

Description:

This C program improves file reading by using a buffered I/O system. It uses a file control block (FCB) to keep track of open files and their data. The program helps read files more efficiently by using a temporary storage space called a buffer. This buffer holds parts of the file, reducing the number of operations needed to access the file data. The program manages opening, reading, and closing files while ensuring users don't request more data than the file contains.

Approach/What I did:

Note: I prefer the camelCase style more, but in this assignment, I switched to snake_case since the README mentioned snake case style functions, and the skeleton I was provided had more snake case style. Thus, I used snake_case for better reading and consistency in this project.

First, I read the instructions multiple times and checked the provided template. I made notes on what was needed and then followed the instructions. Whenever I didn't understand something, I read the official libraries to learn more. Most of the time, I was reading and taking memos:

Implement functions in `b_io.c`:

1. `b_io_fd b_open(char *filename, int flags)`
2. `int b_read(b_io_fd fd, char *buffer, int count)`
3. `int b_close(b_io_fd fd)`

Use only the provided low-level APIs, i.e., `LBAread` and `GetFileInfo`.

`b_open` function:

- Returns an integer file descriptor for tracking the file.
- Allocates a 512-byte buffer (`B_CHUNK_SIZE`) for read operations.
- Calls `GetFileInfo` to find the file size and location.
- If the file is not found, `GetFileInfo` returns `NULL`.

`b_read` function:

- Reads `B_CHUNK_SIZE` byte chunks at a time from `LBAread` into your buffer.
- Copies the appropriate bytes from your buffer to the caller's buffer (as binary data).
- Handles read requests greater than `B_CHUNK_SIZE`.
- Keeps track of the file size and indicates when the end of the file is reached (returns 0).
- Returns the number of bytes transferred to the caller's buffer.

`b_close` function:

- Frees any resources being used.

Purpose and logic:

`char *buffer` in the `b_fcb` struct provides storage for the buffer used for the file, which allows for efficient read operations.

int buf_idx to the b_fcb struct stores the index into the buffer where data can be read from. This allows for efficient tracking of the location of the next byte to read from the buffer.

int block_num to the b_fcb struct stores the current block number of the file being read. This allows for efficient tracking of the current position in the file.

get_current_gpos function calculates the current get position of a file descriptor based on its buffer index and block number. This allows the code to keep track of where it is in the file, even if it has to read data in chunks.

copy_available_bytes function copies the minimum of count and available bytes to the destination using a given file descriptor. This allows for efficient reads of the file, copying data from the buffer to the user's buffer as required.

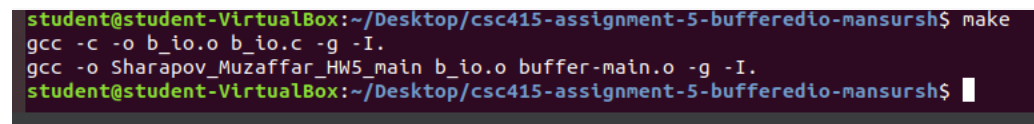
b_open allocates a buffer for the file and stores the buffer index and block number as -1 to indicate that the buffer is empty and no read operation has been called yet. This allows for efficient read operations later.

b_read reads the file in chunks of B_CHUNK_SIZE bytes and buffers the data in the FCB buffer. The function first reads directly into the user's buffer if the requested count is greater than B_CHUNK_SIZE. Then, it reads the file chunk by chunk, copying data from the buffer to the user's buffer using copy_available_bytes. It also keeps track of the current block number and buffer index in the FCB to allow for efficient reads.

b_close frees the buffer allocated for the file and resets the block_num, buf_idx, and fi fields of the FCB. This ensures that any allocated memory is properly freed and the FCB is ready for use with another file.

Analysis

Screen shot of compilation of the program:



```
student@student-VirtualBox:~/Desktop/csc415-assignment-5-bufferedio-mansursh$ make
gcc -c -o b_io.o b_io.c -g -I.
gcc -o Sharapov_Muzaffar_HW5_main b_io.o buffer-main.o -g -I.
student@student-VirtualBox:~/Desktop/csc415-assignment-5-bufferedio-mansursh$
```

Screen shot of compilation and the execution of the program:

```
student@student-VirtualBox:~/Desktop/csc415-assignment-5-buffered-io-mansursh$ make run
./Sharapov_Muzaffar_HW5_main DATA DecOfInd.txt CommonSense.txt
I say to you today, my friends, that in spite of the d
I say to you today, my friends, that in spite of the difficulties and frustrations
ifficulties and frustrations of the moment,
of the moment, I still have a dream. It is a dream deeply rooted in the American dre
I still have a dream. It is a dream deeply rooted in the American dream.
I h
an.
I have a dream that one day this nation will rise up and live out the tr
ave a dream that one day this nation will rise up
ue meaning of its creed: "We hold these truths to be self-evident:
and live out the true meaning of its creed: "We hold these truths
that all men are created equal."
I have
to be self-evident: that all men are created equal."
I have a dream that o
a dream that one day on the red hills of Georgia the sons of former slaves and
ne day on the red hills of Georgia the sons of former slaves and the sons of form
brotherhood.
I have a dream that one day even the state of Mississippi, a desert state, sweltering with the heat of injustice and oppression, will be transformed into an oasis of freedom and justice.
I have a dream that my four children will one day live in a nation where they will not be judged by the color of their skin but by the content of their character.
I have a dream today.
I have a dream that one day the state of Alabama, whose governor's lips are presently dripping with the words of interpositi the sons of former slave-owners will be able to sit down together at
a table ofon and nullification, will be transformed into a situation where little black boys and black gi
brotherhood.
I have a dream that one day even the state of Mississippi, a desert state, sweltering with the heat of injustice and oppression, will be transformed into an oasis of freedom and justice.
I have a dream that my four children will one day live in a nation where they will not be judged by the color of their skin but by the content of their character.
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nullification, will be transformed into a situation where little black boys and black girls will be able to
rls will be able to join hands with little white boys and white girls a
join hands with little white boys and white girls and walk together as sisters and br
nd walk together as sisters and brothers.
I have a dream today.
I have a drea
others.
I have a dream today.
I have a dr
m that one day every valley shall be exalted, every hill and mountain shall be made low
eam that one day every valley shall be exalted, every hill and mountain shal
, the rough places will be made plain, and the crooked places will be made straight
l be made low, the rough places will be made plain, and the crooke
, and the glory of the Lord shall be revealed, and all flesh shall se
d places will be made straight, and the glory of the Lo
e it together.
```

```
File Edit View Search Terminal Help
e it together.

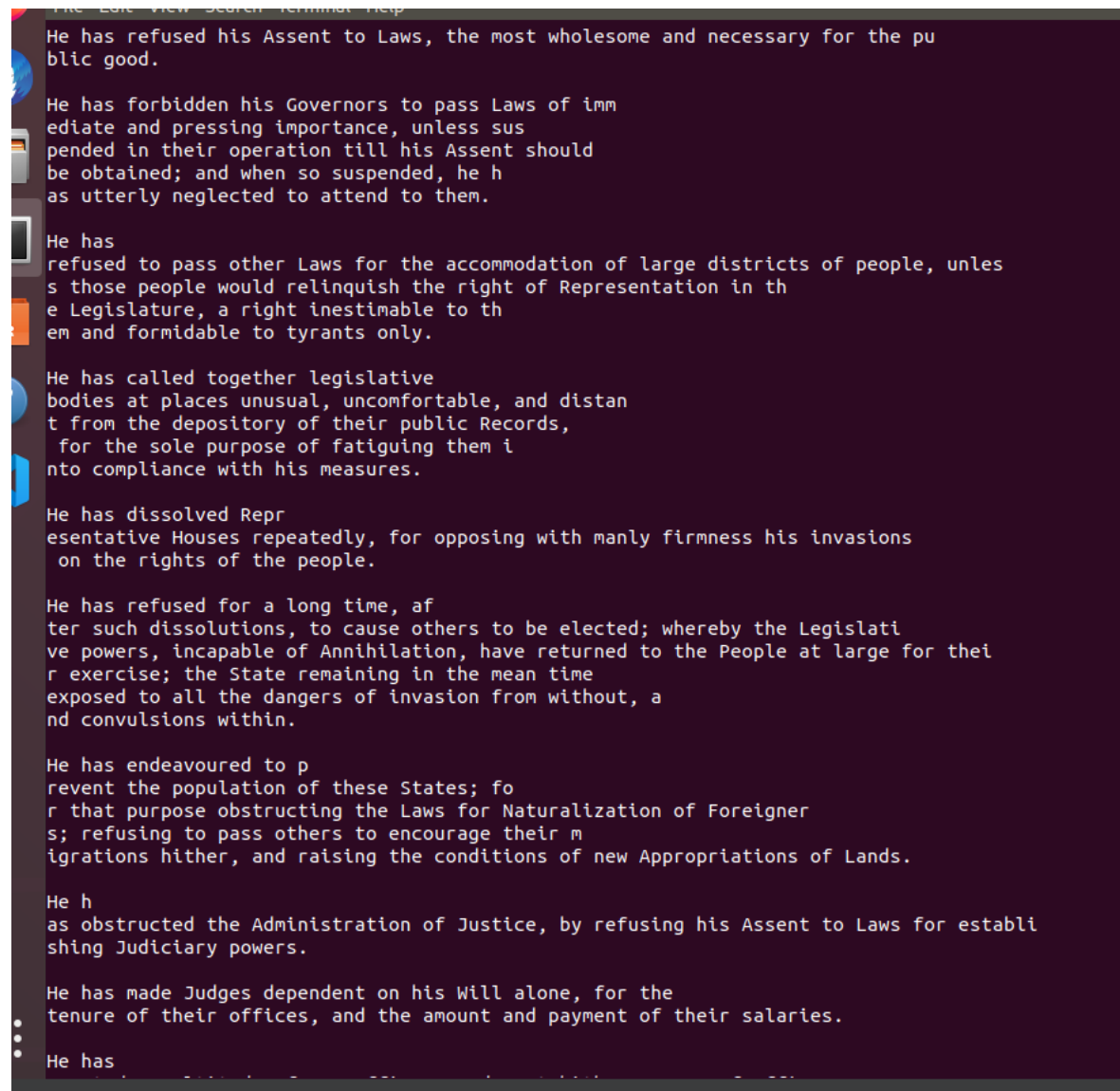
rd shall be revealed, and all flesh shall see it together.

hirteen united States of America, When in the Course o

f human events, it becomes necessary for one people to
hen in the Course of human events, it becomes neces
dissolve the political bands which have connected them with another, and to assume among
sary for one people to dissolve the political
the powers of the earth, the separate and equal statio
bands which have connected them with another, and to assume among the powers of th
n to which the Laws of Nature and of Nature's God entit
e earth, the separate and equal station to which the Laws of Natu
re and of Nature's God entitle them, a decent respect to the opinions of mankind requi
res that they should declare the causes whi
ch impel them to the separation.

We hold these truths to be self-evident, that
all men are created equal, that they are endowed by the
ir Creator with certain unalienable Rights, that among these are Life, Liberty and the pu
rsuit of Happiness.--That to secure these rights, Governments are instituted a
mong Men, deriving their just powers from the consent of the governed,
--That whenever any Form of Government becomes destructi
ve of these ends, it is the Right of the People to alter or to abo
lish it, and to institute new Government, la
ying its foundation on such principles and organizing its po
wers in such form, as to them shall seem most likely to effect their Safety and Happi
ness. Prudence, indeed, will dictate that Governments long established shou
ld not be changed for light and transient causes; and accordi
ngly all experience hath shewn, that mankind are more disposed to suffer, while evi
ls are sufferable, than to right themselv
es by abolishing the forms to which they are accustomed. But wh
en a long train of abuses and usurpations, pursuing invariably the same Object evin
ces a design to reduce them under absolute Despotism, it is their right, it is their dut
y, to throw off such Government, and to provide new G
uards for their future security.--Such has been the patient sufferance of these Co
lonies; 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 a
nd usurpations, all having in direct object the establish
ment of an absolute Tyranny over these Sta
tes. To prove this, let Facts be submitted to a candid wo
rld.

He has refused his Assent to Laws, the most wholesome and necessary for the pu
```



```
He is at this time transporting large  
Armies of foreign Mercenaries to compleat the works of death, desolation and tyrann  
ny, already begun with circumstances of Cru  
uelty & perfidy scarcely paralleled in the most barbarous ages, and totally unworthy the  
Head of a civilized nation.  
  
He has constrained our fellow Citizens  
s 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 known 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 attentions to our British brethren. We have warned them from time to time of attempts by the  
e  
We have read 8120 characters from file DecOfInd.txt  
We have read 1877 characters from file CommonSense.txt  
student@student-VirtualBox:~/Desktop/csc415-assignment-5-bufferedio-mansursh$
```