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),dir->d_name);
```
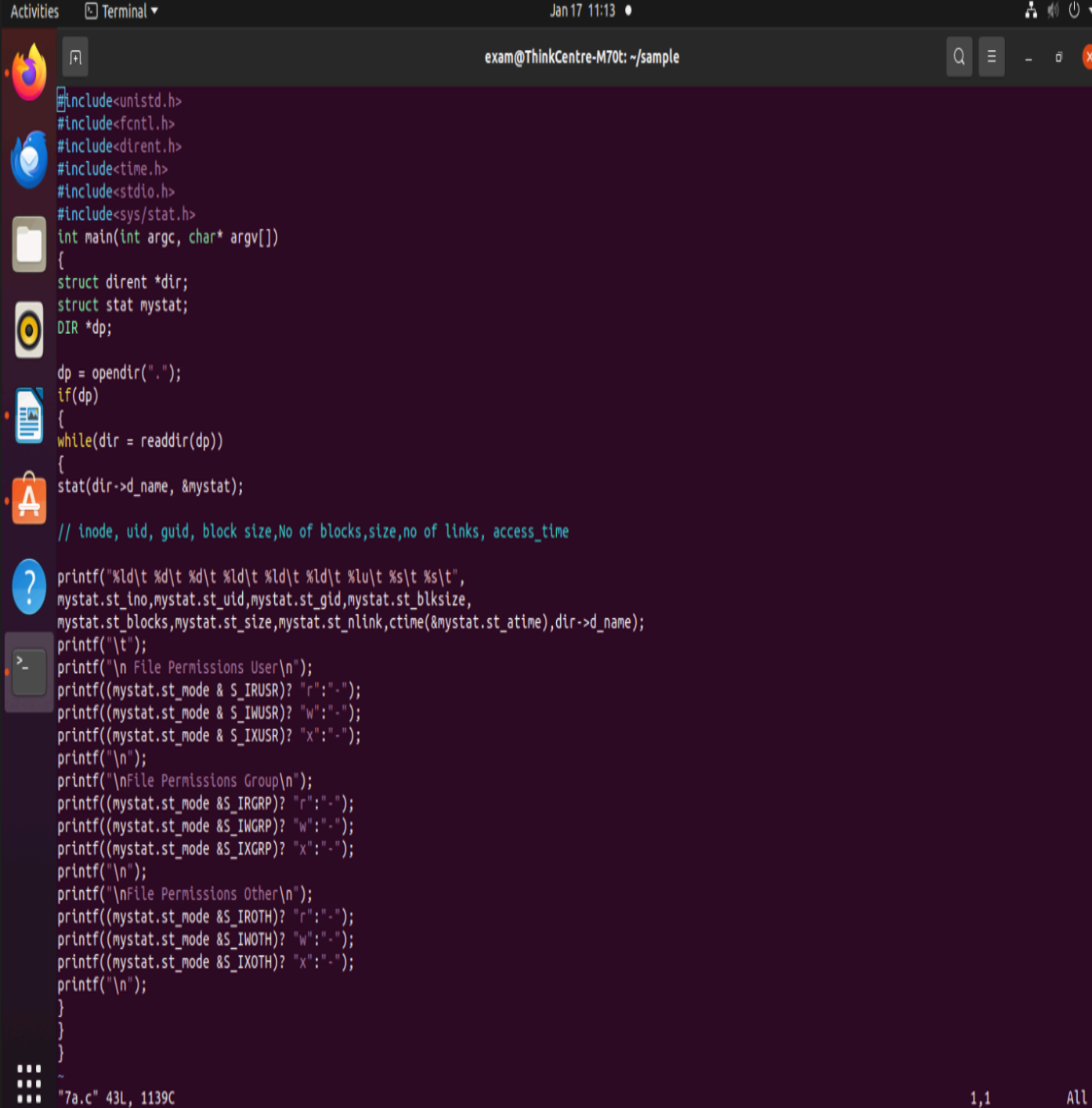
```c
        printf("\t");
        printf("\n File Permissions User\n");
        printf((mystat.st_mode & S_IRUSR)? "r":"-");
        printf((mystat.st_mode & S_IWUSR)? "w":"-");
        printf((mystat.st_mode & S_IXUSR)? "x":"-");
        printf("\n");
        printf("\nFile Permissions Group\n");
        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

```c
#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 %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
3672700  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--
3671397  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
3670959  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.

```
Activities    Terminal                              Jan 17 15:27

                                    ritadmin@ThinkCentre-M70t: ~/ttt

#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.

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.

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

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$
```