

Assignment 5 – Buffer I/O

Description:

The assignment is about implementing a buffered I/O system in C. In a buffered I/O system, data is read and written in chunks rather than byte by byte, which can significantly improve efficiency. The objective is to create three functions (`b_open`, `b_read`, and `b_close`) that handle buffered I/O operations.

The assignment requires not only implementing these functions but also testing them using the provided main program, ensuring correct handling of different scenarios such as reaching the end of the file and managing buffers efficiently. The final submission includes the modified `b_io.c` file, the Makefile, and a writeup describing the logic, steps taken, and the compilation/execution output.

Approach / What I Did:

Understanding the Problem:

Initially, I dedicated significant time to comprehending the problem. This involved gaining insights into the typical operations of open file functions, read functions, and the challenges associated with making these functions efficient.

I sought to understand the underlying purpose and intricacies of file operations.

Exploring Provided Functions:

I thoroughly examined the functions provided by the professor, focusing on understanding the parameters, return values, and the structure of `fileInfo`.

This exploration was crucial in building a foundation for my subsequent implementation.

Implementation of `b_open` Function:

The implementation of the `b_open` function was a relatively straightforward process.

The professor's hints provided valuable guidance, and understanding the functions included in the file was not overly complicated.

The primary tasks included creating a file descriptor, allocating a buffer for read operations (512 bytes), and using `GetFileInfo` to find the file size and location.

Challenges in `b_read` Function:

The most interesting and challenging part was the implementation of the `b_read` function.

I began by experimenting with the `LBRead` function and `memcpy` to understand their behavior.

Identified three scenarios in the read operation:

- Reading from the last byte read, and all new bytes fitting inside the current buffer.
- Reading from the last byte read, insufficient space in the buffer, filling up the buffer, and potentially reading whole blocks of data if the user's byte request exceeds the bytes read.
- Being in the last block where the file ends.

Implementation of b_close Function:

The b_close function involved releasing resources associated with the file. This primarily included freeing the pointer to the file and assigning it to null.

Verification and Testing:

Testing was conducted to ensure the correct functioning of the implemented functions.

Issues and Resolutions:

Issue Description:

Encountered a segmentation fault while experimenting with printf statements within the open function.

This issue disrupted the execution flow and impeded progress in understanding the root cause of the fault.

Resolution Steps:

To address the segmentation fault, I carefully reviewed the code segment responsible for calling GetFileInfo(filename).

Identified that creating a pointer to hold the result of GetFileInfo(filename) and then assigning it to the file structure resolved the issue.

This approach ensured proper memory handling and eliminated the segmentation fault during the execution of the open function.

```
parallels@ubuntu-linux-22-04-02-desktop:~/csc415/csc415-assignment-5-jjestrada2$ make run
gcc -c -o b_io.o b_io.c -g -I.
gcc -o Estrada_Juan_HW5_main b_io.o buffer-mainM1.o -g -I.
./Estrada_Juan_HW5_main DATA DecOfInd.txt CommonSense.txt
-----File Name: (null)
make: *** [Makefile:70: run] Segmentation fault (core dumped)
parallels@ubuntu-linux-22-04-02-desktop:~/csc415/csc415-assignment-5-jjestrada2$ make run
```

Issue Description:

Encountered an error while reading due to improper handling of the memcpy function. The issue stemmed from incorrect usage of memcpy when copying data from the internal buffer to the user buffer during the read operation.

Resolution Steps:

To address the error, I carefully reviewed the segment of code responsible for using memcpy to copy data from the internal buffer to the user buffer. Identified the specific area where the error occurred, which was related to incorrect parameters passed to memcpy. Corrected the memcpy parameters to ensure that the data from the internal buffer was copied to the user buffer accurately and efficiently.

```
*** ERROR *** File DecOfInd.txt: Too many lines requested (301) - Aborting!  
We have read 1800 characters from file DecOfInd.txt  
We have read 1800 characters from file CommonSense.txt  
parallels@ubuntu-linux-22-04-02-desktop:~/csc415/csc415-assignment-5-jjestrada2
```

Screen shot of compilation:

```
parallels@ubuntu-linux-22-04-02-desktop:~/csc415/csc415-assignment-5-jjestrada2$ make  
gcc -c -o b_io.o b_io.c -g -I.  
gcc -o Estrada_Juan_HW5_main b_io.o buffer-mainM1.o -g -I.  
parallels@ubuntu-linux-22-04-02-desktop:~/csc415/csc415-assignment-5-jjestrada2$
```

Screen shot(s) of the execution of the program:

organizing its powers in such form, as to them shall seem most likely to effect their Safe Governments are instituted among Men, deriving their just powers from the consent of the governed, to alter or to abolish it, and to institute new Government, laying its foundation on such principles and forms as shall seem to them most likely to promote their mutual Safety and Happiness unless too much pains are bestowed upon their conversion.

The cause of Liberty and Happiness. Prudence, indeed, will dictate that Governments long established should not be changed for light and transient causes; and accordingly all experience has shown that mankind are more disposed to suffer, while evils are sufferable, than to right themselves by abolishing the forms to which they are accustomed. But when a long train of abuses and usurpations, pursuing the same object, evinces a design to reduce them under absolute Despotism, it is their right, it is their duty, to throw off such Government, and to provide new Guards for their future security. --Such has been the patient sufferance of these Colonies; and such is now the necessity which constrains them to alter their former Systems of Government. The history of the present King of Great Britain is a history of repeated injuries and usurpations, all having in direct object the establishment of an absolute Tyranny over these States. To prove this, let Facts be submitted to a candid world.

He has refused his Assent to Laws, the most wholesome and necessary for the public good.

He has forbidden his Governors to pass Laws of immediate and pressing importance, unless suspended in their operation till his Assent should be obtained; and when so suspended, he has utterly neglected to attend to them.

He has refused to pass other Laws for the accommodation of large districts of people, unless those people would relinquish the right of Representation in the Legislature, a right inestimable to them and formidable to tyrants only.

AUTHOR

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He has refused to pass other Laws for the accommodation of large districts of people, until they should relinquish the right of Representation in the Legislature, a right inestimable to them and formidable to tyrants only.

He has called together legislative bodies at places unusual, uncomfortable, and distant from the depository of their public Records, for the sole purpose of fatiguing them into compliance with his measures.

He has dissolved Representative Houses repeatedly, for opposing with manly firmness his invasions on the rights of the people.

He has refused for a long time, after such dissolutions, to cause others to be chosen; whereby the Legislative powers, incapable of annihilation, have returned to the People at large for their exercise; the State remaining in the mean time exposed to all the dangers of invasion from without, and convulsions within.

He has endeavoured to prevent the population of these States; for that purpose obstructing the Laws for Naturalization of Foreigners; refusing to pass others to encourage their migrations hither, and raising the conditions of new Appropriations of Lands.

He has obstructed the Administration of Justice, by refusing his Assent to Laws for establishing Judiciary powers.

He has affected to render the Judiciary independent of the Legislature, and has thus made the Judiciary more independent of the People than of the Legislature.

He has made Judges dependent on his Will alone, for the tenure of their office, and the amount and payment of their salaries.

He has erected a multitude of New Offices, and sent hither swarms of Officers to harass our people, and eat out their substance.

He has kept among us, in times of peace, Standing Armies without the Consent of our legislatures.

He has affected to render the Military independent of and superior to the Civil power.

He has combined with others to subject us to a jurisdiction foreign to our constitution, and unacknowledged by our laws; giving his Assent to their Acts of pretended Legislation:

habitants of these States:

For cutting off our Trade with all parts of the world:

For imposing Taxes on us without our Consent in many cases, of thues on us without our Consent the benefits of Trial by Jury:

For transporting us beyond Seas to be tried for pretended offences

For abolishing the free System of English Laws in a neighbouring Province, establishing therein an Arbitrary government, and enlarging its Boundaries so as to render it at once an example and fit instrument for introducing the same absolute rule into these Colonies:

For taking away our Charters, abolishing our most valuable Laws, and altering fundamentally the Forms of our Government or suspending our own Legislatures, and declaring themselves Forms of power invested with power to legislate for us in all cases whatsoever.

He has abdicated Government here, by declaring us out of his Protection and waging War against us.

He has plundered our seas, ravaged our Coasts, burnt our towns, and destroyed the lives of our people.

He is at this time transporting large Armies of foreign Mercenaries to compleat the works of death, desolation and tyranny, almost paralleled in the most barbarous ages, and totally unworthy the Head of a civilized nation.

He has constrained our fellow Citizens taken Captive on the high Seas to bear Arms against their Country, to become the executioners of their friends and Brethren, or to fall themselves by their Hands.

He has excited domestic insurrections amongst us, and has endeavoured to bring on the inhabitants of our frontiers, the merciless Indian Savages, whose usual rule of warfare, is an undistinguished destruction of all ages, sexes and conditions.

In every stage of these Oppressions We have Petitioned for Redress in the most humble terms: Our repeated Petitions have been answered only by repeated injury. A Prince whose character is thus marked by every act which may define a Tyrant, is unfit to be the ruler of a free people.

Nor have We been wanting in attention or reverence to our Brittish brethren. We have warned them from time to time of attempts by their Legislatures to extend as usual

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Nor have We been wanting in attention or sympathy to our British brethren. We have warned them from time to time of attempts by their legislature to extend an unwarrantable and oppressive jurisdiction here. We have appealed to their native justice and magnanimity, and we have conjured them by the ties of our common kindred to disavow these usurpations, which, would inevitably interrupt our connections and correspondence. They too have been deaf to the voice of justice and of consanguinity. We must, therefore, acquiesce in the necessity, which denounces our Separation, and hold them, as we hold the rest of mankind, to be Enemies.

We, therefore, the Representatives of the United States of America, in General Congress, Assembled, appealing to the Supreme Judge of the world for the rectitude of our intentions, do, in the Name, and by Authority of the good People of these Colonies, solemnly publish and declare, That these United Colonies are, and of Right ought to be Free and Independent States; that they are Absolved from all Allegiance to the British Crown, and that all political connection between them and the State of Great Britain, is and ought to be totally dissolved; and that as Free and Independent States, they have full Power to levy War, conclude Peace, contract Alliances, establish Commerce, and to do all other Acts and Things which Independent States may of right do. And for the support of this Declaration, with a firm reliance on the protection of divine Providence, we mutually pledge to each other our Lives, our Fortunes and our sacred Honor.

We have read 8120 characters from file DecOfInd.txt

We have read 1877 characters from file CommonSense.txt

parallels@ubuntu-linux-22-04-02-desktop:~/csc415/csc415-assignment-5-jjestrada2\$

```
We have read 8120 characters from file DecOfInd.txt  
We have read 1877 characters from file CommonSense.txt  
parallels@ubuntu-linux-22-04-02-desktop:~/csc415/csc415-assignment-5-
```