

Assignment 5 – Buffered I/O

Description:

This assignment involves implementing buffered I/O functions in C, specifically `b_open`, `b_read`, and `b_close`. These functions will manage file operations using a custom buffer and low-level APIs (`LBAread`, `GetFileInfo`). The objective is to efficiently handle file reading by buffering data in fixed-size chunks, ensuring correct tracking of file descriptors, buffer states, and file positions to support reading multiple files concurrently.

Approach:

1. Initialize the System: Implement the `b_init` function to initialize the file control block (FCB) array and ensure it runs only once.
2. Open a File (`b_open`): Implement `b_open` to obtain a free FCB, use `GetFileInfo` to fetch file details, and initialize the FCB's buffer, indices, and file information.
3. Read from a File (`b_read`): Implement `b_read` to handle reading data from the file into a buffer. Manage buffer states to check if data needs to be read from the file or copied from the buffer. Ensure the function reads data in fixed-size chunks and correctly handles partial reads and end-of-file scenarios.
4. Close a File (`b_close`): Implement `b_close` to free resources associated with the FCB and mark it as available.
5. Handle Edge Cases: Add checks to ensure valid file descriptors, correct block number calculations, and proper error handling for out-of-bound read requests.
6. Debug and Test: Add debug statements to trace the flow and verify correct behavior. Test with multiple files to ensure the implementation handles concurrent file operations as expected.

Issues:

Issue 1: Invalid Block Requests: Receiving system errors indicating invalid block numbers when attempting to read from the file.

Resolution: Verify the correctness of block number calculations, ensure the starting block and file size fetched by GetFileInfo are accurate, and add checks to prevent out-of-bound read requests.

Issue 1: Buffer Management: Handling the buffer states, especially when transitioning between buffered data and new reads from the file, can be complex and error-prone.

Resolution: Implement precise tracking of buffer indices, file positions, and handle partial reads properly. Ensure that the buffer is correctly filled and data is appropriately copied to the caller's buffer without overlapping or missing data.

Screen shot of compilation:

```
student@student:~/Desktop/csc415-assignment-5-buffered-io-YuvrajGupta1808$ make
gcc -c -o b_io.o b_io.c -g -I.
gcc -o Gupta_Yuvraj_HW5_main b_io.o buffer-mainM1.o -g -I.
student@student:~/Desktop/csc415-assignment-5-buffered-io-YuvrajGupta1808$
```

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

Test 1: Base Case

```
student@student:~/Desktop/csc415-assignment-5-buffered-to-YuvrajGupta1808$ make run
./[Gupta_Yuvraj]_HWS_main DATA DecOfInd.txt CommonSense.txt
The unanimous Declaration of the thirteen united States of America, When in the Course o
Perhaps the sentiments contained in the following pages, are not yet
sufficiently fa
f human events, it becomes necessary for one pe
shionable to procure them general favor; a long habit
of not thinking a thin
ople to dissolve the political bands which have connected them with another, and to ass
g wrong, gives it a superficial appearance of
being righ
tne among the powers of the earth, the separate and equal station to wh
t, and raises at first a formidable outcry in defense of
custo
ich the Laws of Nature and of Nature
m. But the tumult soon subsides. Time makes more converts than
reason.

As a long a
t to the opinions of mankind requires that they s
nd violent abuse of power, is generally the Means of calling
the r
hould declare the causes which impel them to the separation.

We hold these truths to
ight of it in question (and in Matters too which might never have
been thought of, had not the Sufferers been aggravated into the inquiry)
and as the King of England hath undertaken in his own Right, to support
the Parliament in what he calls Theirs, and as the good people of this
country are grievously oppressed by the combination, they have an undoubted
privilege to inquire into the pretensions of both, and equally to reject the
usurpation of either.

In the following sheets, the author hath studiously avoided every thing
which is personal among ourselves. Compliments as well as censure to
individuals make no part thereof. The wise, and
be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Right
s, that among these are Life, Liberty and the pursuit of Happiness.--That to secure these rights, Governments are insti
tuted among Men, deriving their just powers from the consent of the governed, --That whenever any Form of Government be
comes destructive of these ends, it is the Right of the People to alter or to abolish it, and to institute new Governe
ment, laying its foundation on such principles and organizing its powers in such form, as to them shall seem most likely
to effect their Safety and Happiness. Prudence, indeed, will dictate tha
the worthy, need not the
triumph of a pamphlet; and t
t Governments long established should not be changed for light and t
hose whose sentiments are injudicious, or
unfr
ransient causes; and accordingly all experi
iendly, will cease of themselves unless too much pains are bestowed
upon thei
ence hath shewn, that mankind are more disposed to suffer, while evils
r conversion.

The cause of America is in a great m
are sufferable, than to right themselves by abolishing the forms to which they are acc
easure the cause of all mankind. Many
circums
ustomed. But when a long train of abuses and usurpations, pursuing invar
tances hath, and will arise, which are not l
iably the same Object evinces a design to re
local, but universal, and
through which the principles of a
duce them under absolute Despotism, it is their right, it is
ll Lovers of Mankind are affected, and in
their duty, to throw off such Government, and to provide new Guards for their fut

the Event of which, their Affections are interested. The laying a Country
desolate
ure security.--Such has been the patient sufferance of these
e with Fire and Sword, declaring War against the natural rights of all
Mankind, and ext
Colonies; and such is now the necessity whi
irrating the Defenders thereof from the Face of the Earth,
ch constrains them to alter their former Systems of Government. The history of t

is the Concern of every Man to whom Nature hat
he present King of Great Britain is a history of repeat
h given the Power of feeling;
of which Class, regardless of Party Censure, is the

AU
ed injuries and usurpations, all having in
THOR
direct object the establishment of an absolute Tyranny over these States. To prove this
, let Facts be submitted to a candid wor
ld.

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

He has forbidden his Governors to pass L
aws of immediate and pressing importance, unless suspended in their operation ti
ll his Assent should be obtained; and when so suspended, he has u
tterly neglected to attend to them.

He has r
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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.

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 elected; 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 made Judges dependent on his Will alone, for the tenure of their offices, 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:

For Quartering large bodies of armed troops among us:

For protecting them, by a mock Trial, from punishment for any Murders which they should commit on the Inhabitants of these States:

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

For imposing Taxes on us without our Consent:

For depriving us in many cases, of 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 Governments:

For suspending our own Legislatures, and declaring themselves 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, already begun with circumstances of Cruelty & perfidy scarcely paralleled in the most barbarous ages, and totally unworthy the Head of a civilized nation.

He has constrained our fellow Citizens taken Captive on t

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

I
n 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 attentions to our Brittish brethren. We have warned them from time to time of attempts by their legislature to extend an unwarrantable jurisdiction over us. We have reminded them of the circumstances of our emigration and settlement 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, Enemies in War, in Peace Friends.

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

student@student:~/Desktop/csc415-assignment-5-buffered-io-YuvrajGupta1808\$ █