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Assignment 2 - Simulation of System commands using System calls

1.Implement the various system commands like cp, grep, ls, head, tail, wc using system calls.

cp command (with option -i.)

Aim :

To copy the contents of one file into another file.

Algorithm :

1:Read the source and destination file with the operation to be performed using command line.

2:If argument length less than 3 or greater than 4, print invalid input.

3:If argument length is equal to 4 and 1st argument is -i, open file in 2nd argument and 3rd argument and store it.

3.1: If source file already exists, ask the user if he wants overwrite the contents. If yes, close the file. Else close the file and exit from the program.

3.2: Create a file in the name of 3rd argument.

3.3: Read the contents of source file and write it in destination file.

3.4: Close the source and the destination file.

4: Else

4.1: Open the source file and store it.

4.2: If source file does not exist, exit and terminate the program.

4.3: Create a file of name as in destination file and store it.

4.4: Read the contents of source file and write it in destination file.

4.5: Close both the files.

Source Code :

```c
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
#include <fcntl.h>
```

```c
int main(int argc, char **argv){
    char buffer[1024];
    int files[2];
    ssize_t count;
    if (argc < 3 || argc > 4){
        printf("Invalid number of arguments!!!\n");
        return -1;
    }
    if(argc==4){
        if(argv[1]="-i"){
            files[0] = open(argv[2], O_RDONLY);
            if (files[0] == -1) {
                printf("Source file does not exist!!!\n");
                return -1;
            }
            files[1]=open(argv[3],O_RDONLY);
            if(files[1]!=-1){
                printf("File exists\nDo you want to over write the existing
content (y/n) : ");
                char ch;
                scanf("%c",&ch);
                if(ch=='y'){
                    close(files[1]);
                }
                else{
                    printf("Copy process terminated\n");
                    close(files[1]);
                    return 0;
                }
            }
            files[1] = creat(argv[3],1000);
            while ((count = read(files[0], buffer, sizeof(buffer))) != 0)
write(files[1], buffer, count);
            close(files[0]);
            close(files[1]);
            printf("Copied successfully\n");
            return 0;
        }
        else {printf("Wrong input\n");return 0;}
    }
    else{
        files[0] = open(argv[1], O_RDONLY);
        if (files[0] == -1){
            printf("Source file does not exist!!!\n");
            return -1;
        }

        files[1]=creat(argv[2],1000);
```

```
        if (files[1] == -1) {
            close(files[0]);
            return -1;
        }
        while ((count = read(files[0], buffer, sizeof(buffer))) != 0)
write(files[1], buffer, count);
        close(files[0]);
        close(files[1]);
        printf("Copied successfully\n");
        return 0;
    }
}
```

Output :

```
kish11@AshKish:/mnt/c/users/ashki/documents$ gcc -o cp cp.c
kish11@AshKish:/mnt/c/users/ashki/documents$ cat>1.txt
this is an assignment for oslab
kish11@AshKish:/mnt/c/users/ashki/documents$ ./cp 1.txt 2.txt
Copied successfully
```

```
kish11@AshKish:/mnt/c/users/ashki/documents$ cat 2.txt
this is an assignment for oslab
```

```
kish11@AshKish:/mnt/c/users/ashki/documents$ cat>>1.txt
this is an assignment to be submitted on 14/03/2022.
kish11@AshKish:/mnt/c/users/ashki/documents$ ./cp -i 1.txt 2.txt
File exists
Do you want to over write the existing content (y/n) : y
Copied successfully
kish11@AshKish:/mnt/c/users/ashki/documents$ cat 2.txt
this is an assignment for oslab
this is an assignment to be submitted on 14/03/2022.
kish11@AshKish:/mnt/c/users/ashki/documents$ cat>>1.txt
process terminates
kish11@AshKish:/mnt/c/users/ashki/documents$ ./cp -i 1.txt 2.txt
File exists
Do you want to over write the existing content (y/n) : n
Copy process terminated
kish11@AshKish:/mnt/c/users/ashki/documents$ cat 2.txt
this is an assignment for oslab
this is an assignment to be submitted on 14/03/2022.
```

ls command (with -l option.)

2.

Aim :

To list all files and directories of a given directory.

Algorithm :

1: Read the directory name with operation to be performed from command line.

2: If argument length is less than 1 or greater than 3, print invalid and terminate from the program.

3: Create a pointer to the structure dirent.

4: If argument length is equal to 3,

4.1: If directory is not present, terminate the program.

4.2: Open directory and store it in a variable.

4.3: While the contents of directory is not null

4.3.1: Print the directory or file name.

4.3.2: Check if the file or directory is readable ‘r’, writable ‘w’ and executable ‘x’. If it is not, print -.

4.3.3: Print the size of it along with the date of creation of it.

4.4: Close the directory that was opened.

5: Else

5.1: Open the directory and store it in a variable.

5.2: While the contents of the directory is not null, print the contents of the directory.

5.3: Close the directory that was opened.

Source code :

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

int main(int argc, char *argv[]){
    if (argc > 3 || argc < 1)  {printf("Inappropriate number of arguements\n");return 0;}
    DIR *dir;
    struct dirent *entry;
    if(argc==3){
        if((dir = opendir(argv[2])) == NULL){
            printf("Unable to open the given directory : \n");
            return 0;
```

```
        }
        dir = opendir(argv[2]);
        while((entry = readdir(dir))!=NULL){
            printf("%s\t",entry->d_name);
            struct stat sbuf;
            stat(entry->d_name,&sbuf);
            if(S_ISDIR(sbuf.st_mode)){
                printf("d");
            }
            else printf("-");
            if(sbuf.st_mode & S_IREAD){
                printf("r");
            }
            else printf("-");
            if(sbuf.st_mode & S_IWRITE){
                printf("w");
            }
            else printf("-");
            if(sbuf.st_mode & S_IEXEC){
                printf("x");
            }
            else printf("-");
            printf("\t%d",sbuf.st_size);
            printf("\t%s\n",ctime(&sbuf.st_ctime));
        }
        closedir(dir);
    }
    else{
        dir = opendir(argv[1]);
        printf("Contents of the given directory :\n");
        while ((entry = readdir(dir)) != NULL){
            printf("  %s\t", entry->d_name);
        }
    printf("\n");
        closedir(dir);
    }
    return 0;
}
```

Output:

```
kish11@AshKish:/mnt/d/SEM 4$ gcc -o ls OS/assignments/ls/ls.c
OS/assignments/ls/ls.c: In function ‘main’:
OS/assignments/ls/ls.c:35:24: warning: format ‘%d’ expects argument of type ‘int’, but argument 2 has type ‘__off_t’ {aka ‘long int’} [-Wformat=]
   35 |             printf("\t%d",sbuf.st_size);
      |                       ~^   ~~~~~~~~~~~
      |                        |       |
      |                        int     __off_t {aka long int}
      |                       %ld
kish11@AshKish:/mnt/d/SEM 4$ ls -l ..
ls: '../System Volume Information': Permission denied
total 324148
drwxrwxrwx 1 kish11 kish11       512 Dec  4 15:13 '$RECYCLE.BIN'
drwxrwxrwx 1 kish11 kish11       512 Mar  9 18:04  Oracle
drwxrwxrwx 1 kish11 kish11       512 Mar  9 18:03  OracleXE112_Win64
-rwxrwxrwx 1 kish11 kish11 331923533 Mar  9 13:49  OracleXE112_Win64.zip
drwxrwxrwx 1 kish11 kish11       512 Mar 13 23:48 'SEM 4'
d--x--x--x 1 kish11 kish11       512 Dec  4 21:08 'System Volume Information'
kish11@AshKish:/mnt/d/SEM 4$ ls -l .
total 20
drwxrwxrwx 1 kish11 kish11   512 Mar 13 23:23 OS
drwxrwxrwx 1 kish11 kish11   512 Mar 10 23:55 SQL
-rwxrwxrwx 1 kish11 kish11 17112 Mar 13 23:48 ls
```

```
kish11@AshKish:/mnt/d/SEM 4$ ./ls .
Contents of the given directory :
  .
  ..
  ls
  OS
  SQL
kish11@AshKish:/mnt/d/SEM 4$ ./ls ..
Contents of the given directory :
  .
  ..
  $RECYCLE.BIN
  Oracle
  OracleXE112_Win64
  OracleXE112_Win64.zip
  SEM 4
  System Volume Information
```

3.Grep command (with option -c.)

Aim :

To develop a C program to implement grep command.

Algorithm :

1: If argument length is greater than 4 or less than 2, terminate the program.

2: If argument length is 3, call the function grep with parameters (2,argument array).

3: Else if argument contains -c, call the function grep with parameters (3,argument array).

4: Else terminate the program.

Function grep(int x,char* argv[])

1: Open the file given the command line and store it in a variable.

2: If the file is not found, terminate from the program telling that the file does not exist.

3: Using a loop, search for the given pattern in each line of the source file.

3.1: if pattern is found and x is 3, increment the value of count. Else print the line.

4 : If x is 3, print the count.

Source Code :

```c
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
#include <string.h>
#include <dirent.h>
#include <fcntl.h>

void grep(int x,char *argv[]){
        int fd = open(argv[x], O_RDONLY);
        if (fd == -1) printf("File does not exist\n");
        char line[100], buffer[1024];
        int l = 0, i = 0, nr, count = 0;
        nr = read(fd, buffer, 1024);
        close(fd);
        while (l < nr){
            for (i = 0; buffer[l] != '\n'; i++, l++){
                line[i] = buffer[l];
            }
            line[i] = '\0';
            l++;
            if (strstr(line, argv[x-1]) && x==3) count++;
            else if(strstr(line, argv[x-1]) && x==2){
                printf("%s\n", line);
            }
        }
        if(x==3) printf("%d\n", count);
}


int main(int argc, char *argv[]){
    if (argc > 4 || argc<2)  printf("Too many arguements\n");
    if(argc==3) grep(2,argv);
    else if(strcmp(argv[1],"-c")==0) grep(3,argv);
    else printf("Wrong input\n");
}
```

Output :

```
kish11@AshKish:/mnt/c/users/ashki/documents$ cat 1.txt
this is an assignment for oslab
it is to be submitted on 14/03/2022
kish11@AshKish:/mnt/c/users/ashki/documents$ gcc -o grep grep.c
kish11@AshKish:/mnt/c/users/ashki/documents$ ./grep an 1.txt
this is an assignment for oslab
kish11@AshKish:/mnt/c/users/ashki/documents$ ./grep is 1.txt
this is an assignment for oslab
it is to be submitted on 14/03/2022
kish11@AshKish:/mnt/c/users/ashki/documents$ ./grep -c is 1.txt
2
kish11@AshKish:/mnt/c/users/ashki/documents$ ./grep the 1.txt
kish11@AshKish:/mnt/c/users/ashki/documents$
```