# Operating Systems

Lab Report #3

**Process Control**

Name

Student ID

## OBJECTIVES

Briefly describe the objective of this lab assignment.

## CODE AND EXECUTION

### Assignment 1: Basic fork() Usage

```
I#include <stdio.h>
#include <unistd.h>
#include <sys/types.h>

int main() {
    int x = 100;
    pid_t pid = fork();

    if (pid < 0) {
        // fork 失败
        fprintf(stderr, "Fork failed");
        return 1;
    } else if (pid == 0) {
        // 子进程
        printf("child fork: x = %d\n", x);
        x += 10;
        printf("After child fork changed: x = %d\n", x);
    } else {
        // 父进程
        printf("parent fork: x = %d\n", x);
        x += 20;
        printf("After parent changed: x = %d\n", x);
    }

    return 0;
}
```

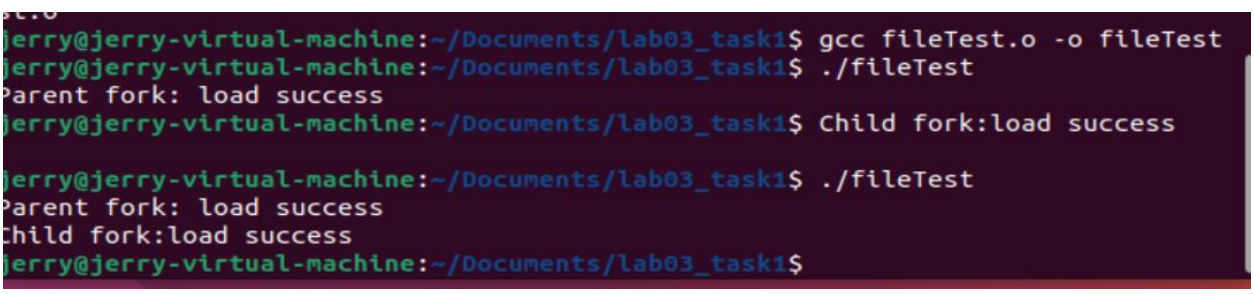
Provide the output or screenshots of your program execution.

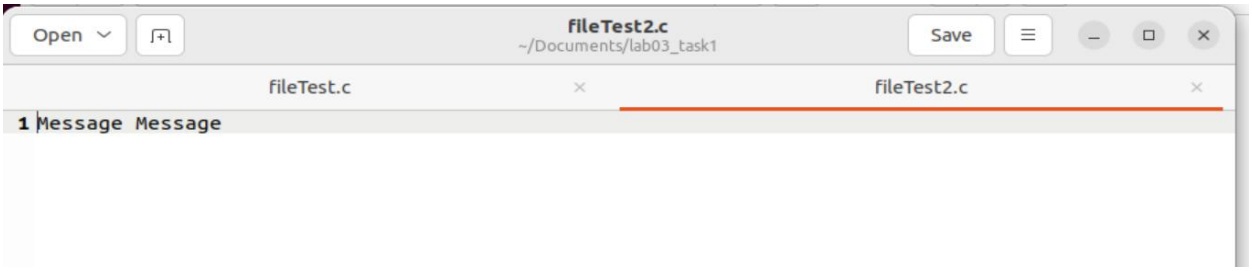
```
int
jerry@jerry-virtual-machine:~/Documents/lab03_task1$ gcc -c '/home/jerry/Documen
ts/lab03_task1/forkText.c' -o forkText.o
jerry@jerry-virtual-machine:~/Documents/lab03_task1$ g++ forkText.o -o forkText
jerry@jerry-virtual-machine:~/Documents/lab03_task1$ cd ./forkText
bash: cd: ./forkText: Not a directory
jerry@jerry-virtual-machine:~/Documents/lab03_task1$ cd ./forkText.o
bash: cd: ./forkText.o: Not a directory
jerry@jerry-virtual-machine:~/Documents/lab03_task1$ ./forkText
paretn fork:x=100
after parent fork change: x=120
jerry@jerry-virtual-machine:~/Documents/lab03_task1$ child fork: x=100
after child fork change:x=110
```

## Assignment 2: File Descriptor Inheritance

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

int main() {
    int fd;
    fd = open("testfile.txt", O_WRONLY | O_CREAT | O_TRUNC, 0644);
    if (fd < 0) {
        perror("open");
        exit(1);
    }

    pid_t pid = fork();

    if (pid < 0) {
        perror("fork");
        close(fd);
        exit(1);
    } else if (pid == 0) {
        // 子进程
        const char *child_msg = "Message from child fork\n";
        write(fd, child_msg, sizeof(child_msg));
        printf("Child fork: load success\n");
    } else {
        // 父进程
        const char *parent_msg = "Message from parent fork\n";
        write(fd, parent_msg, sizeof(parent_msg));
        printf("Parent fork: load success\n");
    }

    close(fd);
    return 0;
}
```

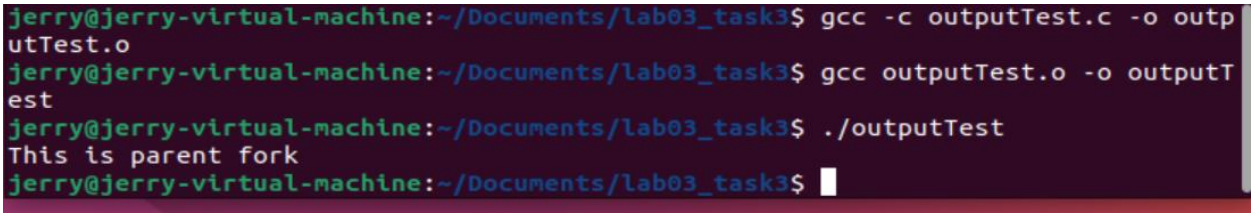
Provide the output or screenshots of your program execution.






## Assignment 3: Standard Output Closure

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

int main() {
    pid_t pid = fork();

    if (pid < 0) {
        // 如果创建子进程失败，输出错误信息并退出程序
        perror("fork");
        exit(1);
    } else if (pid == 0) {
        // 这是子进程执行的代码块
        // 关闭标准输出
        close(STDOUT_FILENO);

        // 尝试打印字符串到标准输出
        printf("这是子进程的输出\n");

        // 为了确保 printf 输出，强制刷新缓冲区
        fflush(stdout);
    } else {
        // 这是父进程执行的代码块
        // 父进程继续正常执行
        printf("这是父进程的输出\n");
    }

    return 0;
}
```



## Assignment 4: Advanced Process Control

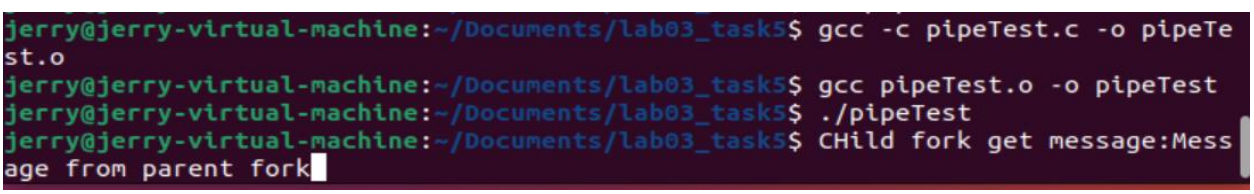
```
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>

int main() {
    pid_t pid = fork();

    if (pid < 0) {
        // 如果创建子进程失败，输出错误信息并退出程序
        perror("fork");
        exit(1);
    } else if (pid == 0) {
        // 这是子进程执行的代码块
        // 关闭标准输出
        close(STDOUT_FILENO);

        // 尝试打印字符串到标准输出
        printf("这是子进程的输出\n");

        // 为了确保 printf 输出，强制刷新缓冲区
        fflush(stdout);
    } else {
        // 这是父进程执行的代码块
        // 父进程继续正常执行
        printf("这是父进程的输出\n");
    }

    return 0;
}
```

```
jerry@jerry-virtual-machine:~/Documents/lab03_task4$ gcc advancedTest.o -o advan
cedTest
jerry@jerry-virtual-machine:~/Documents/lab03_task4$ ./advanced
bash: ./advanced: No such file or directory
jerry@jerry-virtual-machine:~/Documents/lab03_task4$ ./advancedTest
Parent fork: PID=4098, PPID=3457
Child fork : PID=4099, PPID=4098
Grandchild fork cPID=4100, PPID =4099
jerry@jerry-virtual-machine:~/Documents/lab03_task4$
```

## Assignment 5: Pipes for Inter-process Communication

```
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
#include <string.h>

int main() {
    int fd[2]; // 文件描述符数组，fd[0] 为读端，fd[1] 为写端
    pid_t pid;
    const char *msg = "这是从父进程发送的消息\n";
    char buffer[100];
```

```
    // 创建管道
    if (pipe(fd) == -1) {
        perror("pipe");
        exit(1);
    }

    // 创建子进程
    pid = fork();
    if (pid < 0) {
        perror("fork");
        exit(1);
    } else if (pid == 0) {
        // 子进程
        close(fd[1]);  // 关闭写端

        // 从管道读端读取消息
        read(fd[0], buffer, sizeof(buffer));
        printf("子进程读取到的消息: %s", buffer);

        close(fd[0]);  // 关闭读端
    } else {
        // 父进程
        close(fd[0]);  // 关闭读端

        // 向管道写端写入消息
        write(fd[1], msg, strlen(msg) + 1);

        close(fd[1]);  // 关闭写端
    }

    return 0;
}
```




## ANALYSIS

Analyze the behavior of each program. Explain the observed outputs, discuss any challenges encountered, and how they were resolved.

## CONCLUSION

Summarize your findings and experiences from this lab assignment.

## REFERENCES

List any references or resources you used to complete this lab assignment, if any.