include<fcntl.h>
#include<dirent.h>
#include<time.h>
#include<stdio.h>
#include<sys/stat.h>
int main(int argc, char* argv[])
{
    struct dirent *dir;
    struct stat mystat;
    DIR *dp;

    dp = opendir(".");
    if(dp)
    {
        while(dir = readdir(dp))
        {
            stat(dir->d_name, &mystat);

            // inode, uid, guid, block size, No of blocks, size, no of links, access_time

            printf("%ld\t %d\t %d\t %ld\t %ld\t %ld\t %ld\t %lu\t %s\t %s\t",
                mystat.st_ino, mystat.st_uid, mystat.st_gid, mystat.st_blksize,
                mystat.st_blocks, mystat.st_size, mystat.st_nlink, ctime(&mystat.st_atime), dir->d_name);
            printf("\t");
            printf("\n File Permissions User\n");
            printf((mystat.st_mode & S_IRUSR)? "r":"-");
            printf((mystat.st_mode & S_IWUSR)? "w":"-");
            printf((mystat.st_mode & S_IXUSR)? "x":"-");
            printf("\n");
            printf("\nFile Permissions Group\n");
            printf((mystat.st_mode & S_IRGRP)? "r":"-");
            printf((mystat.st_mode & S_IWGRP)? "w":"-");
            printf((mystat.st_mode & S_IXGRP)? "x":"-");
            printf("\n");
            printf("\nFile Permissions Other\n");
            printf((mystat.st_mode & S_IROTH)? "r":"-");
            printf((mystat.st_mode & S_IWOTH)? "w":"-");
            printf((mystat.st_mode & S_IXOTH)? "x":"-");
            printf("\n");
        }
    }
}
```

~
"7a.c" 43L, 1139C

1,1 All

Output:-

```
exam@ThinkCentre-M70t: ~/sample
exam@ThinkCentre-M70t:~/sample$ pwd
/home/exam/sample
exam@ThinkCentre-M70t:~/sample$ cc 7a.c
exam@ThinkCentre-M70t:~/sample$ ./a.out
3541126 1001 1001 4096 8 4096 23 Wed Jan 17 16:26:00 2024
..
File Permissions User
-rwx
File Permissions Group
-r-x
File Permissions Other
-r-x
8672700 1001 1001 4096 8 1139 1 Wed Jan 17 11:14:27 2024
7a.c
File Permissions User
-rw-
File Permissions Group
-rw-
File Permissions Other
-r--
8671397 1001 1001 4096 40 17064 1 Wed Jan 17 11:14:32 2024
a.out
File Permissions User
-rwx
File Permissions Group
-rwx
File Permissions Other
-r-x
8670959 1001 1001 4096 8 6 1 Wed Jan 17 11:12:16 2024
6.txt
File Permissions User
-rw-
File Permissions Group
-rw-
```

stat():

This function return information about a file.

a *stat* structure, which contains the following fields:

```
struct stat {
    dev_t    st_dev;    /* ID of device containing file */
    ino_t    st_ino;    /* inode number */
    mode_t   st_mode;   /* protection */
    nlink_t  st_nlink;  /* number of hard links */
    uid_t    st_uid;    /* user ID of owner */
    gid_t    st_gid;    /* group ID of owner */
    dev_t    st_rdev;   /* device ID (if special file) */
    off_t    st_size;   /* total size, in bytes */
    blksize_t st_blksize; /* blocksize for filesystem I/O */
    blkcnt_t st_blocks; /* number of blocks allocated */
    time_t   st_atime;  /* time of last access */
    time_t   st_mtime;  /* time of last modification */
    time_t   st_ctime;  /* time of last status change */
};
```

7b. Write a C program to remove empty files from the given directory using system calls.

A screenshot of a terminal window showing a C program. The program includes headers for stdio, fcntl, unistd, dirent, and sys/stat. It defines a main function that opens the current directory, iterates through its contents, opens each file, and removes it if it is empty (lseek returns 0).

```
#include<stdio.h>
#include<fcntl.h>
#include<unistd.h>
#include<dirent.h>
#include<sys/stat.h>

int main()
{
    DIR *dp;
    struct dirent *dir;

    int fd,n;

    dp=opendir(".");
    if(dp)
    {
        while((dir=readdir(dp))!=NULL)
        {
            fd=open(dir->d_name, O_RDWR,0777);
            n=lseek(fd,0,SEEK_END);

            if(!n)
            {
                unlink(dir->d_name);
            }
        }
    }
}
```

Output:-

First, we will create an empty files in the directory and execute the above C program to delete the empty files.

To compile the C program

cc 7b.c is used , then a.out file will be created.

```
ritadming@ThinkCentre-M70t:~$ cc 7b.c
ritadming@ThinkCentre-M70t:~$ mkdir ttt
ritadming@ThinkCentre-M70t:~$ cd ttt
ritadming@ThinkCentre-M70t:~/ttt$ touch 77.txt
ritadming@ThinkCentre-M70t:~/ttt$ touch 88.txt
ritadming@ThinkCentre-M70t:~/ttt$ ls
77.txt 88.txt
ritadming@ThinkCentre-M70t:~/ttt$ ls -l
total 0
-rw-rw-r-- 1 ritadming ritadming 0 Jan 17 15:24 77.txt
-rw-rw-r-- 1 ritadming ritadming 0 Jan 17 15:24 88.txt
ritadming@ThinkCentre-M70t:~/ttt$ cd ..
ritadming@ThinkCentre-M70t:~$ mv 7b.c ttt
ritadming@ThinkCentre-M70t:~$ ls -l ttt
total 4
-rw-rw-r-- 1 ritadming ritadming 0 Jan 17 15:24 77.txt
-rw-rw-r-- 1 ritadming ritadming 339 Jan 17 15:23 7b.c
-rw-rw-r-- 1 ritadming ritadming 0 Jan 17 15:24 88.txt
ritadming@ThinkCentre-M70t:~$ ls -l
total 96
-rw-rw-r-- 1 ritadming ritadming 5733 Jul 25 15:53 11.c
-rw-rw-r-- 1 ritadming ritadming 38 Jul 25 12:23 a11.c
-rwxrwxr-x 1 ritadming ritadming 16872 Jan 17 15:23 a.out
-rw-rw-r-- 1 ritadming ritadming 4589 Jul 25 15:00 cop11.c
drwxr-xr-x 2 ritadming ritadming 4096 Feb 3 2022 Desktop
drwxr-xr-x 2 ritadming ritadming 4096 Feb 3 2022 Documents
drwxr-xr-x 2 ritadming ritadming 4096 Feb 3 2022 Downloads
-rw-rw-r-- 1 ritadming ritadming 3784 Jul 25 16:26 first.c
-rw-rw-r-- 1 ritadming ritadming 2033 Jul 25 16:25 frist.c
drwxr-xr-x 2 ritadming ritadming 4096 Feb 3 2022 Music
-rw-rw-r-- 1 ritadming ritadming 2056 Jul 26 15:40 new.c
-rw-rw-r-- 1 ritadming ritadming 2248 Jul 25 12:43 newp11.c
-rw-rw-r-- 1 ritadming ritadming 2178 Jul 25 15:59 p11.c
drwxr-xr-x 2 ritadming ritadming 4096 Jul 25 14:42 Pictures
drwxr-xr-x 2 ritadming ritadming 4096 Feb 3 2022 Public
drwxr-xr-x 2 ritadming ritadming 4096 Feb 3 2022 Templates
drwxrwxr-x 2 ritadming ritadming 4096 Jan 17 15:25 ttt
drwxr-xr-x 2 ritadming ritadming 4096 Feb 3 2022 Videos
ritadming@ThinkCentre-M70t:~$ chmod -R 777 ttt
ritadming@ThinkCentre-M70t:~$
```

Here the directory ttt is created and 2 empty files 77.txt and 88.txt are created inside ttt. Now make sure directory created is having 777 permissions, if not, then assign the permissions by using chmod command.

```
chmod -R 777 ttt
```

like shown in above screenshot.

```
ritadming@ThinkCentre-M70t:~$ chmod -R 777 ttt
ritadming@ThinkCentre-M70t:~$ ls -l
total 96
-rw-rw-r-- 1 ritadming ritadming 5733 Jul 25 15:53 11.c
-rw-rw-r-- 1 ritadming ritadming 38 Jul 25 12:23 a11.c
-rwxrwxr-x 1 ritadming ritadming 16872 Jan 17 15:23 a.out
-rw-rw-r-- 1 ritadming ritadming 4589 Jul 25 15:00 cop11.c
drwxr-xr-x 2 ritadming ritadming 4096 Feb 3 2022 Desktop
drwxr-xr-x 2 ritadming ritadming 4096 Feb 3 2022 Documents
drwxr-xr-x 2 ritadming ritadming 4096 Feb 3 2022 Downloads
-rw-rw-r-- 1 ritadming ritadming 3784 Jul 25 16:26 first.c
-rw-rw-r-- 1 ritadming ritadming 2033 Jul 25 16:25 frist.c
drwxr-xr-x 2 ritadming ritadming 4096 Feb 3 2022 Music
-rw-rw-r-- 1 ritadming ritadming 2056 Jul 26 15:40 new.c
-rw-rw-r-- 1 ritadming ritadming 2248 Jul 25 12:43 newp11.c
-rw-rw-r-- 1 ritadming ritadming 2178 Jul 25 15:59 p11.c
drwxr-xr-x 2 ritadming ritadming 4096 Jan 17 15:26 Pictures
drwxr-xr-x 2 ritadming ritadming 4096 Feb 3 2022 Public
drwxr-xr-x 2 ritadming ritadming 4096 Feb 3 2022 Templates
drwxrwxr-x 2 ritadming ritadming 4096 Jan 17 15:25 ttt
drwxr-xr-x 2 ritadming ritadming 4096 Feb 3 2022 Videos
ritadming@ThinkCentre-M70t:~$
```

Once permissions are assigned to directory, execute the C program to remove empty files in directory ttt shown below.

Activities Terminal Jan 17 15:27

ritadmin@ThinkCentre-M70t: ~/ttt

```
ritadmin@ThinkCentre-M70t:~$ cd ttt
ritadmin@ThinkCentre-M70t:~/ttt$ cc 7b.c
ritadmin@ThinkCentre-M70t:~/ttt$ ./a.out
ritadmin@ThinkCentre-M70t:~/ttt$ ls
7b.c  a.out
ritadmin@ThinkCentre-M70t:~/ttt$ touch 99.txt
ritadmin@ThinkCentre-M70t:~/ttt$ ls
7b.c  99.txt  a.out
ritadmin@ThinkCentre-M70t:~/ttt$ cc 7b.c
ritadmin@ThinkCentre-M70t:~/ttt$ ./a.out
ritadmin@ThinkCentre-M70t:~/ttt$ ls
7b.c  a.out
ritadmin@ThinkCentre-M70t:~/ttt$
```