Name: Mayesha Bintha Mizan
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The EXT-like file system simulator is designed with a focus on modularity, utilizing the pre-defined APIs for interaction with the inode, inode map, block map, and disk blocks. The project is split into two main parts: file operations and directory operations.

File System Layout

Superblock: Contains metadata about the file system, such as the number of available inodes and data blocks, and root directory information. The superblock is crucial for maintaining the overall health of the filesystem.

Inode Management: Each file and directory is represented by an inode, which stores metadata and pointers to data blocks. We use 15 direct blocks and 1 single-indirect block per inode to manage up to 73,216 bytes per file.

Directory Structure: The directory is structured hierarchically, with each directory having a maximum of 25 entries. The first two entries are always the current (.) and parent (..) directories, simplifying navigation and providing efficient path resolution.

Part 1: File Operations

Implemented in file.c. Each command (cat, cp, rm, ln, create, stat) was designed to leverage the existing inode and block management APIs to ensure efficient and correct access to file data.

- **create <name> <size>:** Creates a new file named <name> of specified <size> filled with random characters. Tested creating files of different sizes, ranging from small files (1 KB) to the maximum allowed size (73,216 bytes). Verified that the correct number of blocks was allocated, both direct and indirect blocks. Random content is generated and written to the allocated blocks. The file entry is added to the current directory.

- **cat <name>:** Prints the contents of the file named <name>. Tested reading file content using cat. Verified that the content matched what was written during creation. The inode information is accessed to determine the number of blocks to read.

- **cp <src> <dest>:** Copies the file <src> to <dest> within the current directory. A new inode is allocated, and the metadata from the source inode is copied to the new inode. Tested copying files within the current directory, ensuring that the content and inode data were duplicated correctly. Copied files of different sizes and verified using cat and stat commands to check the contents and metadata.

- **rm <name>:** Deletes the file named <name>. Ensure that during file remove if it has hard link it will only remove the reference and data associated with the file is only removed when the last hard link to the file is deleted. Tested deleting files to ensure that inodes and data blocks were freed properly. If the file has multiple hard links, only the directory entry is removed, and the link count in the inode is decreased.

- **ln <src> <dest>:** Creates a hard link to the file <src> named <dest> in the current directory. Created a hard link for an existing file, verified using stat that the link count was incremented and inode remained the same. This allows multiple directory entries to point to the same file content without duplicating data.

- **stat <name>:** Displays the inode information of the file or directory named <name>. we Created files and directories, then used stat to confirm their properties. This includes the inode number, file type, size, link count, and number of blocks allocated.

Part 2: Directory Operations

Implemented in directory.c. Directory entries are managed in a single disk block of 512 bytes. Care was taken to ensure that changes to the current directory (curDir) are consistent and accurately reflect user commands.

- **mkdir <name>:** The mkdir command is implemented to create a new sub-directory in the current directory. A new inode is allocated for the directory, and a data block is reserved to store directory entries. Ensured that for sub-directory there will be at least 2 entries for own and its parent directory and they are assigned with proper inode. The new directory is added to the current directory's list of entries.

- **rmdir <name>:** The rmdir command removes an empty sub-directory. Before deletion, the command checks if the directory contains any entries beyond . and .. If the directory is empty, its inode and data block are freed, and the entry is removed from the parent directory. Ensured that during directory remove all sub-directories of that directory should be also removed. Non-empty directories cannot be removed, ensuring data consistency and preventing accidental data loss.

- **cd <name>:** Changes the current working directory to <name>. The command reads the inode of the target directory and updates the current directory context. Special entries . and .. are handled to allow for easy navigation to the current or parent directory. Ensured that during directory change current directories info should be saved in the block and after that current directory should be changed.

- **ls:** Lists the contents of the current directory. The command iterates through the directory's entries and reads the corresponding inodes to gather metadata for display.

Ensured that whenever asking for get free node/block we should check superblock free count. Ensured that directory should not be able to remove ownself or parent. A limitation is user cannot do anything in another directory other than current one.

Testing:

For both Part 1 (file operations) and Part 2 (directory operations), we conducted extensive testing using various inputs to ensure all implemented functionalities worked as expected. We created, copied, deleted, linked, and listed files and directories with different sizes, structures, and conditions. Here are the screenshots:

Name: Mayesha Bintha Mizan
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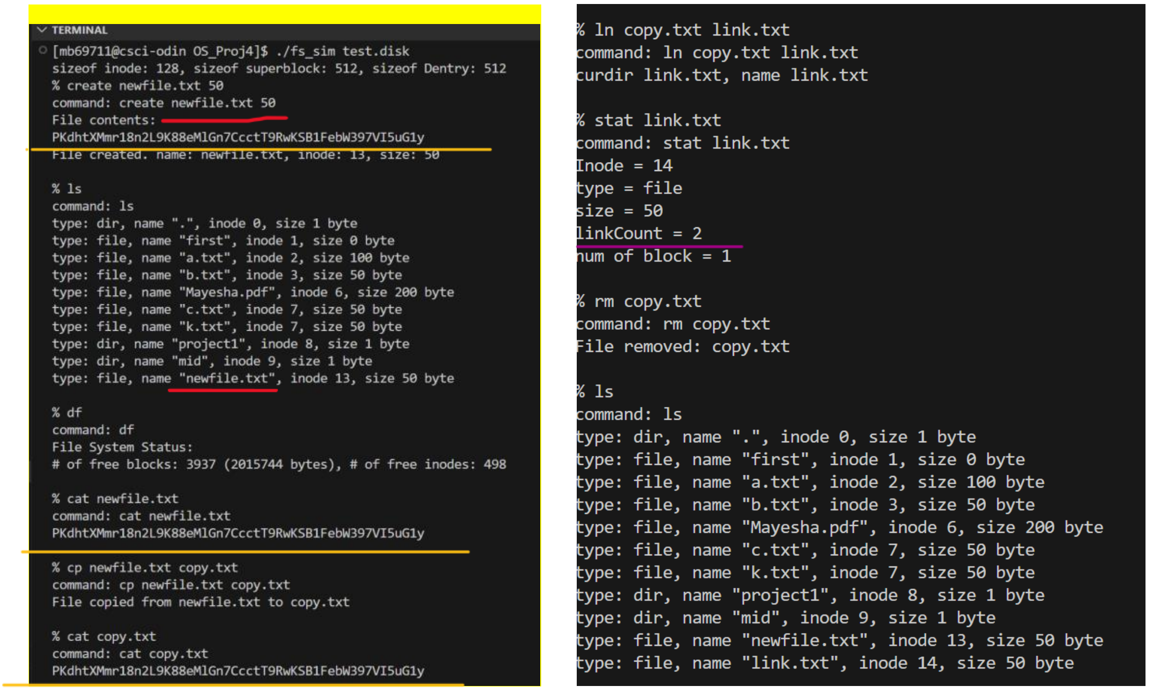


```
TERMINAL
[mb69711@csci-odin OS_Proj4]$ ./fs_sim test.disk
sizeof inode: 128, sizeof superblock: 512, sizeof Dentry: 512
% create newfile.txt 50
command: create newfile.txt 50
File contents:
PKdhtXMmr18n2L9K88eMlGn7CcctT9RwKSB1FebW397VI5uG1y
File created. name: newfile.txt, inode: 13, size: 50

% ls
command: ls
type: dir, name ".", inode 0, size 1 byte
type: file, name "first", inode 1, size 0 byte
type: file, name "a.txt", inode 2, size 100 byte
type: file, name "b.txt", inode 3, size 50 byte
type: file, name "Mayesha.pdf", inode 6, size 200 byte
type: file, name "c.txt", inode 7, size 50 byte
type: file, name "k.txt", inode 7, size 50 byte
type: dir, name "project1", inode 8, size 1 byte
type: dir, name "mid", inode 9, size 1 byte
type: file, name "newfile.txt", inode 13, size 50 byte

% df
command: df
File System Status:
# of free blocks: 3937 (2015744 bytes), # of free inodes: 498

% cat newfile.txt
command: cat newfile.txt
PKdhtXMmr18n2L9K88eMlGn7CcctT9RwKSB1FebW397VI5uG1y

% cp newfile.txt copy.txt
command: cp newfile.txt copy.txt
File copied from newfile.txt to copy.txt

% cat copy.txt
command: cat copy.txt
PKdhtXMmr18n2L9K88eMlGn7CcctT9RwKSB1FebW397VI5uG1y
```

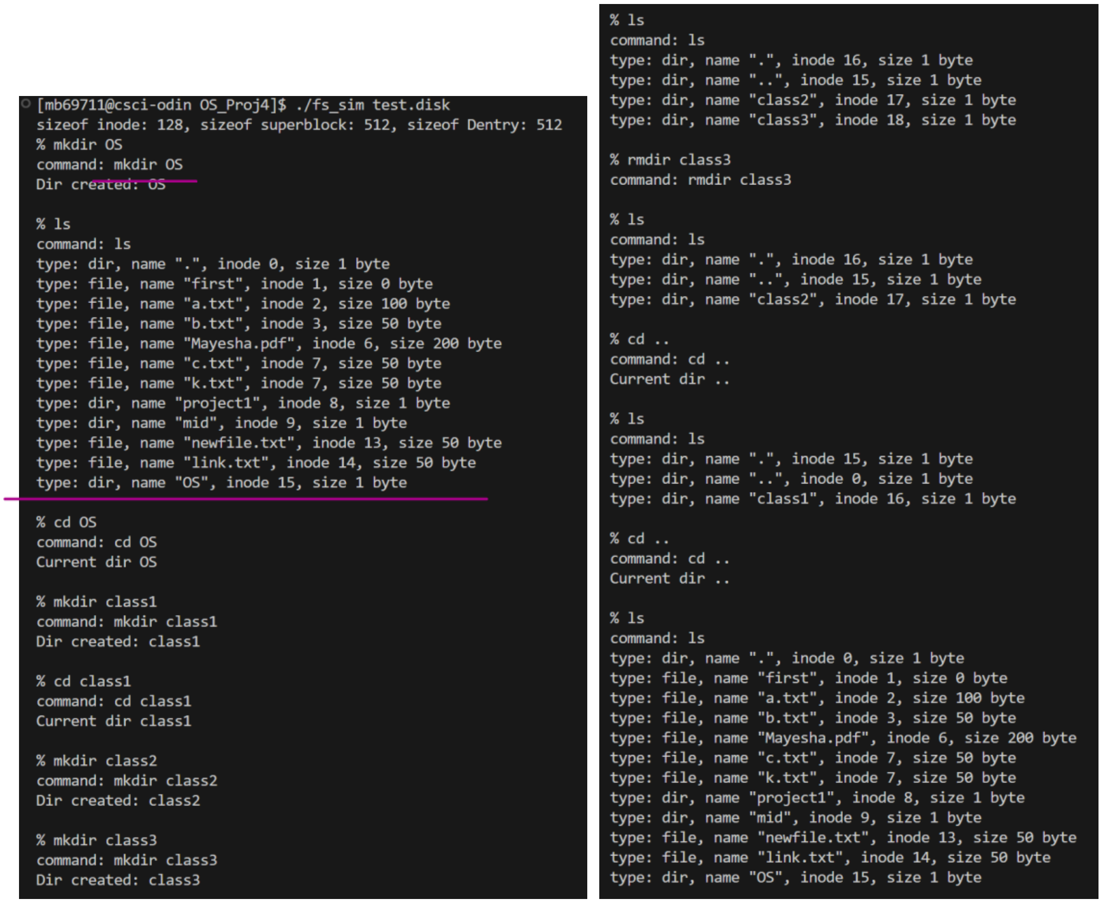
```
% ln copy.txt link.txt
command: ln copy.txt link.txt
curdir link.txt, name link.txt

% stat link.txt
command: stat link.txt
Inode = 14
type = file
size = 50
linkCount = 2
num of block = 1

% rm copy.txt
command: rm copy.txt
File removed: copy.txt

% ls
command: ls
type: dir, name ".", inode 0, size 1 byte
type: file, name "first", inode 1, size 0 byte
type: file, name "a.txt", inode 2, size 100 byte
type: file, name "b.txt", inode 3, size 50 byte
type: file, name "Mayesha.pdf", inode 6, size 200 byte
type: file, name "c.txt", inode 7, size 50 byte
type: file, name "k.txt", inode 7, size 50 byte
type: dir, name "project1", inode 8, size 1 byte
type: dir, name "mid", inode 9, size 1 byte
type: file, name "newfile.txt", inode 13, size 50 byte
type: file, name "link.txt", inode 14, size 50 byte
```

Figure-1: Part-1 testing



```
[mb69711@csci-odin OS_Proj4]$ ./fs_sim test.disk
sizeof inode: 128, sizeof superblock: 512, sizeof Dentry: 512
% mkdir OS
command: mkdir OS
Dir created: OS

% ls
command: ls
type: dir, name ".", inode 0, size 1 byte
type: file, name "first", inode 1, size 0 byte
type: file, name "a.txt", inode 2, size 100 byte
type: file, name "b.txt", inode 3, size 50 byte
type: file, name "Mayesha.pdf", inode 6, size 200 byte
type: file, name "c.txt", inode 7, size 50 byte
type: file, name "k.txt", inode 7, size 50 byte
type: dir, name "project1", inode 8, size 1 byte
type: dir, name "mid", inode 9, size 1 byte
type: file, name "newfile.txt", inode 13, size 50 byte
type: file, name "link.txt", inode 14, size 50 byte
type: dir, name "OS", inode 15, size 1 byte

% cd OS
command: cd OS
Current dir OS

% mkdir class1
command: mkdir class1
Dir created: class1

% cd class1
command: cd class1
Current dir class1

% mkdir class2
command: mkdir class2
Dir created: class2

% mkdir class3
command: mkdir class3
Dir created: class3
```

```
% ls
command: ls
type: dir, name ".", inode 16, size 1 byte
type: dir, name "..", inode 15, size 1 byte
type: dir, name "class2", inode 17, size 1 byte
type: dir, name "class3", inode 18, size 1 byte

% rmdir class3
command: rmdir class3

% ls
command: ls
type: dir, name ".", inode 16, size 1 byte
type: dir, name "..", inode 15, size 1 byte
type: dir, name "class2", inode 17, size 1 byte

% cd ..
command: cd ..
Current dir ..

% ls
command: ls
type: dir, name ".", inode 15, size 1 byte
type: dir, name "..", inode 0, size 1 byte
type: dir, name "class1", inode 16, size 1 byte

% cd ..
command: cd ..
Current dir ..

% ls
command: ls
type: dir, name ".", inode 0, size 1 byte
type: file, name "first", inode 1, size 0 byte
type: file, name "a.txt", inode 2, size 100 byte
type: file, name "b.txt", inode 3, size 50 byte
type: file, name "Mayesha.pdf", inode 6, size 200 byte
type: file, name "c.txt", inode 7, size 50 byte
type: file, name "k.txt", inode 7, size 50 byte
type: dir, name "project1", inode 8, size 1 byte
type: dir, name "mid", inode 9, size 1 byte
type: file, name "newfile.txt", inode 13, size 50 byte
type: file, name "link.txt", inode 14, size 50 byte
type: dir, name "OS", inode 15, size 1 byte
```

Figure-2: Part-2 testing

To further validate our implementation, we fed commands directly from an input file using the following command:

$ ./fs_sim test.disk < testfile.input and $ ./fs_sim test.disk < testdic.input

We then compared the output with the fs_sim_reference executable to generate reference output and ensure correctness. The results matched perfectly with the reference output, indicating that all components were implemented and tested successfully.

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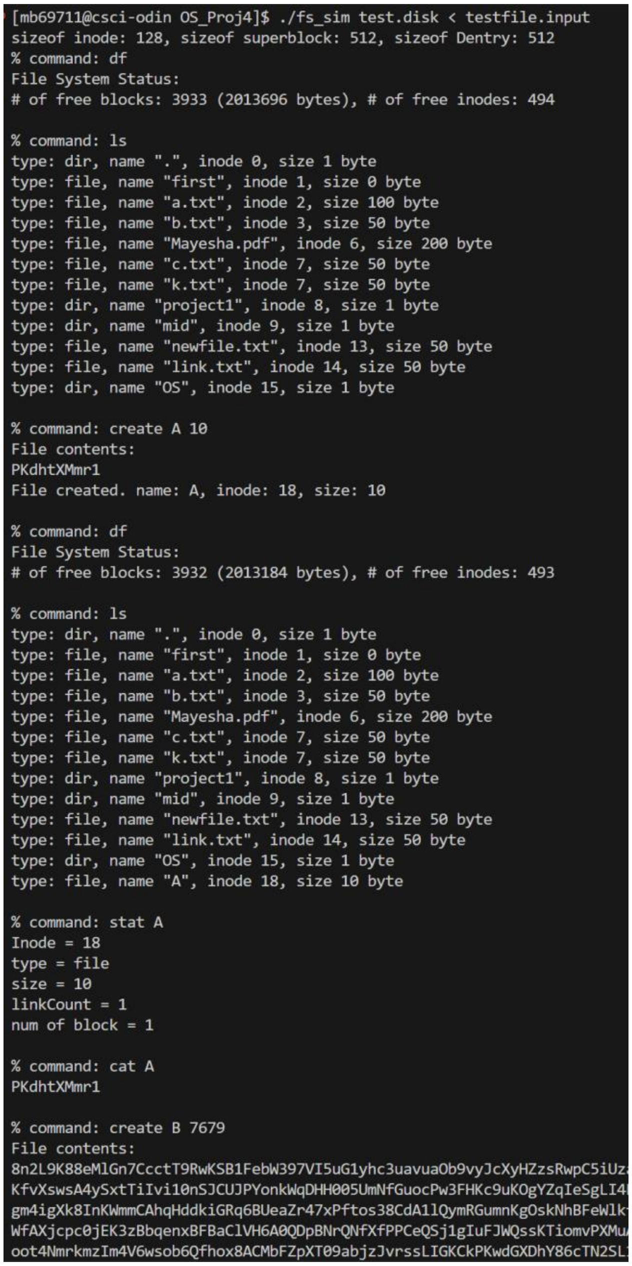
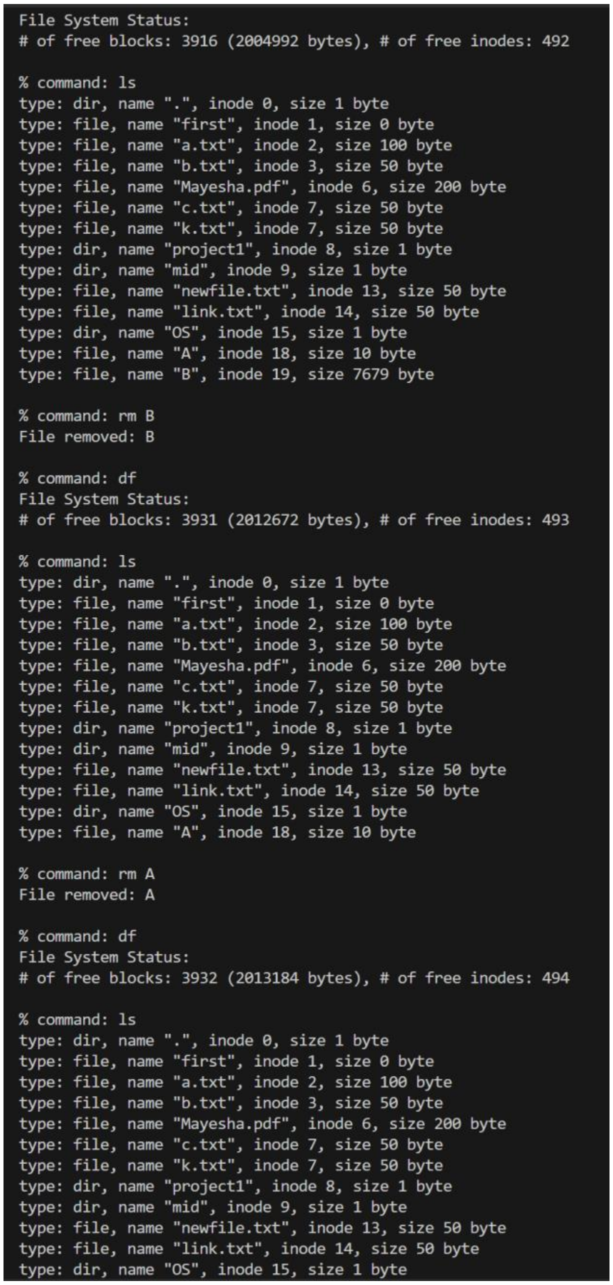
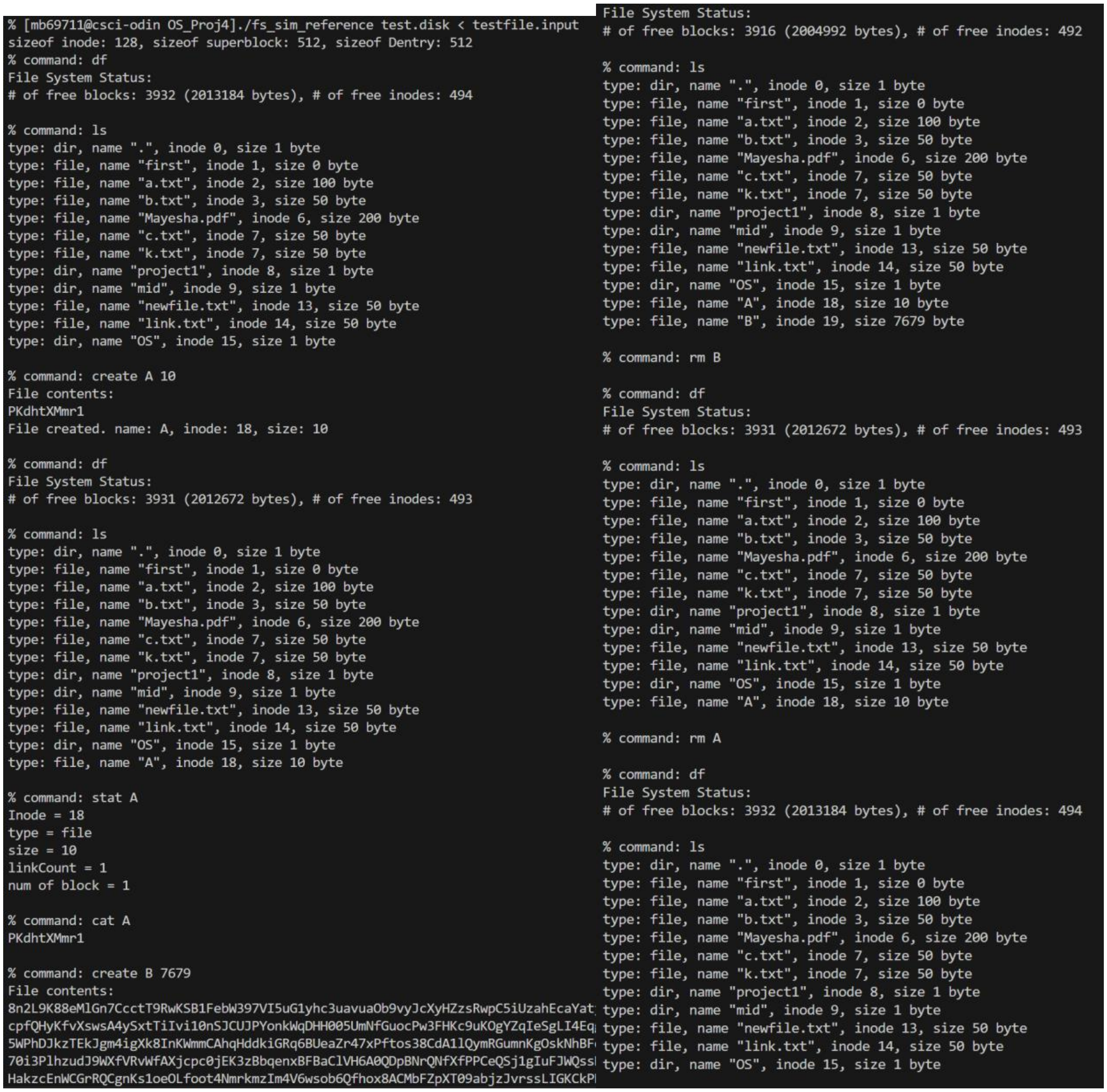


```
[mb69711@csci-odin OS_Proj4]$ ./fs_sim test.disk < testfile.input
sizeof inode: 128, sizeof superblock: 512, sizeof Dentry: 512
% command: df
File System Status:
# of free blocks: 3933 (2013696 bytes), # of free inodes: 494

% command: ls
type: dir, name ".", inode 0, size 1 byte
type: file, name "first", inode 1, size 0 byte
type: file, name "a.txt", inode 2, size 100 byte
type: file, name "b.txt", inode 3, size 50 byte
type: file, name "Mayesha.pdf", inode 6, size 200 byte
type: file, name "c.txt", inode 7, size 50 byte
type: file, name "k.txt", inode 7, size 50 byte
type: dir, name "project1", inode 8, size 1 byte
type: dir, name "mid", inode 9, size 1 byte
type: file, name "newfile.txt", inode 13, size 50 byte
type: file, name "link.txt", inode 14, size 50 byte
type: dir, name "OS", inode 15, size 1 byte

% command: create A 10
File contents:
PKdhtXMmr1
File created. name: A, inode: 18, size: 10

% command: df
File System Status:
# of free blocks: 3932 (2013184 bytes), # of free inodes: 493

% command: ls
type: dir, name ".", inode 0, size 1 byte
type: file, name "first", inode 1, size 0 byte
type: file, name "a.txt", inode 2, size 100 byte
type: file, name "b.txt", inode 3, size 50 byte
type: file, name "Mayesha.pdf", inode 6, size 200 byte
type: file, name "c.txt", inode 7, size 50 byte
type: file, name "k.txt", inode 7, size 50 byte
type: dir, name "project1", inode 8, size 1 byte
type: dir, name "mid", inode 9, size 1 byte
type: file, name "newfile.txt", inode 13, size 50 byte
type: file, name "link.txt", inode 14, size 50 byte
type: dir, name "OS", inode 15, size 1 byte
type: file, name "A", inode 18, size 10 byte

% command: stat A
Inode = 18
type = file
size = 10
linkCount = 1
num of block = 1

% command: cat A
PKdhtXMmr1

% command: create B 7679
File contents:
8n2L9K88eMlGn7CcctT9RwKSB1FebW397VI5uG1yhc3uavuaOb9vyJcXyHZzsRwpC5iUz
KfvXswsA4ySxtTiIvi10nSJCUJPYonkWqDHH005UmNfGuocPw3FHKc9uKOgYZqIeSgLI4
gm4igXk8InKWmmCAhqHddkiGRq6BUeaZr47xPftos38CdA1lQymRGumnKgOskNhBFeWlk
WfAXjcpc0jEK3zBbqenxBFBaClVH6A0QDpBNrQNfXfPPCeQSj1gIuFJWQssKTiomvPXMu
oot4NmrkmzIm4V6wsob6Qfhox8ACMbFZpXT09abjzJvrssLIGKCkPKwdGXDhY86cTN2SL
```



```
File System Status:
# of free blocks: 3916 (2004992 bytes), # of free inodes: 492

% command: ls
type: dir, name ".", inode 0, size 1 byte
type: file, name "first", inode 1, size 0 byte
type: file, name "a.txt", inode 2, size 100 byte
type: file, name "b.txt", inode 3, size 50 byte
type: file, name "Mayesha.pdf", inode 6, size 200 byte
type: file, name "c.txt", inode 7, size 50 byte
type: file, name "k.txt", inode 7, size 50 byte
type: dir, name "project1", inode 8, size 1 byte
type: dir, name "mid", inode 9, size 1 byte
type: file, name "newfile.txt", inode 13, size 50 byte
type: file, name "link.txt", inode 14, size 50 byte
type: dir, name "OS", inode 15, size 1 byte
type: file, name "A", inode 18, size 10 byte
type: file, name "B", inode 19, size 7679 byte

% command: rm B
File removed: B

% command: df
File System Status:
# of free blocks: 3931 (2012672 bytes), # of free inodes: 493

% command: ls
type: dir, name ".", inode 0, size 1 byte
type: file, name "first", inode 1, size 0 byte
type: file, name "a.txt", inode 2, size 100 byte
type: file, name "b.txt", inode 3, size 50 byte
type: file, name "Mayesha.pdf", inode 6, size 200 byte
type: file, name "c.txt", inode 7, size 50 byte
type: file, name "k.txt", inode 7, size 50 byte
type: dir, name "project1", inode 8, size 1 byte
type: dir, name "mid", inode 9, size 1 byte
type: file, name "newfile.txt", inode 13, size 50 byte
type: file, name "link.txt", inode 14, size 50 byte
type: dir, name "OS", inode 15, size 1 byte
type: file, name "A", inode 18, size 10 byte

% command: rm A
File removed: A

% command: df
File System Status:
# of free blocks: 3932 (2013184 bytes), # of free inodes: 494

% command: ls
type: dir, name ".", inode 0, size 1 byte
type: file, name "first", inode 1, size 0 byte
type: file, name "a.txt", inode 2, size 100 byte
type: file, name "b.txt", inode 3, size 50 byte
type: file, name "Mayesha.pdf", inode 6, size 200 byte
type: file, name "c.txt", inode 7, size 50 byte
type: file, name "k.txt", inode 7, size 50 byte
type: dir, name "project1", inode 8, size 1 byte
type: dir, name "mid", inode 9, size 1 byte
type: file, name "newfile.txt", inode 13, size 50 byte
type: file, name "link.txt", inode 14, size 50 byte
type: dir, name "OS", inode 15, size 1 byte
```



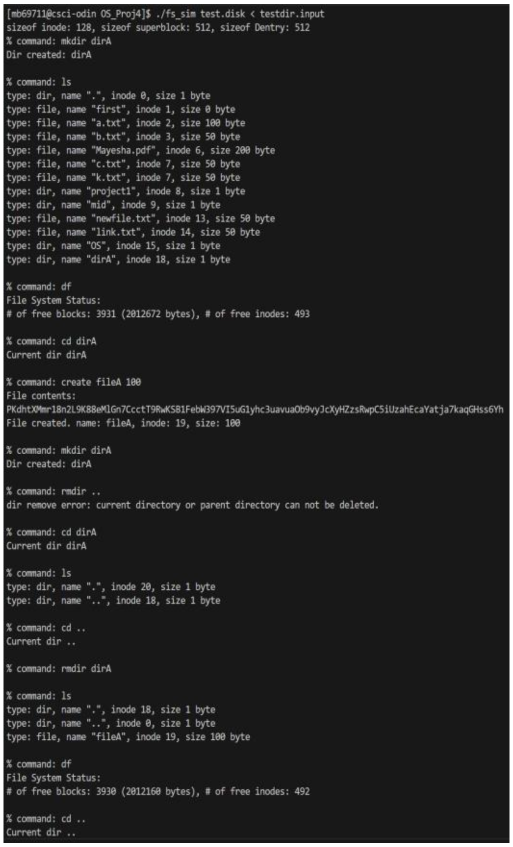
```
% [mb69711@csci-odin OS_Proj4]./fs_sim_reference test.disk < testfile.input
sizeof inode: 128, sizeof superblock: 512, sizeof Dentry: 512
% command: df
File System Status:
# of free blocks: 3932 (2013184 bytes), # of free inodes: 494

% command: ls
type: dir, name ".", inode 0, size 1 byte
type: file, name "first", inode 1, size 0 byte
type: file, name "a.txt", inode 2, size 100 byte
type: file, name "b.txt", inode 3, size 50 byte
type: file, name "Mayesha.pdf", inode 6, size 200 byte
type: file, name "c.txt", inode 7, size 50 byte
type: file, name "k.txt", inode 7, size 50 byte
type: dir, name "project1", inode 8, size 1 byte
type: dir, name "mid", inode 9, size 1 byte
type: file, name "newfile.txt", inode 13, size 50 byte
type: file, name "link.txt", inode 14, size 50 byte
type: dir, name "OS", inode 15, size 1 byte

% command: create A 10
File contents:
PKdhtXMmr1
File created. name: A, inode: 18, size: 10

% command: df
File System Status:
# of free blocks: 3931 (2012672 bytes), # of free inodes: 493

% command: ls
type: dir, name ".", inode 0, size 1 byte
type: file, name "first", inode 1, size 0 byte
type: file, name "a.txt", inode 2, size 100 byte
type: file, name "b.txt", inode 3, size 50 byte
type: file, name "Mayesha.pdf", inode 6, size 200 byte
type: file, name "c.txt", inode 7, size 50 byte
type: file, name "k.txt", inode 7, size 50 byte
type: dir, name "project1", inode 8, size 1 byte
type: dir, name "mid", inode 9, size 1 byte
type: file, name "newfile.txt", inode 13, size 50 byte
type: file, name "link.txt", inode 14, size 50 byte
type: dir, name "OS", inode 15, size 1 byte
type: file, name "A", inode 18, size 10 byte

% command: stat A
Inode = 18
type = file
size = 10
linkCount = 1
num of block = 1

% command: cat A
PKdhtXMmr1

% command: create B 7679
File contents:
8n2L9K88eMlGn7CcctT9RwKSB1FebW397VI5uG1yhc3uavuaOb9vyJcXyHZzsRwpC5iUzahEcaYat
cpfQHyKfvXswsA4ySxtTiIvi10nSJCUJPYonkWqDHH005UmNfGuocPw3FHKc9uKOgYZqIeSgLI4Eq
5WPhDJkzTEkJgm4igXk8InKWmmCAhqHddkiGRq6BUeaZr47xPftos38CdA1lQymRGumnKgOskNhBF
70i3PlhzudJ9WXfVRvWfAXjcpc0jEK3zBbqenxBFBaClVH6A0QDpBNrQNfXfPPCeQSj1gIuFJWQss
HakzcEnWCGrRQCgnKs1oeOLfoot4NmrkmzIm4V6wsob6Qfhox8ACMbFZpXT09abjzJvrssLIGKCkP
```

```
File System Status:
# of free blocks: 3916 (2004992 bytes), # of free inodes: 492

% command: ls
type: dir, name ".", inode 0, size 1 byte
type: file, name "first", inode 1, size 0 byte
type: file, name "a.txt", inode 2, size 100 byte
type: file, name "b.txt", inode 3, size 50 byte
type: file, name "Mayesha.pdf", inode 6, size 200 byte
type: file, name "c.txt", inode 7, size 50 byte
type: file, name "k.txt", inode 7, size 50 byte
type: dir, name "project1", inode 8, size 1 byte
type: dir, name "mid", inode 9, size 1 byte
type: file, name "newfile.txt", inode 13, size 50 byte
type: file, name "link.txt", inode 14, size 50 byte
type: dir, name "OS", inode 15, size 1 byte
type: file, name "A", inode 18, size 10 byte
type: file, name "B", inode 19, size 7679 byte

% command: rm B

% command: df
File System Status:
# of free blocks: 3931 (2012672 bytes), # of free inodes: 493

% command: ls
type: dir, name ".", inode 0, size 1 byte
type: file, name "first", inode 1, size 0 byte
type: file, name "a.txt", inode 2, size 100 byte
type: file, name "b.txt", inode 3, size 50 byte
type: file, name "Mayesha.pdf", inode 6, size 200 byte
type: file, name "c.txt", inode 7, size 50 byte
type: file, name "k.txt", inode 7, size 50 byte
type: dir, name "project1", inode 8, size 1 byte
type: dir, name "mid", inode 9, size 1 byte
type: file, name "newfile.txt", inode 13, size 50 byte
type: file, name "link.txt", inode 14, size 50 byte
type: dir, name "OS", inode 15, size 1 byte
type: file, name "A", inode 18, size 10 byte

% command: rm A

% command: df
File System Status:
# of free blocks: 3932 (2013184 bytes), # of free inodes: 494

% command: ls
type: dir, name ".", inode 0, size 1 byte
type: file, name "first", inode 1, size 0 byte
type: file, name "a.txt", inode 2, size 100 byte
type: file, name "b.txt", inode 3, size 50 byte
type: file, name "Mayesha.pdf", inode 6, size 200 byte
type: file, name "c.txt", inode 7, size 50 byte
type: file, name "k.txt", inode 7, size 50 byte
type: dir, name "project1", inode 8, size 1 byte
type: dir, name "mid", inode 9, size 1 byte
type: file, name "newfile.txt", inode 13, size 50 byte
type: file, name "link.txt", inode 14, size 50 byte
type: dir, name "OS", inode 15, size 1 byte
```

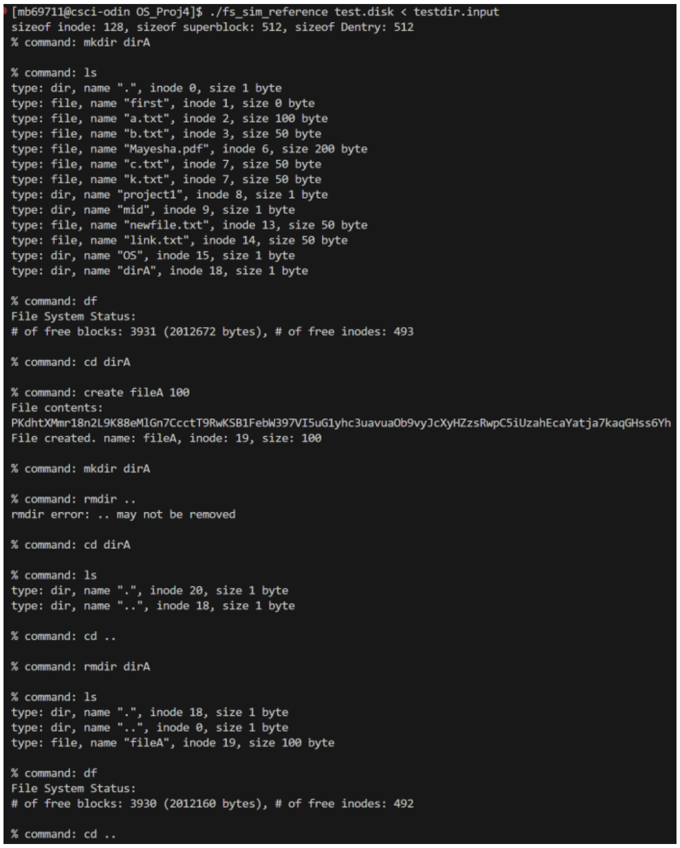
Figure-3: comparison of fs_sim test.disk < testfile.input

with fs_sim reference test.disk < testfile.input

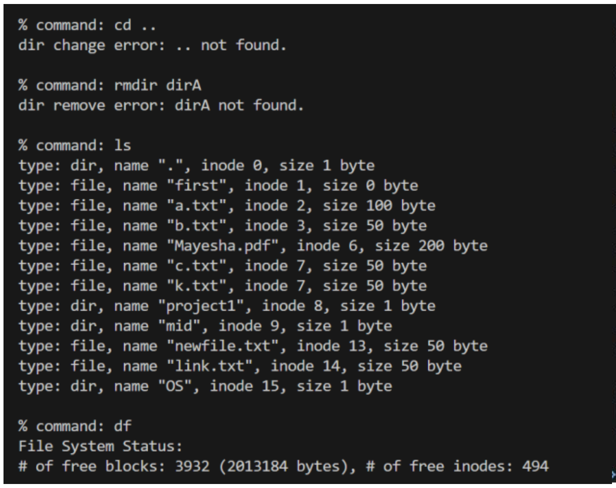
Name: Mayesha Bintha Mizan
ID-811281302



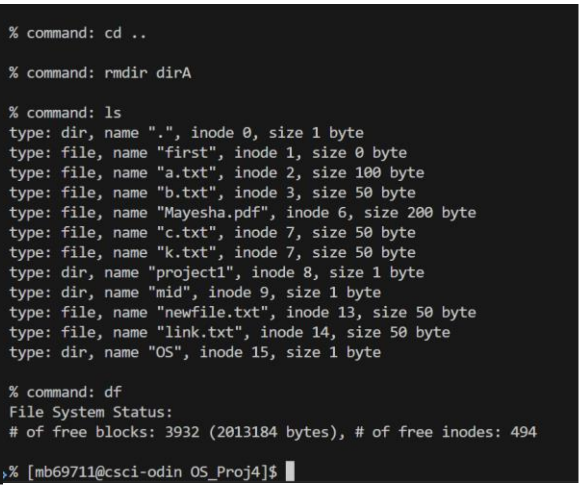
```
[mb69711@csci-odin OS_Proj4]$ ./fs_sim test.disk < testdir.input
sizeof inode: 128, sizeof superblock: 512, sizeof Dentry: 512
% command: mkdir dirA
Dir created: dirA

% command: ls
type: dir, name ".", inode 0, size 1 byte
type: file, name "first", inode 1, size 0 byte
type: file, name "a.txt", inode 2, size 100 byte
type: file, name "b.txt", inode 3, size 50 byte
type: file, name "Mayesha.pdf", inode 6, size 200 byte
type: file, name "c.txt", inode 7, size 50 byte
type: file, name "k.txt", inode 7, size 50 byte
type: dir, name "project1", inode 8, size 1 byte
type: dir, name "mid", inode 9, size 1 byte
type: file, name "newfile.txt", inode 13, size 50 byte
type: file, name "link.txt", inode 14, size 50 byte
type: dir, name "OS", inode 15, size 1 byte
type: dir, name "dirA", inode 18, size 1 byte

% command: df
File System Status:
# of free blocks: 3931 (2012672 bytes), # of free inodes: 493

% command: cd dirA
Current dir dirA

% command: create fileA 100
File contents:
PKdhtXMmr18n2L9K88eMlGn7CcctT9RwKSB1FebW397VI5uG1yhc3uavuaOb9vyJcXyHZzsRwpC5iUzahEcaYatja7kaqGHss6Yh
File created. name: fileA, inode: 19, size: 100

% command: mkdir dirA
Dir created: dirA

% command: rmdir ..
dir remove error: current directory or parent directory can not be deleted.

% command: cd dirA
Current dir dirA

% command: ls
type: dir, name ".", inode 20, size 1 byte
type: dir, name "..", inode 18, size 1 byte

% command: cd ..
Current dir ..

% command: rmdir dirA

% command: ls
type: dir, name ".", inode 18, size 1 byte
type: dir, name "..", inode 0, size 1 byte
type: file, name "fileA", inode 19, size 100 byte

% command: df
File System Status:
# of free blocks: 3930 (2012160 bytes), # of free inodes: 492

% command: cd ..
Current dir ..
```



```
[mb69711@csci-odin OS_Proj4]$ ./fs_sim_reference test.disk < testdir.input
sizeof inode: 128, sizeof superblock: 512, sizeof Dentry: 512
% command: mkdir dirA

% command: ls
type: dir, name ".", inode 0, size 1 byte
type: file, name "first", inode 1, size 0 byte
type: file, name "a.txt", inode 2, size 100 byte
type: file, name "b.txt", inode 3, size 50 byte
type: file, name "Mayesha.pdf", inode 6, size 200 byte
type: file, name "c.txt", inode 7, size 50 byte
type: file, name "k.txt", inode 7, size 50 byte
type: dir, name "project1", inode 8, size 1 byte
type: dir, name "mid", inode 9, size 1 byte
type: file, name "newfile.txt", inode 13, size 50 byte
type: file, name "link.txt", inode 14, size 50 byte
type: dir, name "OS", inode 15, size 1 byte
type: dir, name "dirA", inode 18, size 1 byte

% command: df
File System Status:
# of free blocks: 3931 (2012672 bytes), # of free inodes: 493

% command: cd dirA

% command: create fileA 100
File contents:
PKdhtXMmr18n2L9K88eMlGn7CcctT9RwKSB1FebW397VI5uG1yhc3uavuaOb9vyJcXyHZzsRwpC5iUzahEcaYatja7kaqGHss6Yh
File created. name: fileA, inode: 19, size: 100

% command: mkdir dirA

% command: rmdir ..
rmdir error: .. may not be removed

% command: cd dirA

% command: ls
type: dir, name ".", inode 20, size 1 byte
type: dir, name "..", inode 18, size 1 byte

% command: cd ..

% command: rmdir dirA

% command: ls
type: dir, name ".", inode 18, size 1 byte
type: dir, name "..", inode 0, size 1 byte
type: file, name "fileA", inode 19, size 100 byte

% command: df
File System Status:
# of free blocks: 3930 (2012160 bytes), # of free inodes: 492

% command: cd ..
```



```
% command: cd ..
dir change error: .. not found.

% command: rmdir dirA
dir remove error: dirA not found.

% command: ls
type: dir, name ".", inode 0, size 1 byte
type: file, name "first", inode 1, size 0 byte
type: file, name "a.txt", inode 2, size 100 byte
type: file, name "b.txt", inode 3, size 50 byte
type: file, name "Mayesha.pdf", inode 6, size 200 byte
type: file, name "c.txt", inode 7, size 50 byte
type: file, name "k.txt", inode 7, size 50 byte
type: dir, name "project1", inode 8, size 1 byte
type: dir, name "mid", inode 9, size 1 byte
type: file, name "newfile.txt", inode 13, size 50 byte
type: file, name "link.txt", inode 14, size 50 byte
type: dir, name "OS", inode 15, size 1 byte

% command: df
File System Status:
# of free blocks: 3932 (2013184 bytes), # of free inodes: 494
```



```
% command: cd ..

% command: rmdir dirA

% command: ls
type: dir, name ".", inode 0, size 1 byte
type: file, name "first", inode 1, size 0 byte
type: file, name "a.txt", inode 2, size 100 byte
type: file, name "b.txt", inode 3, size 50 byte
type: file, name "Mayesha.pdf", inode 6, size 200 byte
type: file, name "c.txt", inode 7, size 50 byte
type: file, name "k.txt", inode 7, size 50 byte
type: dir, name "project1", inode 8, size 1 byte
type: dir, name "mid", inode 9, size 1 byte
type: file, name "newfile.txt", inode 13, size 50 byte
type: file, name "link.txt", inode 14, size 50 byte
type: dir, name "OS", inode 15, size 1 byte

% command: df
File System Status:
# of free blocks: 3932 (2013184 bytes), # of free inodes: 494

% [mb69711@csci-odin OS_Proj4]$
```

Figure-4: comparison of fs_sim test.disk < testdir.input

with fs_sim reference test.disk < testdir.input

Extra Credit: File System Checker

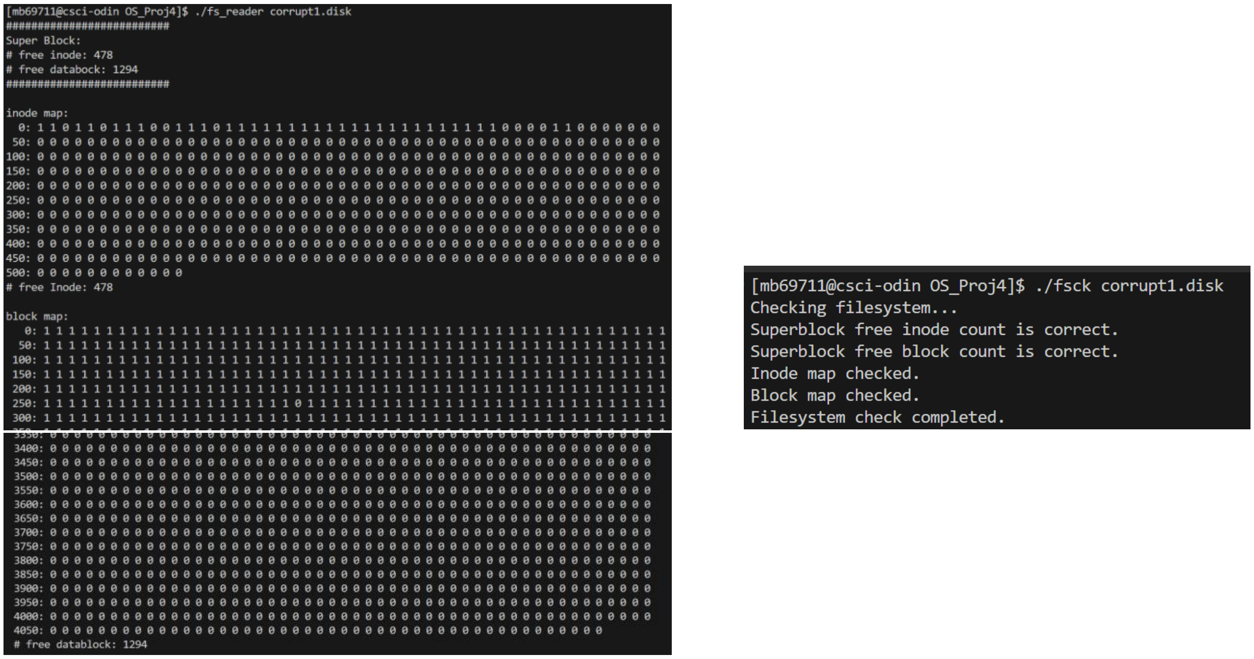
Implemented in fsck.c. The checker (fsck) scans the superblock, inode map, and block map to identify and correct inconsistencies.

1. **Superblock Consistency**: The checker ensures that the freeInodeCount and freeBlockCount in the superblock accurately match the actual number of free inodes and blocks in the filesystem.
2. **Inode Map Validation**: The inode map is checked and repaired to maintain accurate tracking of which inodes are in use and which are free.
3. **Block Map Validation**: The block map is similarly validated and repaired to ensure correct tracking of which blocks are in use or free.

The tool starts by mounting the filesystem, then performs checks on each component, and attempts to correct any discrepancies. Once all checks are complete, the filesystem is unmounted to save all changes and maintain a consistent state.

Testing

To test the fsck implementation, I compiled the fsck.c file using the make command. Then, I ran the checker on the corrupted disk files to detect and fix inconsistencies. After running fsck, I used the fs_reader program to verify that the fixed filesystems were correct for all the test disks (corrupted1.disk, corrupted2.disk, corrupted3.disk, and ori.disk). The outputs of the fixed disks matched exactly with the output of the original disk (ori.disk), indicating that all inconsistencies were successfully resolved. Here are the screenshots:



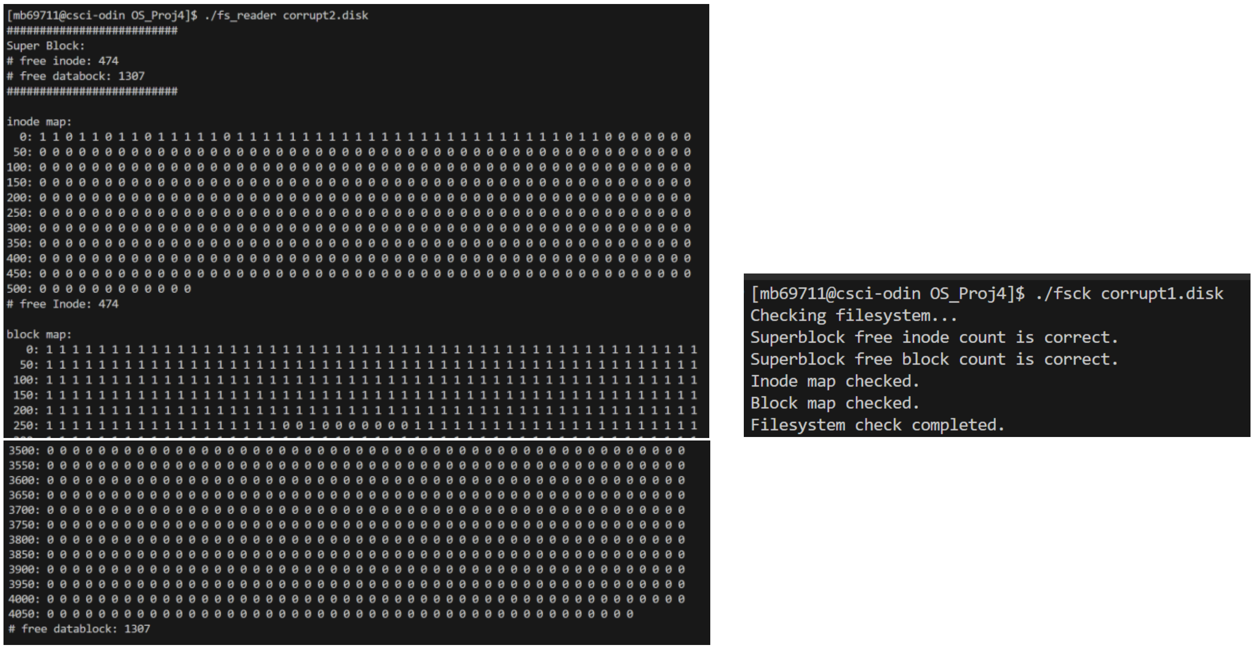
```
[mb69711@csci-odin OS_Proj4]$ ./fs_reader corrupt1.disk
##########################
Super Block:
# free inode: 478
# free databock: 1294
##########################

inode map:
  0: 1 1 0 1 1 0 1 1 1 0 0 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 1 1 0 0 0 0 0 0 0
 50: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
100: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
150: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
200: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
250: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
300: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
350: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
400: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
450: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
500: 0 0 0 0 0 0 0 0 0 0 0 0
# free Inode: 478

block map:
   0: 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
  50: 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
 100: 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
 150: 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
 200: 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
 250: 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
 300: 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
```

```
 3350: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 3400: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 3450: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 3500: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 3550: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 3600: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 3650: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 3700: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 3750: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 3800: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 3850: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 3900: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 3950: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 4000: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 4050: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 # free datablock: 1294
```

```
[mb69711@csci-odin OS_Proj4]$ ./fsck corrupt1.disk
Checking filesystem...
Superblock free inode count is correct.
Superblock free block count is correct.
Inode map checked.
Block map checked.
Filesystem check completed.
```

Figure-5 : corrupted1.disk

Name: Mayesha Bintha Mizan
ID-811281302

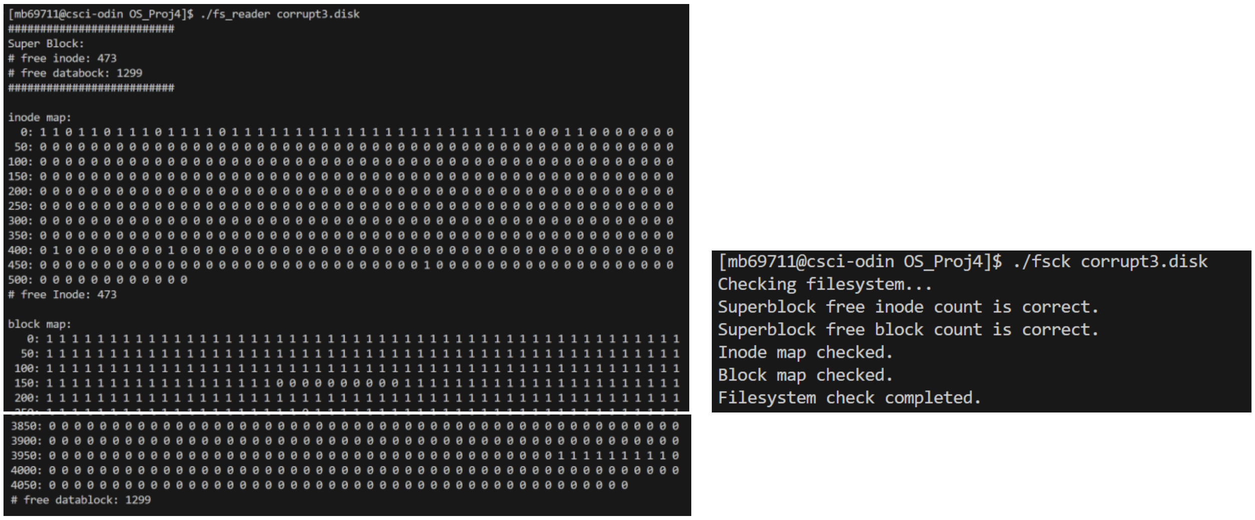


```
[mb69711@csci-odin OS_Proj4]$ ./fs_reader corrupt2.disk
##########################
Super Block:
# free inode: 474
# free databock: 1307
##########################

inode map:
  0: 1 1 0 1 1 0 1 1 0 1 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1 0 0 0 0 0 0 0
 50: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
100: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
150: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
200: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
250: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
300: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
350: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
400: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
450: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
500: 0 0 0 0 0 0 0 0 0 0 0 0
# free Inode: 474

block map:
   0: 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
  50: 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
 100: 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
 150: 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
 200: 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
 250: 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 1 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
```

```
3500: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
3550: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
3600: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
3650: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
3700: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
3750: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
3800: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
3850: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
3900: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
3950: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
4000: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
4050: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
# free datablock: 1307
```

```
[mb69711@csci-odin OS_Proj4]$ ./fsck corrupt1.disk
Checking filesystem...
Superblock free inode count is correct.
Superblock free block count is correct.
Inode map checked.
Block map checked.
Filesystem check completed.
```

Figure-6 : corrupted2.disk



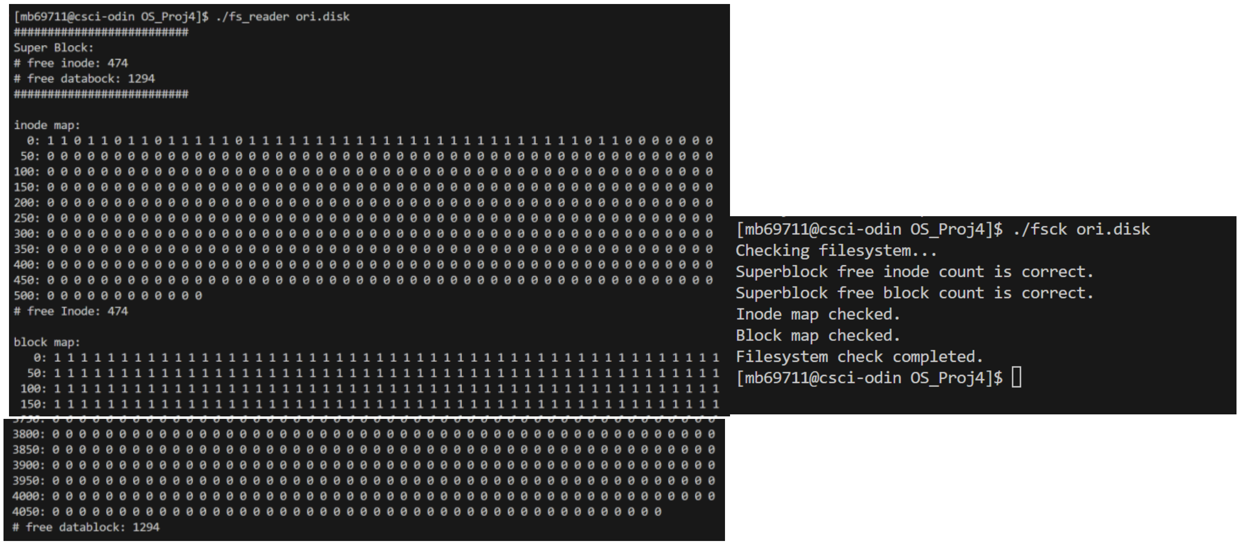
```
[mb69711@csci-odin OS_Proj4]$ ./fs_reader corrupt3.disk
##########################
Super Block:
# free inode: 473
# free databock: 1299
##########################

inode map:
  0: 1 1 0 1 1 0 1 1 1 0 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 1 1 0 0 0 0 0 0 0
 50: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
100: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
150: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
200: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
250: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
300: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
350: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
400: 0 1 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
450: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
500: 0 0 0 0 0 0 0 0 0 0 0 0
# free Inode: 473

block map:
   0: 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
  50: 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
 100: 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
 150: 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
 200: 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
```

```
3850: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
3900: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
3950: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1 1 0
4000: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
4050: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
# free datablock: 1299
```

```
[mb69711@csci-odin OS_Proj4]$ ./fsck corrupt3.disk
Checking filesystem...
Superblock free inode count is correct.
Superblock free block count is correct.
Inode map checked.
Block map checked.
Filesystem check completed.
```

Figure-7 : corrupted3.disk

Name: Mayesha Bintha Mizan
ID-811281302



```
[mb69711@csci-odin OS_Proj4]$ ./fs_reader ori.disk
##########################
Super Block:
# free inode: 474
# free databock: 1294
##########################

inode map:
  0: 1 1 0 1 1 0 1 1 0 1 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1 0 0 0 0 0 0 0
 50: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
100: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
150: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
200: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
250: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
300: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
350: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
400: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
450: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
500: 0 0 0 0 0 0 0 0 0 0 0 0
# free Inode: 474

block map:
   0: 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
  50: 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
 100: 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
 150: 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
```

```
3800: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
3850: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
3900: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
3950: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
4000: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
4050: 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
# free datablock: 1294
```

```
[mb69711@csci-odin OS_Proj4]$ ./fsck ori.disk
Checking filesystem...
Superblock free inode count is correct.
Superblock free block count is correct.
Inode map checked.
Block map checked.
Filesystem check completed.
[mb69711@csci-odin OS_Proj4]$
```

Figure-5 : ori.disk

This project successfully simulates an EXT-like filesystem with file and directory operations, including file creation, deletion, linking, and directory management. The extra credit component (fsck) effectively ensures filesystem consistency by detecting and correcting metadata discrepancies. The project was thoroughly tested, and the results matched the expected behavior, confirming the correctness and reliability of the system.