

Assignment 5 – Buffered I/O

Description:

For this assignment, we focused on implementing buffered I/O operations in C. The main objectives were understanding advanced buffering techniques, tracking information for multiple files, and understanding low-level file functionality. The aim was to prepare for more complex file system projects by mastering the handling of end-of-file conditions, memory management, and understanding existing code. The task required creating functions to open, read, and close files, with careful attention to buffering and tracking file states. This assignment was designed to improve our understanding of low-level file operations and develop efficient memory management and file handling skills.

Approach:

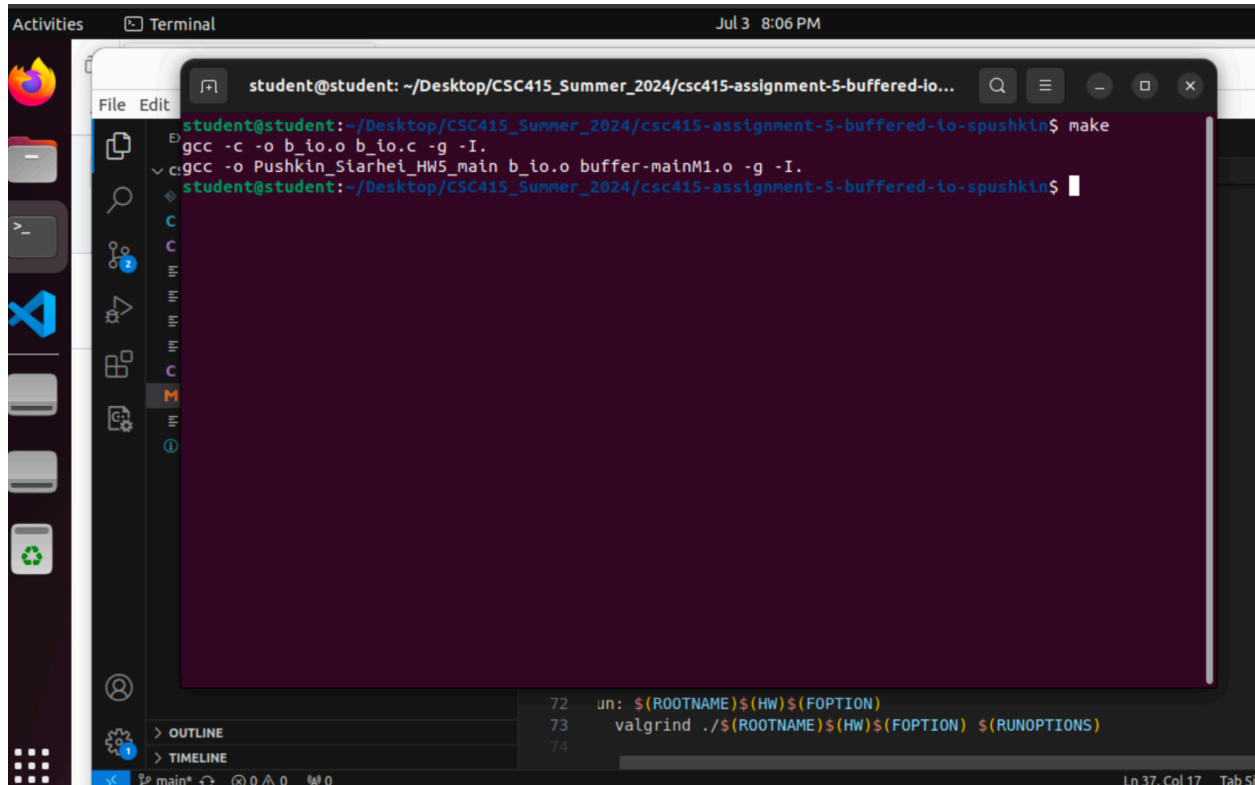
While working on this assignment, I implemented buffered I/O operations in C, prioritizing efficient file reading with fixed-size buffers. I began by thoroughly understanding the requirements and constraints, then examined the provided skeleton code to comprehend the program's structure and expected behavior. This initial analysis allowed me to grasp the assignment thoroughly and modify the provided code as needed. As required, I created three functions: `b_open`, `b_read`, and `b_close` in the `b_io.c` file, using the supplied low-level APIs (`LBaread` and `GetFileInfo`). I first implemented the `b_open` function, which entailed allocating a buffer for each open file and setting up the file descriptor and other necessary information. I used an array of structures to handle multiple open files, with each element representing a file's state. This method enabled me to keep track of each file's buffer, file descriptor, and other details separately, ensuring that file operations did not interfere. For the `b_read` function, I focused on reading data from the file into the buffer and transferring it to the caller's buffer in chunks of `B_CHUNK_SIZE` (512). I carefully managed scenarios where the requested read size exceeded the buffer size, ensuring accurate data reading and transfer. I also implemented logic to handle end-of-file conditions and track the remaining bytes to be read. In the `b_close` function, I ensured the proper release of all resources associated with the file, including freeing buffer memory and resetting the file state. Throughout the implementation, I tried to pay close attention to memory management to prevent memory leaks and ensure efficient resource utilization.

Issues and Resolutions:

One significant challenge I faced was proper management of the buffer during read operations to ensure seamless data transfer to the caller's buffer during read operations. This involved handling situations where the buffer was not completely filled or when the end of the file was reached. To address this, I carefully monitored the buffer's state, offset, and the number of bytes left to read, ensuring accurate data transfer and proper management of end-of-file scenarios. By overcoming these issues, I ensured the reliability of the read operations and

enhanced the program's overall stability. Overall, this assignment significantly improved my knowledge of buffering strategies, file operations, and efficient memory management in C, providing valuable insights into low-level I/O handling and careful resource management.

Screen shot of compilation:



The screenshot shows a terminal window titled "student@student: ~/Desktop/CSC415_Summer_2024/csc415-assignment-5-buffered-io...". The terminal output shows the execution of the 'make' command, which runs two 'gcc' commands to compile the program. The first command is 'gcc -c -o b_io.o b_io.c -g -I.' and the second is 'gcc -o Pushkin_Siarhei_HW5_main b_io.o buffer-mainM1.o -g -I.'. The terminal window is part of a larger application with a sidebar on the left containing icons for file manager, terminal, and other tools. The bottom of the terminal window shows a status bar with the text 'Ln 37, Col 17, Tab S'.

```
student@student: ~/Desktop/CSC415_Summer_2024/csc415-assignment-5-buffered-io...  
student@student:~/Desktop/CSC415_Summer_2024/csc415-assignment-5-buffered-io-spushkin$ make  
gcc -c -o b_io.o b_io.c -g -I.  
gcc -o Pushkin_Siarhei_HW5_main b_io.o buffer-mainM1.o -g -I.  
student@student:~/Desktop/CSC415_Summer_2024/csc415-assignment-5-buffered-io-spushkin$
```

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

```
student@student:~/Desktop/CSC415_Summer_2024/csc415-assignment-5-buffered-io-...  
s. 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 co  
rrespondence. They too have been deaf to the voice of justice and of consanguinity. We mus  
t, therefore, acquiesce in the necessity, which den  
ounces our Separation, and hold them, as we hold the rest of mankind, Enemies in Wa  
r, in Peace Friends.  
  
We, therefore, the Represe  
ntatives 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 Nam  
e, and by Authority of the good People of these C  
olonies, solemnly publish and declare, That these United Colonies are, and of Rig  
ht ought to be Free and Independent States; that they are Absolved from all Al  
legiance to the British Crown, and that all political connection betwe  
en 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 Commerc  
e, and to do all other Acts and Things which Independent States may of rig  
ht do. And for the support of this Declaration, with a fir  
m reliance on the protection of divine Providence, we m  
utually 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_Summer_2024/csc415-assignment-5-buffered-io-spushkin$  
72 un: $(ROOTNAME)$(HW)$(FOPTION)  
73 un: $(ROOTNAME)$(HW)$(FOPTION) $(RUNOPTIONS)
```