

CSE222 Data Structures and Algorithms

Homework #4 Report

Introduction

The goal of this project was to design and implement a simulation of a file system directory structure similar to those found in operating systems. This simulation includes functionalities such as creating, deleting, and moving files and directories, as well as listing contents and searching through them. The project emphasizes the use of object-oriented programming principles and data structures like linked lists to manage directories and files efficiently.

Methods

```
private void printWholeTree(Directory dir, String prefix, Directory current) { ...  
private void printDirectoryTree(Directory dir, String prefix, Directory current) { ...
```

First method prints whole system tree (Option 0 in Menu).

Second method prints from root the current directory.

```
public Directory changeDirectory(String path)
```

This method changes the current Directory.

```
public void createFile(String name) { ...  
public void createDirectory(String name) { ...
```

These method creates a file or directory in current Directory given names as parameter.

```
public void listDirectoryContents()
```

This method prints currentDirectory's contents.

```
public void moveFileOrDirectory(String name, String newPathString)
```

The **moveFileOrDirectory** method relocates a file or directory to a specified path without duplicating any data. It updates the parent directory reference of the moving item to reflect the new location and removes it from the old parent's list of children. This method ensures that a directory cannot be moved into itself or any of its subdirectories to prevent a recursive loop. If the specified new path does not exist or the item to be moved is not found, the method will throw an informative exception.

```
private void deleteRecursively(FileSystemElement fse)
```

This method takes a file system element as an argument and performs a recursive deletion. It starts at the given element and, if it's a directory, it calls itself on all children, effectively traversing the tree structure and deleting all files and subdirectories within. Once the contents are deleted, the method ensures that the element itself is removed from its parent directory's children list.

```
private FileSystemElement searchEntireFileSystem(Directory dir, String name) { ...
```

This method searches the entire file system for an element with the specified name. It begins the search at the provided directory and recursively checks all subdirectories and files. If it finds an element with the matching name, it returns that element; otherwise, it returns null, indicating that the element does not exist in the system.

```
public void deleteFileOrDirectory(String name)
```

This public method is the interface for external classes to delete a file or directory by name. It uses the **searchEntireFileSystem** method to locate the element throughout the file system. Once found, it calls **deleteRecursively** to remove the element and its contents. It also handles the case where the current directory or its descendants is deleted, by setting the current directory to the nearest valid ancestor.

```
private boolean isDescendant(Directory current, FileSystemElement elementToDelete)
```

This method checks if the current directory is a descendant of the directory to be deleted. It walks up the directory tree from the current directory, checking if any parent matches the directory to be deleted. This is used to ensure that we do not delete a directory that contains the current directory within it.

```
private void setCurrentDirectoryToNearestValid(FileSystemElement deletedElement)
```

After an element is deleted, this method sets the current directory to the nearest valid ancestor directory. It's a safety measure to avoid having a current directory reference that points to a non-existent directory. If no valid ancestors are found, it sets the current directory to the root of the file system.

```
private String searchRecursive(Directory current, String name, String path) { ...
```

The **searchRecursive** method is a private utility designed to locate a file or directory within the file system. It operates by traversing the directory tree, starting from a given directory and searching through all children. If it finds an element with the matching name, it returns the path to that element. If the element is a directory, it dives deeper into the tree recursively. This process continues until either the element is found or all directories have been explored, in which case an empty string is returned indicating the element does not exist within the file system. This method is crucial for implementing deep searches, enabling the discovery of files or directories regardless of their level of nesting.

```
public void sortContentsByDate(Directory dir)
```

sortContentsByDate methods sorts current directories contents by date.

Additional Helper Methods

```
public Directory getCurrentDirectory()
```

```
public String getCurrentPath(Directory dir)
```

Example Program and Outputs

- To compile, generate a Javadoc file and run the program “make” command entered.

```
alperen@DESKTOP-D8VFTCK:/mnt/c/Users/duran/OneDrive/Masaüstü/HW4$ make
javac -g -d ./bin Directory.java
javac -g -d ./bin File.java
javac -g -d ./bin FileSystem.java
javac -g -d ./bin FileSystemElement.java
javac -g -d ./bin Main.java
javadoc -d ./doc Directory.java File.java FileSystem.java FileSystemElement.java Main.java
Loading source file Directory.java...
Loading source file File.java...
Loading source file FileSystem.java...
Loading source file FileSystemElement.java...
Loading source file Main.java...
Constructing Javadoc information...
Standard Doclet version 11.0.22
Building tree for all the packages and classes...
Generating ./doc/Directory.html...
Generating ./doc/File.html...
Generating ./doc/FileSystem.html...
Generating ./doc/FileSystemElement.html...
Generating ./doc/Main.html...
Generating ./doc/package-summary.html...
Generating ./doc/package-tree.html...
Generating ./doc/constant-values.html...
Building index for all the packages and classes...
Generating ./doc/overview-tree.html...
Generating ./doc/index-all.html...
Building index for all classes...
Generating ./doc/allclasses-index.html...
Generating ./doc/allpackages-index.html...
Generating ./doc/deprecated-list.html...
Building index for all classes...
Generating ./doc/allclasses.html...
Generating ./doc/allclasses.html...
Generating ./doc/index.html...
Generating ./doc/help-doc.html...
java -cp ./bin Main
===== File System Management Menu =====
0. Print Whole System Tree
1. Change directory
2. List directory contents
3. Create file/directory
4. Delete file/directory
5. Move file/directory
6. Search file/directory
7. Print directory tree
8. Sort contents by date created
9. Exit
```

- home directory created

```
===== File System Management Menu =====
0. Print Whole System Tree
1. Change directory
2. List directory contents
3. Create file/directory
4. Delete file/directory
5. Move file/directory
6. Search file/directory
7. Print directory tree
8. Sort contents by date created
9. Exit
Please select an option: 3
Current directory: root
Create file (f) or directory (d)? d
Enter name: home
Directory created: home
```

- user directory created

```
Please select an option: 3
Current directory: root
Create file (f) or directory (d)? d
Enter name: user
Directory created: user
```

- Documents directory created

```
Please select an option: 3
Current directory: root
Create file (f) or directory (d)? d
Enter name: Documents
Directory created: Documents
```

- Projects directory created

```
Please select an option: 3
Current directory: root
Create file (f) or directory (d)? d
Enter name: Projects
Directory created: Projects
```

- Project2 directory created

```
Please select an option: 3
Current directory: root
Create file (f) or directory (d)? d
Enter name: Project2
Directory created: Project2
```

- Current directory and contents listed

```
Please select an option: 7
Path to current directory from root:
* root/ (Current Directory)
  * home/
  * user/
  * Documents/
  * Projects/
  * Project2/
  * File System Manager.txt
```

- project-outline.txt created

```
Please select an option: 3
Current directory: root
Create file (f) or directory (d)? f
Enter name: project-outline.txt
File created: project-outline.txt
```

- user directory moved to /home

```
Please select an option: 5
Current directory: root
Enter the name of the file/directory to move: user
Enter the new directory path to move to: /home
user moved to /home
```

- Documents directory moved to /home/user

```
Please select an option: 5
Current directory: root
Enter the name of the file/directory to move: Documents
Enter the new directory path to move to: /home/user
Documents moved to /home/user
```

- Projects directory moved to /home/user/Documents

```
Please select an option: 5
Current directory: root
Enter the name of the file/directory to move: Projects
Enter the new directory path to move to: /home/user/Documents
Projects moved to /home/user/Documents
```

- Project2 directory moved to /home/user/Documents/Projects

```
Please select an option: 5
Current directory: root
Enter the name of the file/directory to move: Project2
Enter the new directory path to move to: /home/user/Documents/Projects
Project2 moved to /home/user/Documents/Projects
```

- Whole system tree listed

```
Please select an option: 0
Whole tree from root:
* root/ (Current Directory)
  * home/
    * user/
      * Documents/
        * Projects/
          * Project2/
project-outline.txt
```

- project-outline.txt moved /home/user/Documents/Projects/Project2

```
Current directory: root
Enter the name of the file/directory to move: project-outline.txt
Enter the new directory path to move to: /home/user/Documents/Projects/Project2
project-outline.txt moved to /home/user/Documents/Projects/Project2
```

- Current directory changed from root the /home/user/Documents/Projects/Project2

```
Please select an option: 1
Current directory: root
Enter the directory path to change to: /home/user/Documents/Projects/Project2
Directory changed to: root/home/user/Documents/Projects/Project2
```

- From root the current path printed

```
Please select an option: 7
Path to current directory from root:
* root/
  * home/
    * user/
      * Documents/
        * Projects/
          * Project2/ (Current Directory)
            * project-outline.txt
```

- Research-notes.txt created in the current path

```
Please select an option: 3
Current directory: root/home/user/Documents/Projects/Project2
Create file (f) or directory (d)? f
Enter name: research-notes.txt
File created: research-notes.txt
```

- From root the current path printed

```
Please select an option: 7
Path to current directory from root:
* root/
  * home/
    * user/
      * Documents/
        * Projects/
          * Project2/ (Current Directory)
            * project-outline.txt
            * research-notes.txt
```

- Contents of current directory listed

```
Please select an option: 2
Current directory: root/home/user/Documents/Projects/Project2
Contents of root/home/user/Documents/Projects/Project2:
project-outline.txt
research-notes.txt
```

- Sorted contents listed

```
Please select an option: 8
Current directory: root/home/user/Documents/Projects/Project2
Sorting contents of the directory by date created...
project-outline.txt - (2024-04-22 11:40:34.848)
research-notes.txt - (2024-04-22 11:44:11.882)
```

- Searching file

```
Please select an option: 6
Enter the search query: project-outline.txt
Searching from root...
Found: /home/user/Documents/Projects/Project2/project-outline.txt
```

- Searching directory

```
Please select an option: 6
Enter the search query: Documents
Searching from root...
Found: /home/user/Documents
```

- Deleting file

```
Please select an option: 4
Current directory: root/home/user/Documents/Projects/Project2
Enter the name of the file/directory to delete: project-outline.txt
project-outline.txt deleted.
```

- Directory Tree after deletion

```
Path to current directory from root:
* root/
  * home/
    * user/
      * Documents/
        * Projects/
          * Project2/ (Current Directory)
            * research-notes.txt
```

- Deleting directory

```
Please select an option: 4
Current directory: root/home/user/Documents/Projects/Project2
Enter the name of the file/directory to delete: Projects
Projects deleted.
```

- Directory Tree after deletion(Current Directory assigned to nearest parent)

```
Please select an option: 7
Path to current directory from root:
* root/
  * home/
    * user/
      * Documents/ (Current Directory)
```

- Deleting directory

```
Please select an option: 4
Current directory: root/home/user/Documents
Enter the name of the file/directory to delete: home
home deleted.
```

- Directory Tree after deletion(Current Directory assigned to nearest parent)

```
Please select an option: 7
Path to current directory from root:
* root/ (Current Directory)
```