Assignment4

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File Systems

Environment of running my program

Operating system: Windows 11

IDE: Visual Studio 2022

CUDA Version: 11.8

GPU Information: Nvidia GeForce GTX 1050

HPC environment

Operating system: CENTOS-7

CUDA verison: 11.7

GPU information: Nvidia Quadro RTX 4000

Steps to excecute my program

The following are the steps to execute the program:

1. Go to root directory
2. Run sbatch ./slurm.sh

How did I design my program

From the virtual memory specification given, we can calculate that page offset needs 5 bits, physical page number needs 10 bits, and virtual page number needs 13 bits.

Super Block

The super block is a bitmap to track current used space and free space. Each bit in the super block indicates whether the corresponding 32k block in the contents of files.

File Control Block Design

Each FCB entry contains information of one file and each of them is of size 32 bytes. Each FCB contains file name (first 20 bytes), block index indicating the starting block for the file (next 2 bytes), file size (next 2 bytes), file creation time (next 4 bytes), file modification time (last 4 bytes).

fs_open

1. Given a file name, search for the FCB location.
2. If the mode is read, it will return the FCB with specified file name. If no such file is found, it will signal an error.
3. If the mode is write, it will create a new file at the first free FCB. If no free FCB is found, it will signal an error. If the file is found or created, it will return the corresponding FCB index.

fs_read

1. Check if all arguments are valid.
2. Read the file contents into the output buffer.

fs_write

1. Check if all arguments are valid.
2. Write the input into the file. Then the bitmap in super block and the modification time of corresponding tile are updated.

fs_gsys LS_D LS_S

Accoding to the passes option, use selection sort to sort all FCB in orders, and then display the results by file names.

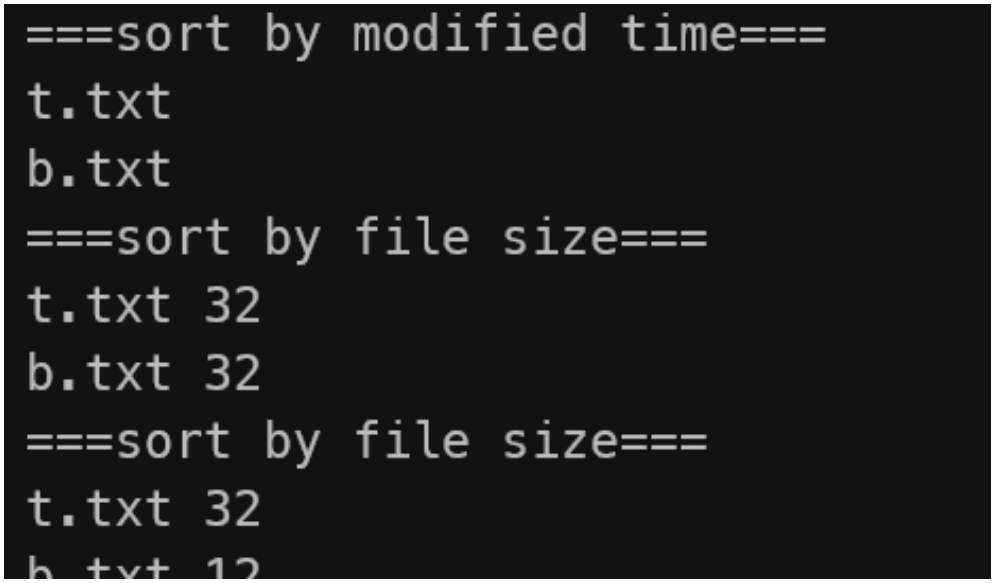
fs_gsys rm

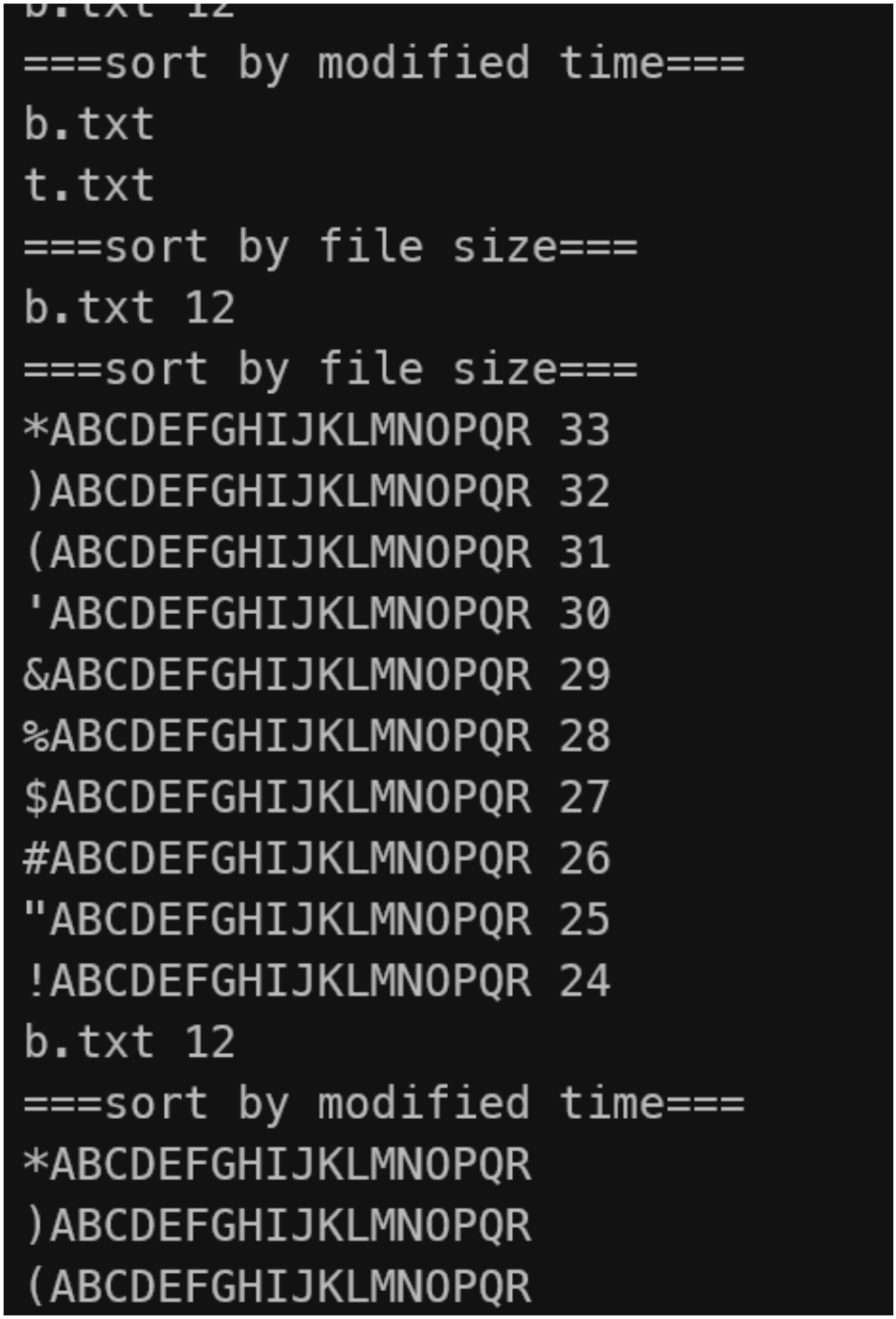
The target file is removed by cleaning the corresponding bit in the bitmap, and also set the corresponding file name to empty string.

Problems I met

I met the problem of how to design the file control block with efficient space usage. I figured out the solution of allocating metadata including name, size, creation time, and modification time, and extract each field using bit-wise operations when necessary.

Screenshot of my program output





What did I learn from the tasks

In this task, I learned the following knowledge:

1. I learned the basic structure and got better understanding of file systems through implementation.
2. I learned how to do contiguous allocation.
3. I also learned some basic knowledge about cuda programming like declaring variables and functions in different positions using *device* and *host* .