# UNIX INPUT / OUTPUT

# PART – 2

## LAB # 06

**Fall 2023**

**CSE-302L**

**Systems Programming Lab**

Submitted by: **AIMAL KHAN**

Registration No.: **21PWCSE1996**

Class Section: **A**

"On my honor, as student of University of Engineering and Technology, I have neither given nor received unauthorized assistance on this academic work."

Student Signature: ________________

Submitted to:

**Engr. Abdullah Hamid**

Sunday, January 28, 2024

Department of Computer Systems Engineering

University of Engineering and Technology, Peshawar

## CSE 302L: SYSTEMS PROGRAMMING LAB

## LAB ASSESSMENT RUBRICS

| Criteria & Point Assigned | Outstanding 2 | Acceptable 1.5 | Considerable 1 | Below Expectations 0.5 | Score |
|---|---|---|---|---|---|
| **Attendance and Attentiveness in Lab**<br>PLO08 | Attended in proper Time and attentive in Lab | Attended in proper Time but not attentive in Lab | Attended late but attentive in Lab | Attended late not attentive in Lab | |
| **Capability of writing Program/Algorithm/Drawing Flow Chart**<br>PLO1, PLO2, PLO3, PLO5 | Right attempt/ no errors and well formatted | Right attempt/ no errors but not well formatted | Right attempt/ minor errors and not well formatted | Wrong attempt | |
| **Result or Output/ Completion of target in Lab**<br>PLO9 | 100% target has been completed and well formatted. | 75% target has been completed and well formatted. | 50% target has been completed but not well formatted. | None of the outputs are correct. | |
| **Overall, Knowledge**<br>PLO10, | Demonstrates excellent knowledge of lab | Demonstrates good knowledge of lab | Has partial idea about the Lab and procedure followed | Has poor idea about the Lab and procedure followed | |
| **Attention to Lab Report**<br>PLO4, | Submission of Lab Report in Proper Time i.e., in next day of lab, with proper documentation. | Submission of Lab Report in proper time but not with proper documentation. | Late Submission with proper documentation. | Late Submission very poor documentation | |

## Instructor:

| | |
|---|---|
| Name: ____________________________ | Signature: ___________________________ |

# Unix I/O Part 2

## Objectives:

Learn about these systems concepts

- Redirections
- Pipelining
- Cat utility
- Multi processes

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## Tasks:

**Task 1**: Write a program for parallel file copying using multiple processes. (First check if the no of files entered are even and if yes then create a child process for each pair and read from one and write to other)

**Code in C:**

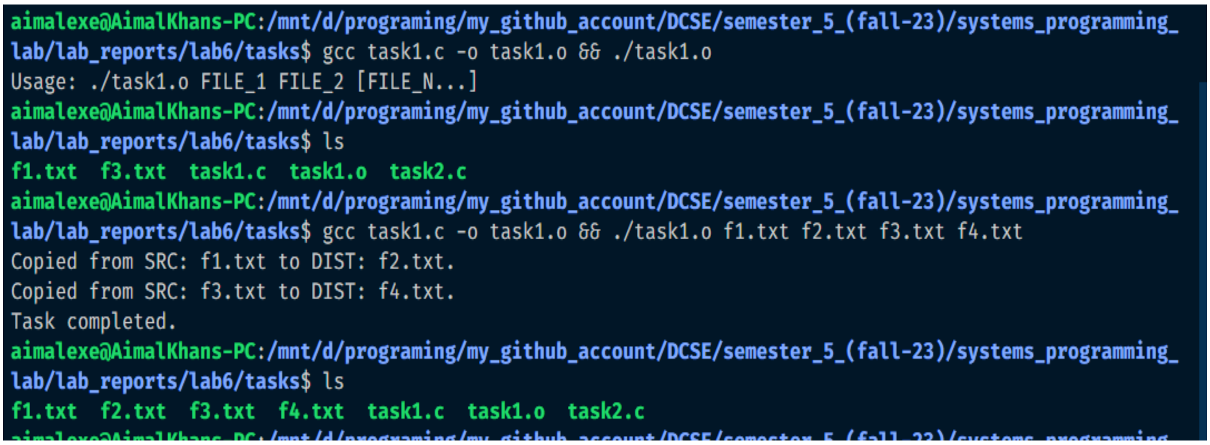
```
#include <stdlib.h>
#include <stdio.h>
#include <unistd.h>
#include <sys/types.h>
#include <sys/wait.h>
#include "../../reusable_code_snippets/readWrite.h"

int main(int argc, char *argv[])
{
    if (argc < 3)
    {
        fprintf(stderr, "Usage: %s FILE_1 FILE_2 [FILE_N...]\n",
argv[0]);
        return 1;
    }

    if (argc % 2 == 0)
    {
        perror("Argument must be even in count.\n");
        return 1;
    }

    pid_t processId;
    for (int i = 1; i < argc; i += 2)
    {
        if ((processId = fork()) < 0)
        {
            perror("Process Creation Failed!!\n");
            return 1;
        }
        else if (processId == 0)
        {
            if (readWrite(argv[i], argv[i + 1]) < 0)
            {
                perror("Something went wrong while reading or
writing a file.\n");
                return 1;
            }
            printf("Copied from SRC: %s to DIST: %s.\n", argv[i],
argv[i + 1]);
            return 0;
        }
        else
            wait(NULL);
    }
    printf("Task completed.\n");
    return 0;
}
```

**Output:**



```
aimalexe@AimalKhans-PC:/mnt/d/programing/my_github_account/DCSE/semester_5_(fall-23)/systems_programming_
lab/lab_reports/lab6/tasks$ gcc task1.c -o task1.o && ./task1.o
Usage: ./task1.o FILE_1 FILE_2 [FILE_N...]
aimalexe@AimalKhans-PC:/mnt/d/programing/my_github_account/DCSE/semester_5_(fall-23)/systems_programming_
lab/lab_reports/lab6/tasks$ ls
f1.txt  f3.txt  task1.c  task1.o  task2.c
aimalexe@AimalKhans-PC:/mnt/d/programing/my_github_account/DCSE/semester_5_(fall-23)/systems_programming_
lab/lab_reports/lab6/tasks$ gcc task1.c -o task1.o && ./task1.o f1.txt f2.txt f3.txt f4.txt
Copied from SRC: f1.txt to DIST: f2.txt.
Copied from SRC: f3.txt to DIST: f4.txt.
Task completed.
aimalexe@AimalKhans-PC:/mnt/d/programing/my_github_account/DCSE/semester_5_(fall-23)/systems_programming_
lab/lab_reports/lab6/tasks$ ls
f1.txt  f2.txt  f3.txt  f4.txt  task1.c  task1.o  task2.c
aimalexe@AimalKhans-PC:/mnt/d/programing/my_github_account/DCSE/semester_5_(fall-23)/systems_programming
```

**Task 2**: Implement “**Cat**” utility.

**Code in C:**

```
#include <stdlib.h>
#include <stdio.h>
#include <unistd.h>
#include <fcntl.h>
#include <errno.h>
#include <string.h>
#include <sys/stat.h>
#include "../../reusable_code_snippets/readWrite.h"

int main(int argc, char *argv[])
{
    int readWriteReturnValue, keyboard = STDIN_FILENO, screen =
STDOUT_FILENO, file;
    if (argc == 1)
    {
        // for 'cat' read from stdin and print on stdout.
        readWriteReturnValue = readWriteOnly(&keyboard, &screen);
        if (readWriteReturnValue < 0)
        {
            perror("Something went wrong while reading from stdin or
writing to stdout.\n");
            return 1;
        }
    }
    else if (argc == 2)
    { // for 'cat file' read from file and write to stdout.
        file = open(argv[1], O_RDONLY);
        if (file == -1)
        {
            fprintf(stderr, "Something went wrong while opening the
source file: %s due to %s\n", argv[1], strerror(errno));
            return -1;
        }

        readWriteReturnValue = readWriteOnly(&file, &screen);
        if (readWriteReturnValue < 0)
        {
            perror("Something went wrong while reading from stdin or
writing to stdout.\n");
            return 1;
        }

        if (close(file) == -1)
        {
            fprintf(stderr, "Error while closing the file. %s\n",
strerror(errno));
            return 1;
        }
    }
    else if (argc == 3)
    { // for 'cat > file' read from stdin and write to file.
```

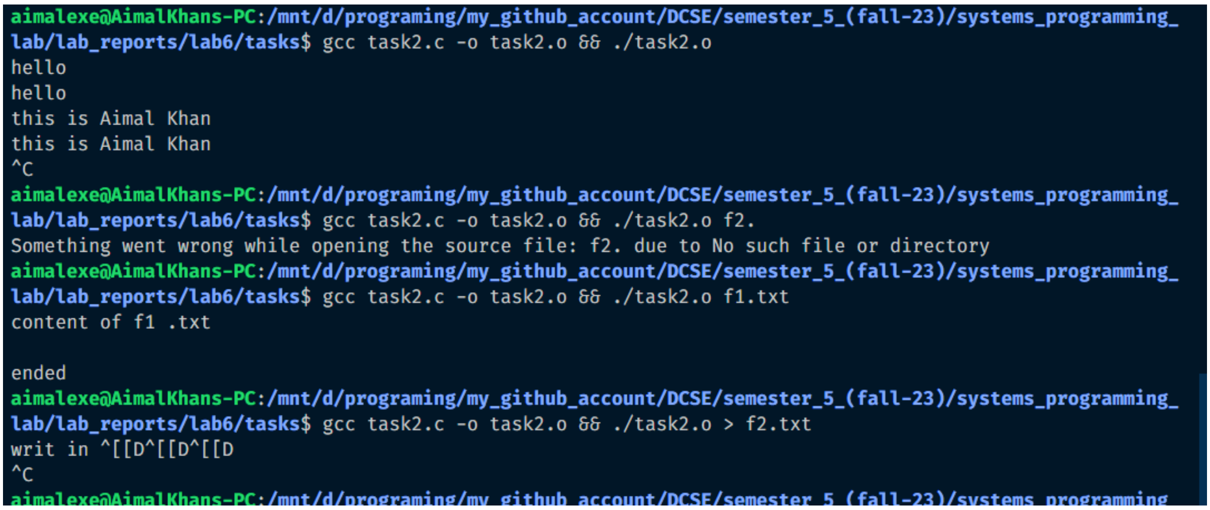
```
        file = open(argv[3], O_CREAT | O_TRUNC, S_IRWXG | S_IRWXO | 
S_IRWXU);
        if (file == -1)
        {
            fprintf(stderr, "Something went wrong while opening the 
source file: %s due to %s\n", argv[1], strerror(errno));
            return -1;
        }

        readWriteReturnValue = readWriteOnly(&keyboard, &file);
        if (readWriteReturnValue < 0)
        {
            perror("Something went wrong while reading from stdin or 
writing to stdout.\n");
            return 1;
        }

        if (close(file) == -1)
        {
            fprintf(stderr, "Error while closing the file. %s\n", 
strerror(errno));
            return 1;
        }
    }
    else if (argc == 4)
    { // for 'cat file1 > file2' read from file1 and write to file2.
        readWriteReturnValue = readWrite(argv[2], argv[4]);
        if (readWriteReturnValue < 0)
        {
            perror("Something went wrong while reading from stdin or 
writing to stdout.\n");
            return 1;
        }
    }

    return 0;
}
```

**Output:**



```
aimalexe@AimalKhans-PC:/mnt/d/programing/my_github_account/DCSE/semester_5_(fall-23)/systems_programming_
lab/lab_reports/lab6/tasks$ gcc task2.c -o task2.o && ./task2.o
hello
hello
this is Aimal Khan
this is Aimal Khan
^C
aimalexe@AimalKhans-PC:/mnt/d/programing/my_github_account/DCSE/semester_5_(fall-23)/systems_programming_
lab/lab_reports/lab6/tasks$ gcc task2.c -o task2.o && ./task2.o f2.
Something went wrong while opening the source file: f2. due to No such file or directory
aimalexe@AimalKhans-PC:/mnt/d/programing/my_github_account/DCSE/semester_5_(fall-23)/systems_programming_
lab/lab_reports/lab6/tasks$ gcc task2.c -o task2.o && ./task2.o f1.txt
content of f1 .txt

ended
aimalexe@AimalKhans-PC:/mnt/d/programing/my_github_account/DCSE/semester_5_(fall-23)/systems_programming_
lab/lab_reports/lab6/tasks$ gcc task2.c -o task2.o && ./task2.o > f2.txt
writ in ^[[D^[[D^[[D
^C
aimalexe@AimalKhans-PC:/mnt/d/programing/my_github_account/DCSE/semester_5_(fall-23)/systems_programming
```

## Reference:

To view my codes, please refer to my GitHub account: https://github.com/aimalexe/DCSE/tree/main/semester_5_(fall-23)/systems_programming_lab/lab_reports .

## Conclusion:

In conclusion, I have learned in depth about these system calls like read, open, close, write, buffers, cat, redirections, pipelining and much more. Now I am able to use these in future projects.

The End.