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CSC415 Operating Systems

Assignment 5 – Buffered I/O

Description:
This project involves creating efficient buffered I/O functions in C to read data from files. Through this assignment to learn how to optimize file reading, manage multiple files, and handle end-of-file situations correctly. Using low-level APIs and ensure that the buffered I/O operations are performed efficiently.

Approach:
To ensure a thorough understanding of the existing structure and the functions that require implementation, I plan on carefully reviewing the provided skeleton code (`b_io.c`).

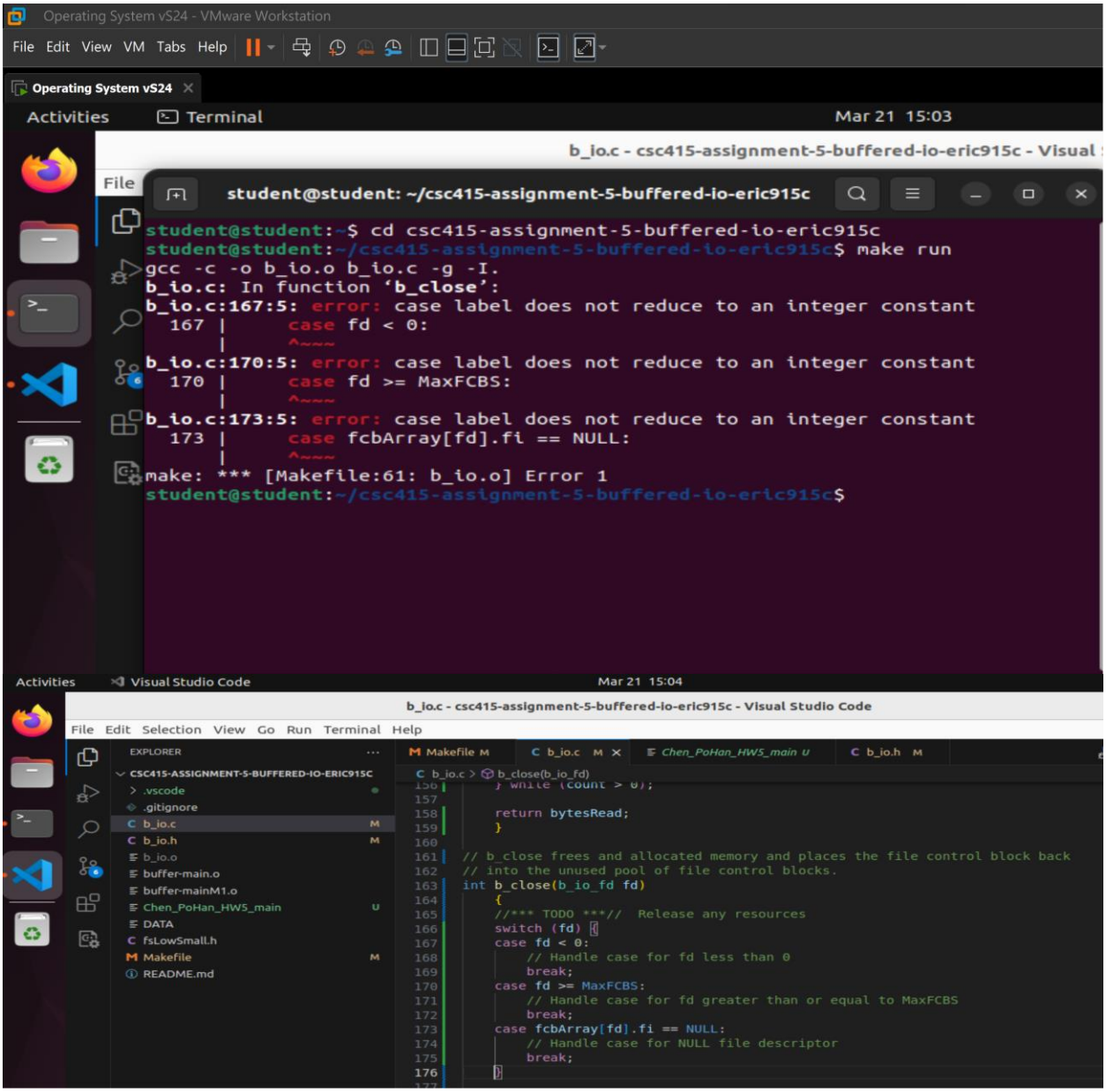
The 'b_open' function starts by allocating a file descriptor and initializing the file control block (FCB) for the opened file. To retrieve file information and allocate a buffer of 'B_CHUNK_SIZE' bytes if necessary, the function uses the 'GetFileInfo' function. After obtaining file information, 'b_open()' uses the 'b_getFCB()' function to get a free file descriptor from the system. If there are no free descriptors available or the obtained descriptor exceeds the maximum allowable limit ('MaxFCBS'), the function returns an error code indicating that it is unable to open the file. Assuming that a valid file descriptor is obtained, the function associates the retrieved file information with the corresponding FCB, initializing its position to the beginning of the file.

The `b_read` function is the second part of the process. It uses `LBAread` to read data in chunks of `B_CHUNK_SIZE` and buffer it. The data is then copied to the caller's buffer while keeping track of the position in both the buffer and the file. To ensure proper handling of end-of-file conditions, the function `b_read` keeps track of the position in the buffer and file, ensuring a smooth transfer to the caller's buffer. This tracking mechanism allows for accurate management of data retrieval, ensuring that the correct parts of the file are read and transferred to the caller's buffer.

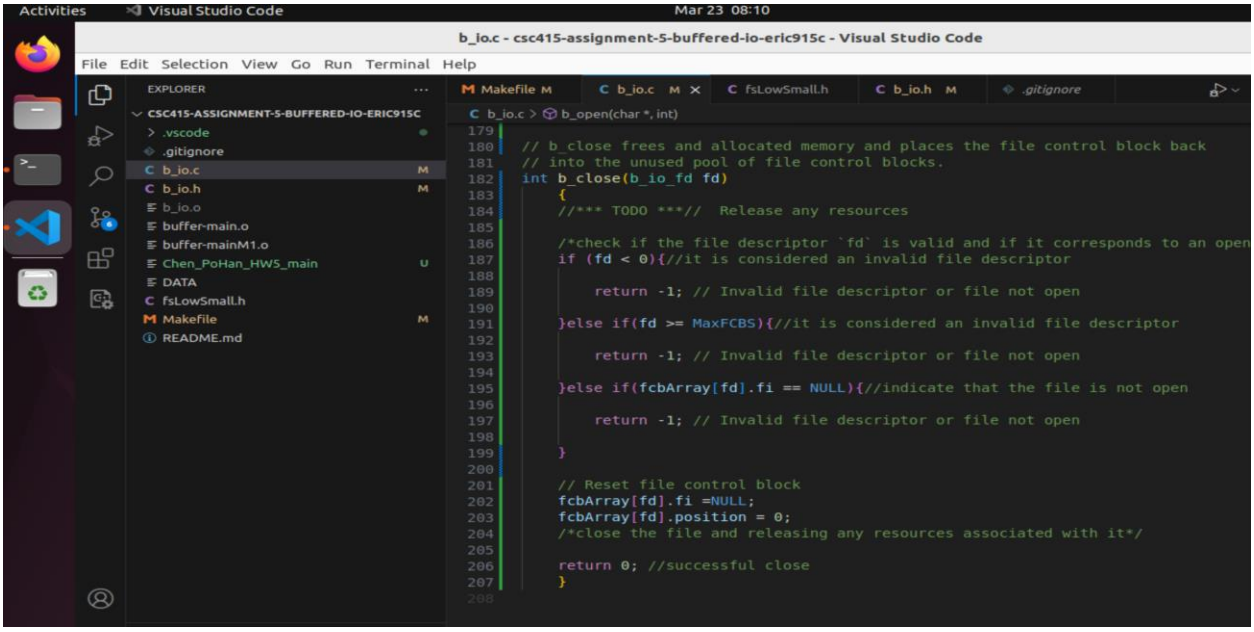
The `b_close()` function is responsible for releasing the resources associated with an archive. It checks for invalid archive descriptors and resets FCB. When `b_close()` is invoked, it starts by verifying the validity of the provided file descriptor. It performs a thorough check to ensure that the descriptor falls within the valid range and corresponds to an open file. This step is necessary to prevent errors and ensure system stability. Once the file descriptor is confirmed valid, `b_close()` proceeds to release the resources associated with the file. This includes deallocating any memory buffers or resources that were allocated during file operations. By releasing these resources, the function ensures efficient memory management and prevents memory leaks.

Issues and Resolutions:

My first issue was error in `b_close()` function: "case label does not reduce to an integer constant" when using a `switch` statement.

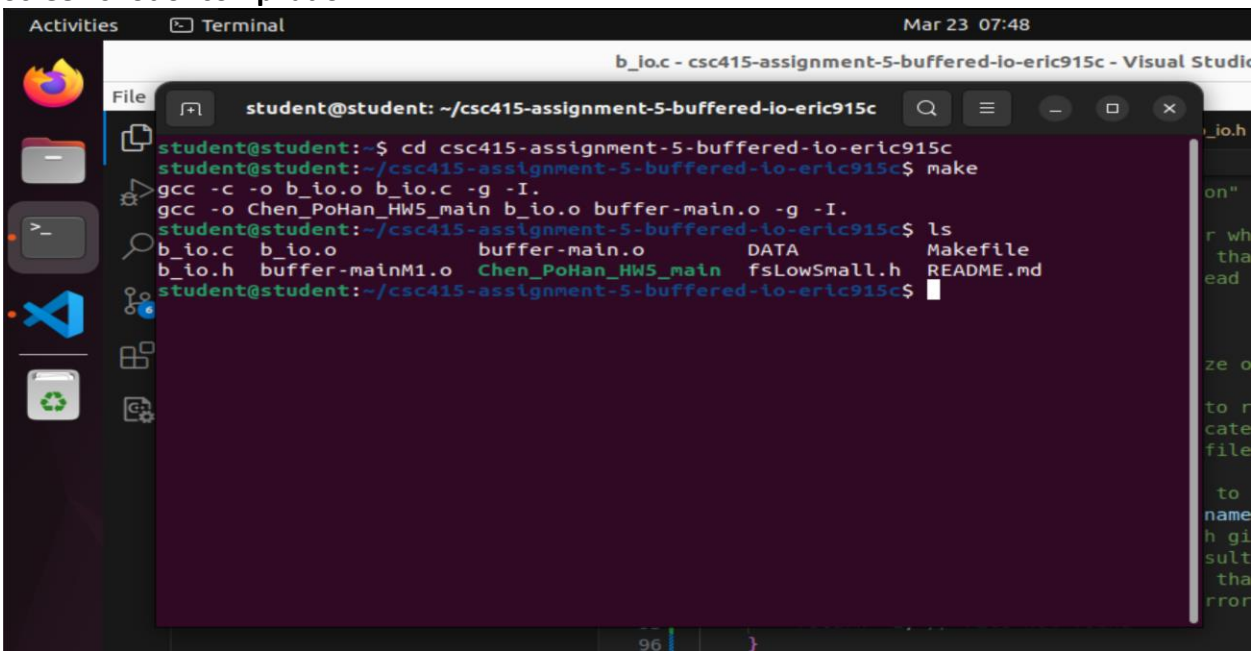


I resolved it by checking the `case` labels of the `switch` statement do not reduce to constant integer values, which is a requirement in C. To resolve this, I modified the `b_close()` function to use `if-else` statements instead of a `switch` statement for handling different cases based on the value of `fd`.

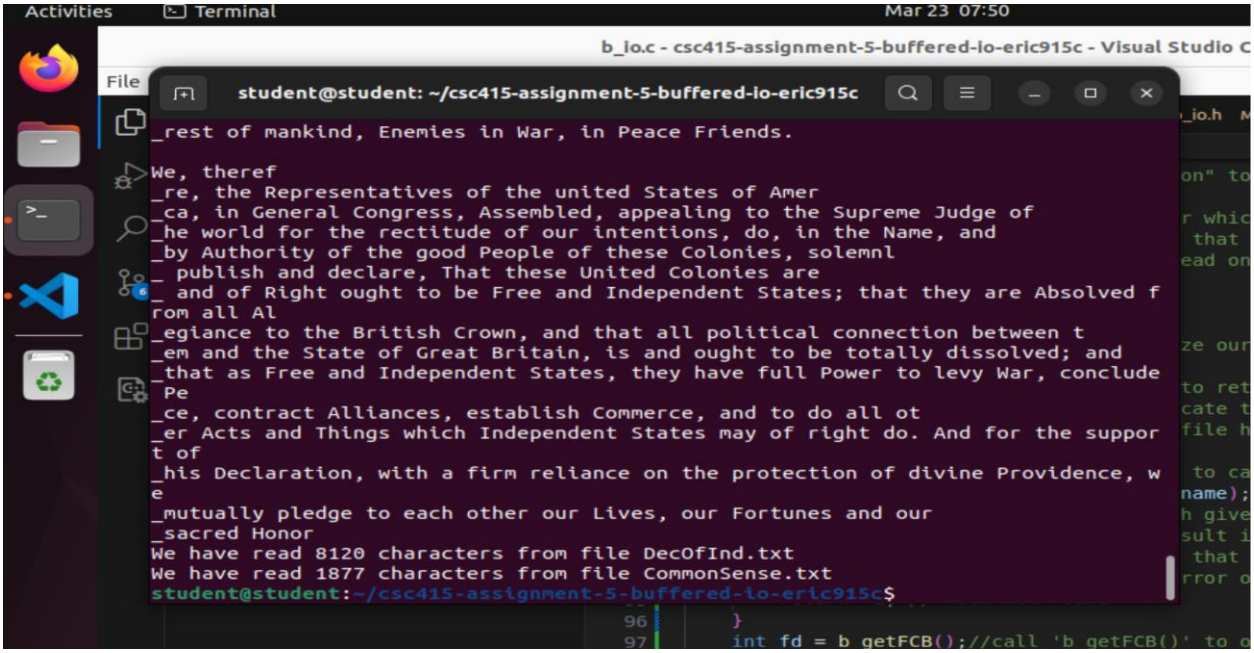


Analysis: (If required for the assignment)

Screen shot of compilation:



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


Activities
Terminal
Mar 23 07:50
b_io.c - csc415-assignment-5-buffered-io-eric915c - Visual Studio C
File
student@student: ~/csc415-assignment-5-buffered-io-eric915c
_rest of mankind, Enemies in War, in Peace Friends.
We, theref
_re, the Representatives of the united States of Amer
_ca, in General Congress, Assembled, appealing to the Supreme Judge of
_he world for the rectitude of our intentions, do, in the Name, and
_by Authority of the good People of these Colonies, solemnl
_ publish and declare, That these United Colonies are
_ and of Right ought to be Free and Independent States; that they are Absolved f
rom all Al
_egiance to the British Crown, and that all political connection between t
_em 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
Pe
_ce, contract Alliances, establish Commerce, and to do all ot
_er Acts and Things which Independent States may of right do. And for the suppor
t of
_his Declaration, with a firm reliance on the protection of divine Providence, w
e
_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:~/csc415-assignment-5-buffered-io-eric915c$
}
int fd = b_getFCB();//call 'b_getFCB()' to o