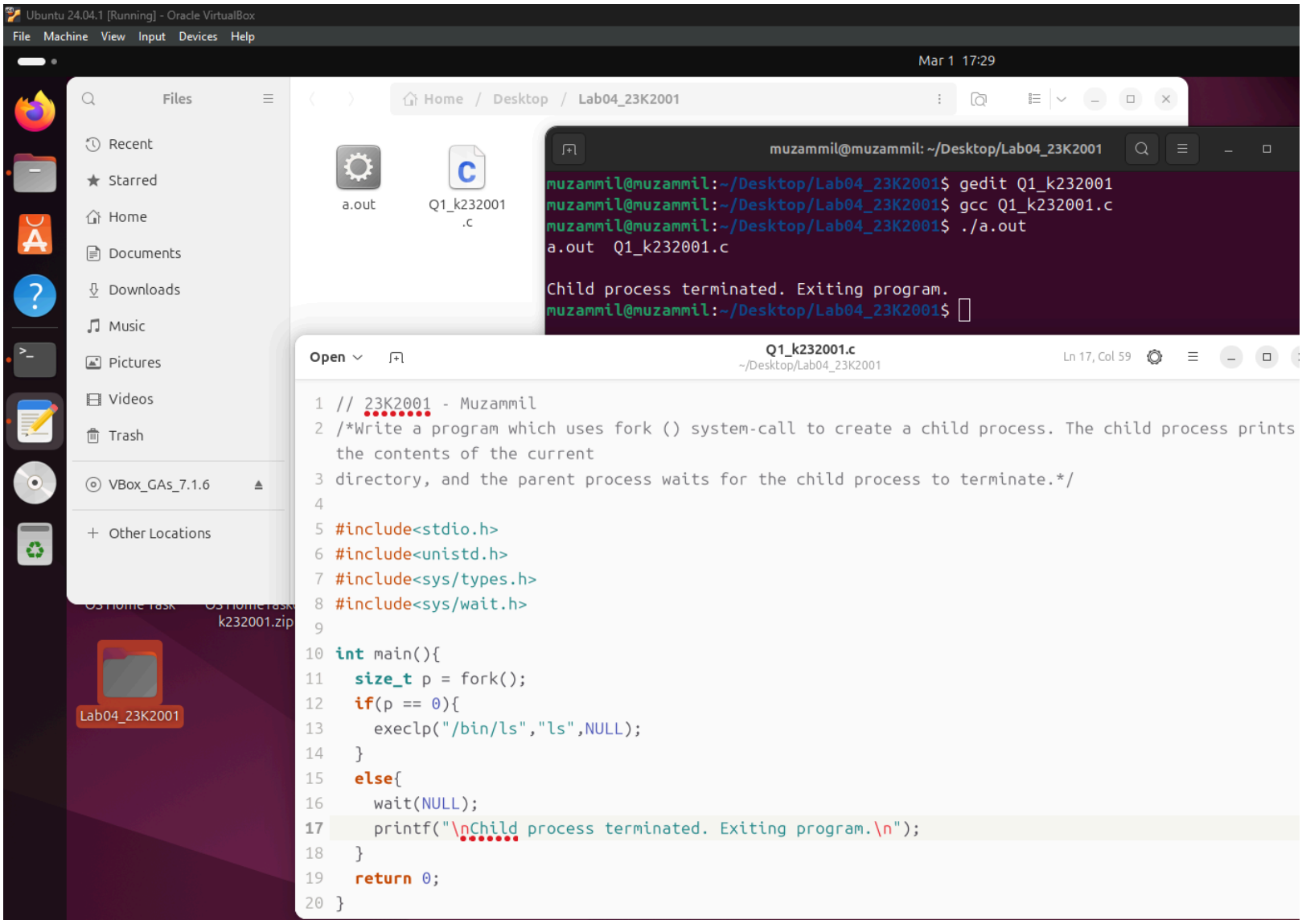
Operating Systems

LAB#04

23K-2001

BCS-4J

Q1:


Ubuntu 24.04.1 [Running] - Oracle VirtualBox
File Machine View Input Devices Help
Mar 1 17:29
Files
Recent
Starred
Home
Documents
Downloads
Music
Pictures
Videos
Trash
VBox_GAs_7.1.6
Other Locations
Home / Desktop / Lab04_23K2001
a.out
Q1_k232001.c
muzammil@muzammil: ~/Desktop/Lab04_23K2001
muzammil@muzammil:~/Desktop/Lab04_23K2001$ gedit Q1_k232001
muzammil@muzammil:~/Desktop/Lab04_23K2001$ gcc Q1_k232001.c
muzammil@muzammil:~/Desktop/Lab04_23K2001$ ./a.out
a.out Q1_k232001.c
Child process terminated. Exiting program.
muzammil@muzammil:~/Desktop/Lab04_23K2001$
Open
Q1_k232001.c
~/Desktop/Lab04_23K2001
Ln 17, Col 59
// 23K2001 - Muzammil
/*Write a program which uses fork () system-call to create a child process. The child process prints the contents of the current
directory, and the parent process waits for the child process to terminate.*/
#include<stdio.h>
#include<unistd.h>
#include<sys/types.h>
#include<sys/wait.h>
int main(){
size_t p = fork();
if(p == 0){
execlp("/bin/ls","ls",NULL);
}
else{
wait(NULL);
printf("\nChild process terminated. Exiting program.\n");
}
return 0;
}
Lab04_23K2001

```
// 23K2001 - Muzammil
/*Write a program which uses fork () system-call to create a child process. The child process
prints the contents of the current
directory, and the parent process waits for the child process to terminate.*/

#include<stdio.h>
#include<unistd.h>
#include<sys/types.h>
#include<sys/wait.h>

int main(){
  size_t p = fork();
  if(p == 0){
        execlp("/bin/ls","ls",NULL);
  }
  else{
        wait(NULL);
        printf("\nChild process terminated. Exiting program.\n");
  }
  return 0;
}
```

Q2:

Ubuntu 24.04.1 [Running] - Oracle VirtualBox

File Machine View Input Devices Help

Mar 1 18:06

Files

Recent

Starred

Home

Home / Desktop / Lab04_23K2001

a.out

Q1_k232001.c

Q2_k232001.c

Open

Q2_k232001.c
~/Desktop/Lab04_23K2001

Ln 18, Col 58

Q1_k232001.c

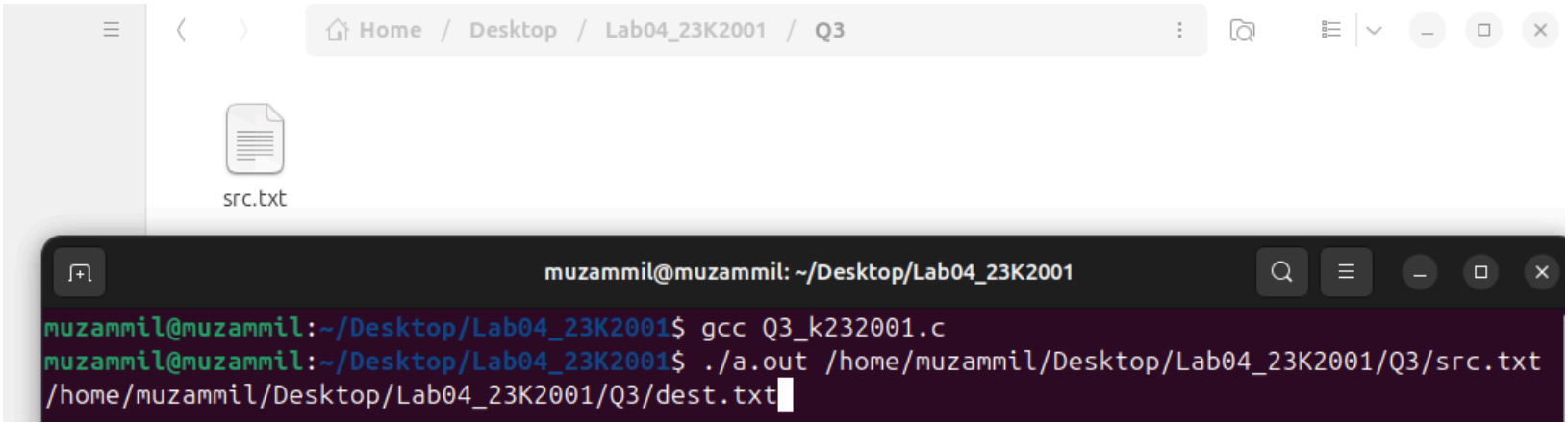
Q2_k232001.c

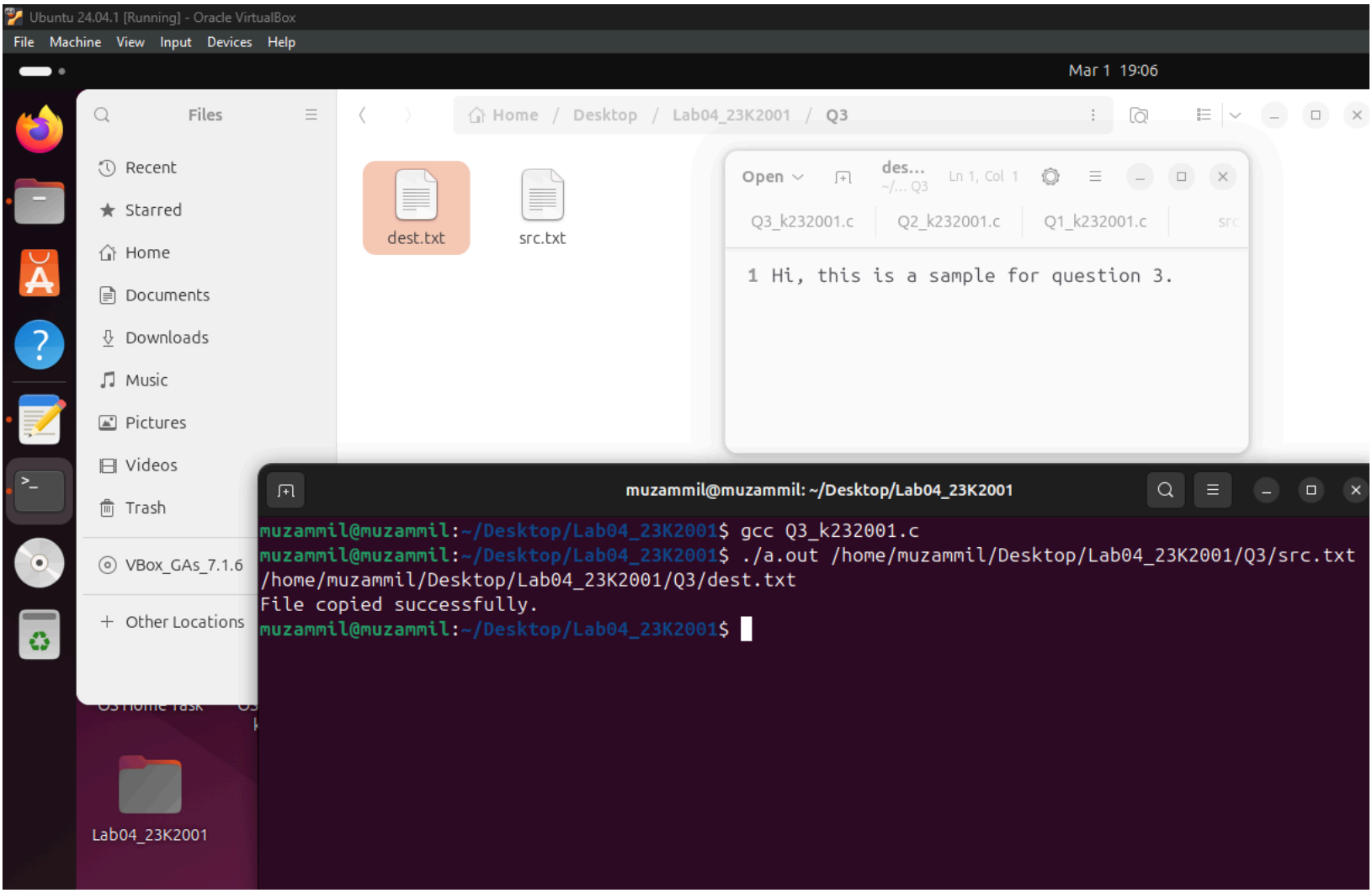
```c
// 23K2001 - Muzammil
/*Write a program which prints its PID and uses fork () system call to create a child process. After fork () system call, both
parent and child processes print what kind of process they are and their PID. Also, the parent process prints its child's PID,
and the child process prints its parent's PID.*/

#include<stdio.h>
#include<unistd.h>
#include<sys/types.h>
#include<sys/wait.h>

int main(){
  size_t p = fork();
  if(p == 0){
    printf("\n(Inside child):\nCurrent Process: p_id = %d\nParent Process: p_id = %d\n",getpid(),getppid());
  }
  else{
    wait(NULL);
    printf("\n(Inside parent):\nChild Process: p_id = %lu\nCurrent Process: p_id = %d\nParent Process: p_id = %d\n",p,getpid(),getppid());
  }
  return 0;
}
```

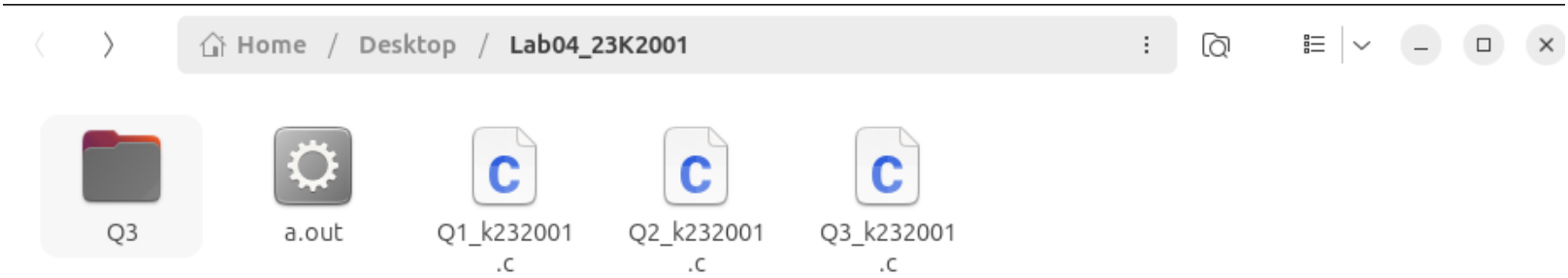
```
muzammil@muzammil: ~/Desktop/Lab04_23K2001
muzammil@muzammil:~/Desktop/Lab04_23K2001$ gedit Q2_k232001.c
muzammil@muzammil:~/Desktop/Lab04_23K2001$ gcc Q2_k232001.c
muzammil@muzammil:~/Desktop/Lab04_23K2001$ ./a.out

(Inside child):
Current Process: p_id = 4306
Parent Process: p_id = 4305

(Inside parent):
Child Process: p_id = 4306
Current Process: p_id = 4305
Parent Process: p_id = 3358
muzammil@muzammil:~/Desktop/Lab04_23K2001$
```

```
// 23K2001 - Muzammil
/*Write a program which prints its PID and uses fork () system call to create a child process.
After fork () system call, both
parent and child processes print what kind of process they are and their PID. Also, the parent
process prints its child's PID,
and the child process prints its parent's PID.*/

#include<stdio.h>
#include<unistd.h>
#include<sys/types.h>
#include<sys/wait.h>

int main(){
  size_t p = fork();
  if(p == 0){
        printf("\n(Inside child):\nCurrent Process: p_id = %d\nParent Process: p_id =
%d\n",getpid(),getppid());
  }
  else{
        wait(NULL);
        printf("\n(Inside parent):\nChild Process: p_id = %lu\nCurrent Process: p_id =
%d\nParent Process: p_id = %d\n",p,getpid(),getppid());
  }
  return 0;
}
```

Q3:


Home / Desktop / Lab04_23K2001 / Q3
src.txt
muzammil@muzammil: ~/Desktop/Lab04_23K2001
muzammil@muzammil:~/Desktop/Lab04_23K2001$ gcc Q3_k232001.c
muzammil@muzammil:~/Desktop/Lab04_23K2001$ ./a.out /home/muzammil/Desktop/Lab04_23K2001/Q3/src.txt
/home/muzammil/Desktop/Lab04_23K2001/Q3/dest.txt

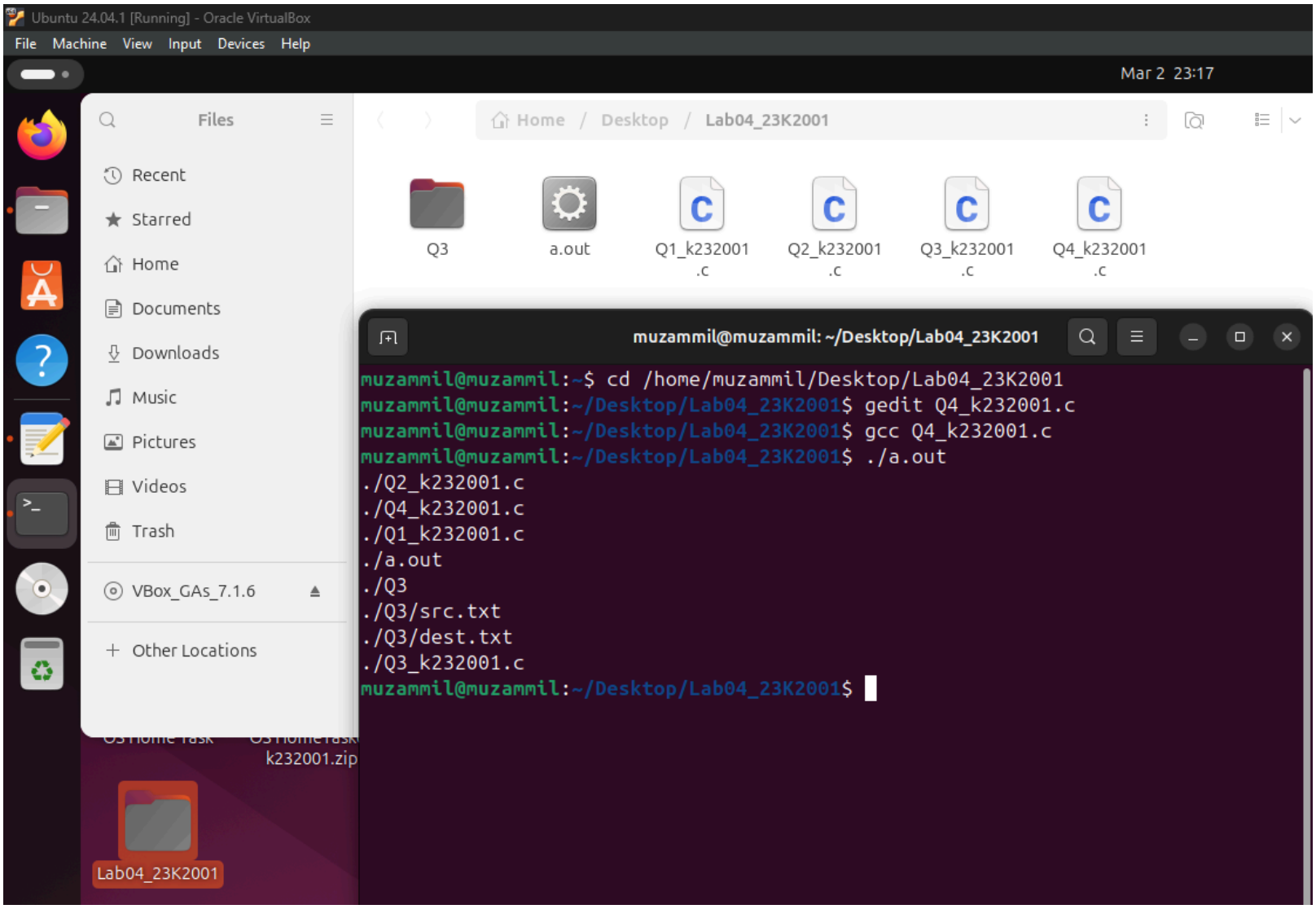

Ubuntu 24.04.1 [Running] - Oracle VirtualBox
File Machine View Input Devices Help
Mar 1 19:06
Files
Recent
Starred
Home
Documents
Downloads
Music
Pictures
Videos
Trash
VBox_GAs_7.1.6
Other Locations
Home / Desktop / Lab04_23K2001 / Q3
dest.txt
src.txt
Open
des...
~/... Q3
Ln 1, Col 1
Q3_k232001.c
Q2_k232001.c
Q1_k232001.c
1 Hi, this is a sample for question 3.
muzammil@muzammil: ~/Desktop/Lab04_23K2001
muzammil@muzammil:~/Desktop/Lab04_23K2001$ gcc Q3_k232001.c
muzammil@muzammil:~/Desktop/Lab04_23K2001$ ./a.out /home/muzammil/Desktop/Lab04_23K2001/Q3/src.txt
/home/muzammil/Desktop/Lab04_23K2001/Q3/dest.txt
File copied successfully.
muzammil@muzammil:~/Desktop/Lab04_23K2001$
Lab04_23K2001




```
// 23K2001 - Muzammil
/*Develop a program that copies the contents of one file into another file using system calls.
The program should accept two file paths as command-line arguments: the source file to be
copied
from and the destination file to be copied to. Ensure proper error handling for
file opening, reading, and writing operations.*/

#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
#include <fcntl.h>
#include <sys/types.h>
#include <sys/stat.h>

int main(int argc, char *argv[]) {
        int f1, f2;
        ssize_t bytes_read, bytes_written;
        char buffer[1024];

        // Open input file (1st argument) for reading
        f1 = open(argv[1], O_RDONLY);
        if (f1 == -1) {
        perror("Failed to open input file");
        exit(EXIT_FAILURE);
        }
        // Open output file (2nd argument) for writing (create if not exists, truncate if exists)
        f2 = open(argv[2], O_WRONLY | O_CREAT | O_TRUNC, S_IRUSR | S_IWUSR);
        if (f2 == -1) {
        perror("Failed to open output file");
        close(f1);
        exit(EXIT_FAILURE);
        }

        // Read from input file and write to output file
        while ((bytes_read = read(f1, buffer, sizeof(buffer))) > 0) {
        bytes_written = write(f2, buffer, bytes_read);
        if (bytes_written != bytes_read) {
```

```
        perror("Write error");
        close(f1);
        close(f2);
        exit(EXIT_FAILURE);
        }
        }
        if (bytes_read == -1) {
        perror("Read error");
        close(f1);
        close(f2);
        exit(EXIT_FAILURE);
        }

        // Close input and output files
        if (close(f1) == -1) {
        perror("Failed to close input file");
        exit(EXIT_FAILURE);
        }
        if (close(f2) == -1) {
        perror("Failed to close output file");
        exit(EXIT_FAILURE);
        }

        printf("File copied successfully.\n");
        return 0;
}
```

Q4:


Ubuntu 24.04.1 [Running] - Oracle VirtualBox
File Machine View Input Devices Help
Mar 2 23:17
Files
Recent
Starred
Home
Documents
Downloads
Music
Pictures
Videos
Trash
VBox_GAs_7.1.6
Other Locations
Home / Desktop / Lab04_23K2001
Q3
a.out
Q1_k232001.c
Q2_k232001.c
Q3_k232001.c
Q4_k232001.c
k232001.zip
Lab04_23K2001
muzammil@muzammil: ~/Desktop/Lab04_23K2001
muzammil@muzammil:~$ cd /home/muzammil/Desktop/Lab04_23K2001
muzammil@muzammil:~/Desktop/Lab04_23K2001$ gedit Q4_k232001.c
muzammil@muzammil:~/Desktop/Lab04_23K2001$ gcc Q4_k232001.c
muzammil@muzammil:~/Desktop/Lab04_23K2001$ ./a.out
./Q2_k232001.c
./Q4_k232001.c
./Q1_k232001.c
./a.out
./Q3
./Q3/src.txt
./Q3/dest.txt
./Q3_k232001.c
muzammil@muzammil:~/Desktop/Lab04_23K2001$

Open

Q4_k232001.c
~/Desktop/Lab04_23K2001

Ln 31, Col 1

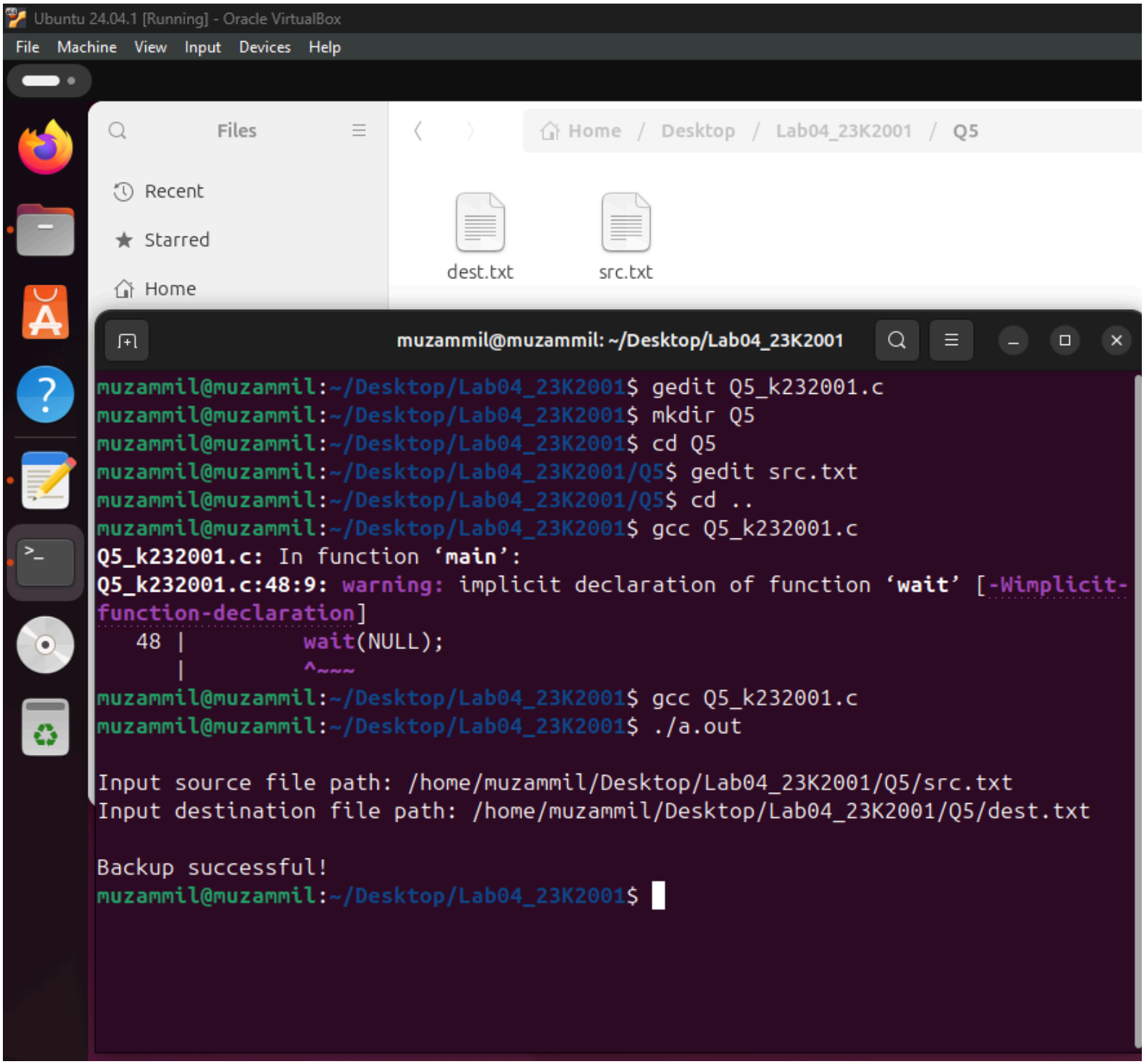
Q4_k232001.c | Q3_k232001.c | Q2_k232001.c | Q1_

```c
#include <stdio.h>
#include <dirent.h>
#include <sys/stat.h>
#include <string.h>

void listFiles(const char *path) {
    DIR *dir = opendir(path);
    if (!dir) return;

    struct dirent *entry;
    char newPath[1024];

    while ((entry = readdir(dir))) {
        if (entry->d_name[0] == '.')
          continue;

        printf("%s/%s\n", path, entry->d_name);
        struct stat st;
        snprintf(newPath, sizeof(newPath), "%s/%s", path, entry->d_name);
        if (stat(newPath, &st) == 0 && S_ISDIR(st.st_mode))
            listFiles(newPath);
    }

    closedir(dir);
}

int main() {
    listFiles("."); // Current directory
    return 0;
}
```

```
// 23K2001 - Muzammil
/*Write a program that lists all files and directories in the current directory using system calls.
The program should traverse the
directory structure recursively and print the names of all files and directories found, along with
their respective types (file or
directory).*/

#include <stdio.h>
#include <dirent.h>
#include <sys/stat.h>
#include <string.h>

void listFiles(const char *path) {
	DIR *dir = opendir(path);
	if (!dir) return;

	struct dirent *entry;
	char newPath[1024];

	while ((entry = readdir(dir))) {
	if (entry->d_name[0] == '.')
	continue;

	printf("%s/%s\n", path, entry->d_name);
	struct stat st;
	snprintf(newPath, sizeof(newPath), "%s/%s", path, entry->d_name);
	if (stat(newPath, &st) == 0 && S_ISDIR(st.st_mode))
	listFiles(newPath);
	}

	closedir(dir);
}

int main() {
	listFiles("."); // Current directory
	return 0;
}
```

Q5:

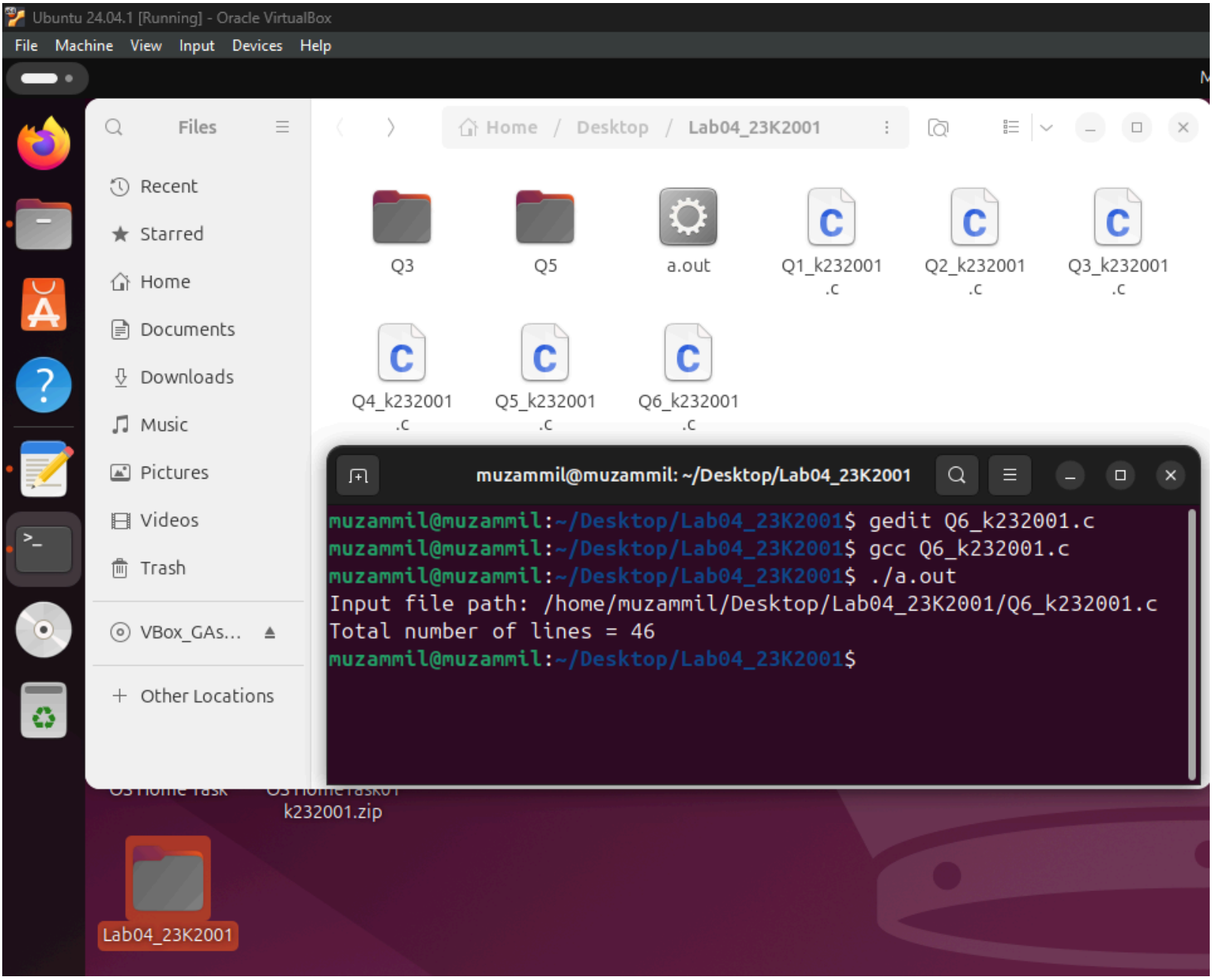

Home / Desktop / Lab04_23K2001 / Q5
src.txt
Open
src.txt
~/Desktop/Lab04_23K2001/Q5
Ln 1, Col 1
src.txt
Q5_k232001.c
Q4_k232001.c
Q3_k232001.c
1 Hi, this is a sample for question 05.


Ubuntu 24.04.1 [Running] - Oracle VirtualBox
File Machine View Input Devices Help
Files
Recent
Starred
Home
Home / Desktop / Lab04_23K2001 / Q5
dest.txt
src.txt
muzammil@muzammil: ~/Desktop/Lab04_23K2001
muzammil@muzammil:~/Desktop/Lab04_23K2001$ gedit Q5_k232001.c
muzammil@muzammil:~/Desktop/Lab04_23K2001$ mkdir Q5
muzammil@muzammil:~/Desktop/Lab04_23K2001$ cd Q5
muzammil@muzammil:~/Desktop/Lab04_23K2001/Q5$ gedit src.txt
muzammil@muzammil:~/Desktop/Lab04_23K2001/Q5$ cd ..
muzammil@muzammil:~/Desktop/Lab04_23K2001$ gcc Q5_k232001.c
Q5_k232001.c: In function 'main':
Q5_k232001.c:48:9: warning: implicit declaration of function 'wait' [-Wimplicit-function-declaration]
48 | wait(NULL);
| ^~~~
muzammil@muzammil:~/Desktop/Lab04_23K2001$ gcc Q5_k232001.c
muzammil@muzammil:~/Desktop/Lab04_23K2001$ ./a.out
Input source file path: /home/muzammil/Desktop/Lab04_23K2001/Q5/src.txt
Input destination file path: /home/muzammil/Desktop/Lab04_23K2001/Q5/dest.txt
Backup successful!
muzammil@muzammil:~/Desktop/Lab04_23K2001$


```
// 23K2001 - Muzammil
/*Write a C program to create a backup of a file. The program takes two filenames as input
(source and destination), where the parent process opens both files, forks a
child process to read from the source file and write to the destination file,
and ensures proper error handling if the file does not exist.*/
#include <stdio.h>
#include <stdlib.h>
#include <sys/wait.h>
#include <unistd.h>
#include <fcntl.h>

int main(){
        char src[100], dest[100];
        printf("\nInput source file path: ");
        scanf("%s", src);
        printf("Input destination file path: ");
        scanf("%s", dest);

        int f1 = open(src, O_RDONLY);
        if (f1 == -1){
        perror("\nError opening source file");
        return 1;
        }
        int f2 = open(dest, O_WRONLY | O_CREAT | O_TRUNC, 0644);
        if (f2 == -1){
        perror("\nError creating destination file");
        close(f1);
        return 1;
        }
        pid_t pid = fork();
        if (pid == -1){
```

```
        perror("\nFork failed");
        close(f1);
        close(f2);
        return 1;
        }

        if (pid == 0){
        char buffer[1024];
        ssize_t bytesRead;

        while ((bytesRead = read(f1, buffer, sizeof(buffer))) > 0)
        write(f2, buffer, bytesRead);

        close(f1);
        close(f2);
        printf("\nBackup successful!\n");
        }
        else
        wait(NULL);

        return 0;
}
```

Q6:


Ubuntu 24.04.1 [Running] - Oracle VirtualBox
File Machine View Input Devices Help
Files
Recent
Starred
Home
Documents
Downloads
Music
Pictures
Videos
Trash
VBox_GAs...
Other Locations
Home / Desktop / Lab04_23K2001
Q3
Q5
a.out
Q1_k232001.c
Q2_k232001.c
Q3_k232001.c
Q4_k232001.c
Q5_k232001.c
Q6_k232001.c
muzammil@muzammil: ~/Desktop/Lab04_23K2001
muzammil@muzammil:~/Desktop/Lab04_23K2001$ gedit Q6_k232001.c
muzammil@muzammil:~/Desktop/Lab04_23K2001$ gcc Q6_k232001.c
muzammil@muzammil:~/Desktop/Lab04_23K2001$ ./a.out
Input file path: /home/muzammil/Desktop/Lab04_23K2001/Q6_k232001.c
Total number of lines = 46
muzammil@muzammil:~/Desktop/Lab04_23K2001$
k232001.zip
Lab04_23K2001

Open

Q6_k232001.c
~/Desktop/Lab04_23K2001

Q6_k232001.c × | Q5_k232001.c | Q4_k232001.c | Q3_k2

```c
after the child process finishes execution.*/
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
#include <fcntl.h>
#include <sys/wait.h>

int main(){
    char path[100];
    printf("Input file path: ");
    scanf("%s", path);

    int fd = open(path, O_RDONLY);
    if (fd == -1){
        perror("Error opening file");
        return 1;
    }
    pid_t pid = fork();
    if (pid == -1){
        perror("Fork failed");
        close(fd);
        return 1;
    }

    if (pid == 0){
        char ch;
        int lines = 0;

        while (read(fd, &ch, 1) > 0){
            if (ch == '\n')
                lines++;
        }
        close(fd);
        printf("Total number of lines = %d\n", lines);
        exit(0);
    }
    else
        wait(NULL);

    return 0;
}

```

// 23K2001 - Muzammil

```
/*Write a C program to lines the number of lines in a file. The parent process
opens the file, forks a child process that reads character by character,
liness the newline (\n) characters, and prints the total line lines
after the child process finishes execution.*/
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
#include <fcntl.h>
#include <sys/wait.h>

int main(){
	char path[100];
	printf("Input file path: ");
	scanf("%s", path);

	int fd = open(path, O_RDONLY);
	if (fd == -1){
	perror("Error opening file");
	return 1;
	}
	pid_t pid = fork();
	if (pid == -1){
	perror("Fork failed");
	close(fd);
	return 1;
	}

	if (pid == 0){
	char ch;
	int lines = 0;

	while (read(fd, &ch, 1) > 0){
	if (ch == '\n')
		lines++;
	}
	close(fd);
	printf("Total number of lines = %d\n", lines);
	exit(0);
	}
	else
	wait(NULL);

	return 0;
}
```

Q7:

Ubuntu 24.04.1 [Running] - Oracle VirtualBox

File Machine View Input Devices Help

Mar 3 00:39

muzammil@muzammil: ~/Desktop/Lab04_23K2001

```
muzammil@muzammil:~/Desktop/Lab04_23K2001$ gedit Q7_k232001.c
muzammil@muzammil:~/Desktop/Lab04_23K2001$ gcc Q7_k232001.c
muzammil@muzammil:~/Desktop/Lab04_23K2001$ ./a.out
Input file path: /home/muzammil/Desktop/Lab04_23K2001/Q7_k232001.c
// 23K2001 - Muzammil
/*Write a C program to display the contents of a file on the terminal.
The parent process opens the file and forks a child process, which reads the file
using read() and writes the content to the terminal using write(),
while handling errors if the file does not exist.*/
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
#include <fcntl.h>
#include <sys/wait.h>

int main() {
    char path[100];
    printf("Input file path: ");
    scanf("%s", path);

    int fd = open(path, O_RDONLY);
    if (fd == -1){
        perror("Error opening file");
        return 1;
    }
    pid_t pid = fork();
    if (pid == -1){
        perror("Fork failed");
        close(fd);
        return 1;
    }

    if (pid == 0){
        char buffer[1024];
        int bytesRead;
        while ((bytesRead = read(fd, buffer, sizeof(buffer))) > 0)
            write(STDOUT_FILENO, buffer, bytesRead);

        close(fd);
        exit(0);
```

Open

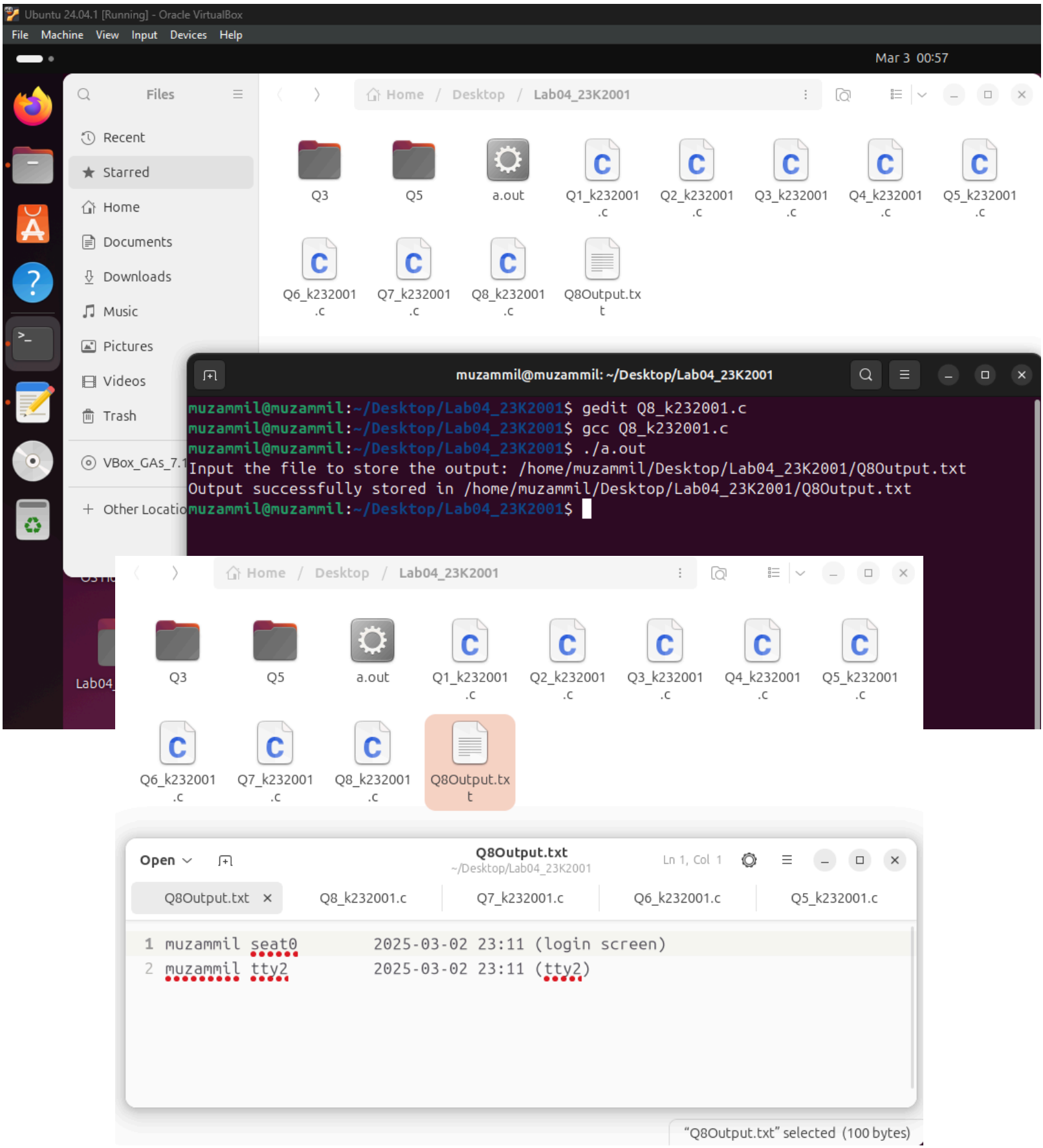
Q7_k232001.c
~/Desktop/Lab04_23K2001

Q7_k232001.c × | Q6_k232001.c | Q5_k232001.c

```c
int main() {
    char path[100];
    printf("Input file path: ");
    scanf("%s", path);

    int fd = open(path, O_RDONLY);
    if (fd == -1){
        perror("Error opening file");
        return 1;
    }
    pid_t pid = fork();
    if (pid == -1){
        perror("Fork failed");
        close(fd);
        return 1;
    }

    if (pid == 0){
        char buffer[1024];
        int bytesRead;
        while ((bytesRead = read(fd, buffer, sizeof(buffer))) > 0)
            write(STDOUT_FILENO, buffer, bytesRead);

        close(fd);
        exit(0);
    }
    else
        wait(NULL);

    return 0;
}
```

```
// 23K2001 - Muzammil
/*Write a C program to display the contents of a file on the terminal.
The parent process opens the file and forks a child process, which reads the file
using read() and writes the content to the terminal using write(),
while handling errors if the file does not exist.*/
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
#include <fcntl.h>
#include <sys/wait.h>

int main() {
	char path[100];
	printf("Input file path: ");
	scanf("%s", path);

	int fd = open(path, O_RDONLY);
	if (fd == -1){
	perror("Error opening file");
	return 1;
	}
	pid_t pid = fork();
	if (pid == -1){
	perror("Fork failed");
	close(fd);
	return 1;
	}

	if (pid == 0){
	char buffer[1024];
	int bytesRead;
	while ((bytesRead = read(fd, buffer, sizeof(buffer))) > 0)
	write(STDOUT_FILENO, buffer, bytesRead);

	close(fd);
	exit(0);
	}
	else
	wait(NULL);

	return 0;
}
```

Q8:


Ubuntu 24.04.1 [Running] - Oracle VirtualBox
File Machine View Input Devices Help
Mar 3 00:57
Files
Recent
Starred
Home
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VBox_GAs_7.1
Other Locatio
Home / Desktop / Lab04_23K2001
Q3
Q5
a.out
Q1_k232001.c
Q2_k232001.c
Q3_k232001.c
Q4_k232001.c
Q5_k232001.c
Q6_k232001.c
Q7_k232001.c
Q8_k232001.c
Q8Output.txt
muzammil@muzammil: ~/Desktop/Lab04_23K2001
muzammil@muzammil:~/Desktop/Lab04_23K2001$ gedit Q8_k232001.c
muzammil@muzammil:~/Desktop/Lab04_23K2001$ gcc Q8_k232001.c
muzammil@muzammil:~/Desktop/Lab04_23K2001$ ./a.out
Input the file to store the output: /home/muzammil/Desktop/Lab04_23K2001/Q8Output.txt
Output successfully stored in /home/muzammil/Desktop/Lab04_23K2001/Q8Output.txt
muzammil@muzammil:~/Desktop/Lab04_23K2001$
Open
Q8Output.txt
~/Desktop/Lab04_23K2001
Ln 1, Col 1
Q8Output.txt
Q8_k232001.c
Q7_k232001.c
Q6_k232001.c
Q5_k232001.c
1 muzammil seat0 2025-03-02 23:11 (login screen)
2 muzammil tty2 2025-03-02 23:11 (tty2)
"Q8Output.txt" selected (100 bytes)

Open

Q8_k232001.c
~/Desktop/Lab04_23K2001

Ln 24, Col 22

Q8_k232001.c | Q7_k232001.c | Q6_k232001.c

```c
#include <fcntl.h>
#include <sys/wait.h>

int main(){
    char file[100];
    printf("Input the file to store the output: ");
    scanf("%s", file);
    pid_t pid = fork();
    if (pid == -1){
        perror("Fork failed");
        return 1;
    }

    if (pid == 0){
        int fd = open(file, O_WRONLY | O_CREAT | O_TRUNC, 0644);
        if (fd == -1){
            perror("Error opening file");
            exit(1);
        }
        dup2(fd, STDOUT_FILENO);
        close(fd);

        execlp("who", "who", NULL);
        perror("execlp failed");
        exit(1);
    }
    else{
        wait(NULL);
        printf("Output successfully stored in %s\n", file);
    }
    return 0;
}
```

```
// 23K2001 - Muzammil
/*Write a C program creates a child process using fork(). The child process
redirects its output to a file and executes the who command using execlp().
The parent process waits for the child to finish and informs
the user that the output has been successfully stored.*/
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
#include <fcntl.h>
#include <sys/wait.h>

int main(){
	char file[100];
	printf("Input the file to store the output: ");
	scanf("%s", file);
	pid_t pid = fork();
	if (pid == -1){
	perror("Fork failed");
	return 1;
	}

	if (pid == 0){
	int fd = open(file, O_WRONLY | O_CREAT | O_TRUNC, 0644);
	if (fd == -1){
	perror("Error opening file");
	exit(1);
	}
	dup2(fd, STDOUT_FILENO);
	close(fd);

	execlp("who", "who", NULL);
	perror("execlp failed");
	exit(1);
	}
	else{
	wait(NULL);
	printf("Output successfully stored in %s\n", file);
	}
	return 0;
}
```