

Laboratory Report



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Description

This Lab report is a study of Windows & UNIX operating systems commands that are available to users and services to allow interaction with the systems resources via command-line interface (CLI). This report details the basic user commands most frequently used when working with Windows & UNIX systems and how these system commands can be assembled into scripts to automate execution of multiple commands on each system.

Aims

The primary aims of this report was derived from AUT Letterkenny – PGDip. in Cloud Technologies – Infrastructure as Code (IaC) module, which documented practical Lab exercises during the course and contribute to investigation into benefits/drawbacks when using Windows and UNIX commands. Key aims of the report are:

1. Demonstrate/document Windows DOS CLI commands when working on Windows OS,
2. Demonstrate/document UNIX terminal commands when working in UNIX OS,
3. Capture & summarise both DOS and UNIX commands for easy reference,
4. Summarize advantages/disadvantages of using system commands per OS,

Methodology

Prior to beginning investigation, the following software version was required to assess Windows and UNIX CLIs. The below software versions were installed on an Azure Virtual Machine (VM) to ensure both CLIs were running on identical configuration.

Table 1: Software required.

Item	Description	Manufacturer	Make	Model	Serial Number	Calibration Date
1	Command.com	Microsoft	Windows	11	10.0.22621.2428	21Sep23
2	Ubuntu CLI	Canonical Group Limited	Ubuntu	22.04.02 LT	2204.2.47.0	21Sep23
3	Workstation, Terminal Server	Azure	Windows	11	0000-0003-3177-8106-6470-6075-37	21Sep23

This study was conducted to show evidence of completion of lab exercises and document the following goals when observing DOS & UNIX OS commands:

1. Complete all DOS exercises as documented in IaC module lecture notes [1]
2. Complete all UNIX exercises as documented in IaC module lecture notes [1]
3. Referenced DOS best practices/standards available to users [2]
4. Referenced UNIX best practices/standards available to users [3]

Results and Testing

This section details the testing approach conducted and results that were recorded when reviewing both systems CLIs.

On completion of Windows & UNIX CLI analysis, testing of both CLIs was completed successfully with no issues encountered. Details summary of results recorded are as follows:

Test 1: Create and run DOS commands to manipulate windows operating system as outlined in point 1 in methodologies. Manipulation of the Windows OS included navigating the OS, creation and deletion of directories, creation and deletion of files and reporting OS System information.

Result 1: DOS commands were executed successfully with result recorded via output screenshots available in Appendix 1 – Figure 1, 2, 3 & 4.

Test 2: Create and run UNIX commands to manipulate UNIX operating system as outlined in point 2 in methodologies. Manipulation of the UNIX OS included navigating the OS, creation and deletion of directories, creation and deletion of files and reporting OS System information.

Result 2: UNIX commands were executed successfully with result recorded via output screenshots available in Appendix 2 - Figure 5, 6, 7 & 8.

Test 3: Capturing of most commonly used DOS & UNIX system command as outlined in point 3 & 4 in methodologies.

Result 3: Basic DOS and UNIX command were recorded in Quick Reference guide (.xsl). Results of Quick Reference Guide will accompany this report.

Conclusions

The commands available on both Windows and Unix CLI are an extremely effective tool when interacting with the core operating systems. Although there are drawbacks to be considered when using CLI, there are also advantages.

Windows DOS:

Although DOS only allows for monouser and single task operations on its operating system, DOS commands are NOT case sensitive (allowing user to focus on command phrases syntax & not grammar). DOS is lightweight (16bit OS) and freely available on all Windows OS allowing users to run system commands that are backward compatible. DOS uses backslashes as its file system navigation & allows for batch files (.bat) scripting. Unfortunately, DOS commands has limited security capability in comparison to UNIX.

UNIX Shell:

UNIX shell differs from DOS as it allows for multiuser and multitasking capabilities. UNIX commands and file names are however case sensitive. UNIX offers open-source implementation. UNIX uses forward slashes as its file system navigation & allows for shell files (.sh) scripting. Unix offers robust security features when supporting enhanced file management.

While both DOS & UNIX commands syntax differ, both require knowledge of commands that leads to difficulty for users to quickly learn and run complex commands. UNIX commands are often considered more powerful over DOS commands, as UNIX commands offer more multitasking/networking/connectivity support capabilities.

References

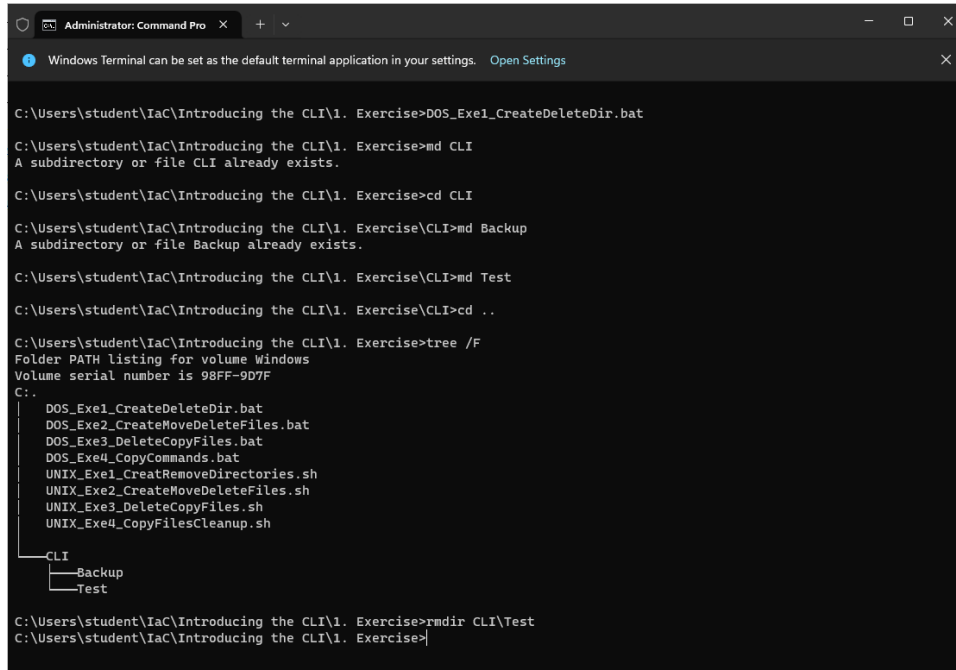
- [1] J. O'Raw, "Command Line Interface," in *AUT Letterkenny - PGDip in Cloud Computing - Infrastructure as Code*, Letterkenny, 2023.
- [2] Microsoft, "Windows Commands," <https://learn.microsoft.com/en-us/windows-server/administration/windows-commands/windows-commands>, 26 April 2023. [Online]. Available: <https://learn.microsoft.com/en-us/windows-server/administration/windows-commands/windows-commands>. [Accessed 18 October 2023].
- [3] "Basic Unix Commands," unixtutorial.org, January 2019. [Online]. Available: <https://www.unixtutorial.org/basic-unix-commands>. [Accessed 16 October 2023].

Appendices

This section outlines the results that were recorded during the execution of Windows & UNIX scripts. Although these are low level commands, they are still effective when navigating & controlling the operation systems file structure:

Windows DOS Command Results:

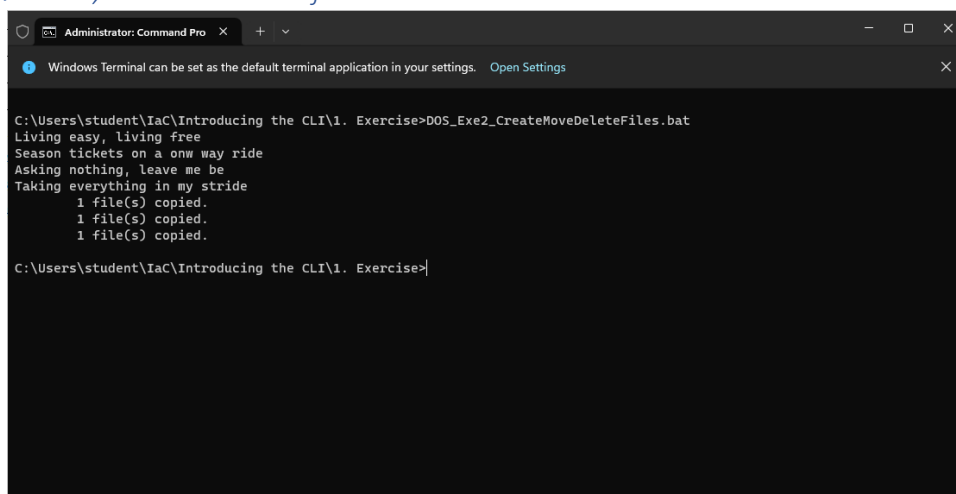
Exercise 1: Create and Delete directories.



```
C:\Users\student\IaC\Introducing the CLI\1. Exercise>DOS_Exe1_CreateDeleteDir.bat
C:\Users\student\IaC\Introducing the CLI\1. Exercise>md CLI
A subdirectory or file CLI already exists.
C:\Users\student\IaC\Introducing the CLI\1. Exercise>cd CLI
C:\Users\student\IaC\Introducing the CLI\1. Exercise\CLI>md Backup
A subdirectory or file Backup already exists.
C:\Users\student\IaC\Introducing the CLI\1. Exercise\CLI>md Test
C:\Users\student\IaC\Introducing the CLI\1. Exercise\CLI>cd ..
C:\Users\student\IaC\Introducing the CLI\1. Exercise>tree /F
Folder PATH listing for volume Windows
Volume serial number is 98FF-9D7F
C:.
|_ DOS_Exe1_CreateDeleteDir.bat
|_ DOS_Exe2_CreateMoveDeleteFiles.bat
|_ DOS_Exe3_DeleteCopyFiles.bat
|_ DOS_Exe4_CopyCommands.bat
|_ UNIX_Exe1_CreateRemoveDirectories.sh
|_ UNIX_Exe2_CreateMoveDeleteFiles.sh
|_ UNIX_Exe3_DeleteCopyFiles.sh
|_ UNIX_Exe4_CopyFilesCleanup.sh
|_ CLI
|   |_ Backup
|       |_ Test
C:\Users\student\IaC\Introducing the CLI\1. Exercise>rmdir CLI\Test
C:\Users\student\IaC\Introducing the CLI\1. Exercise>
```

Figure 1: DOS: Create and Delete directories.

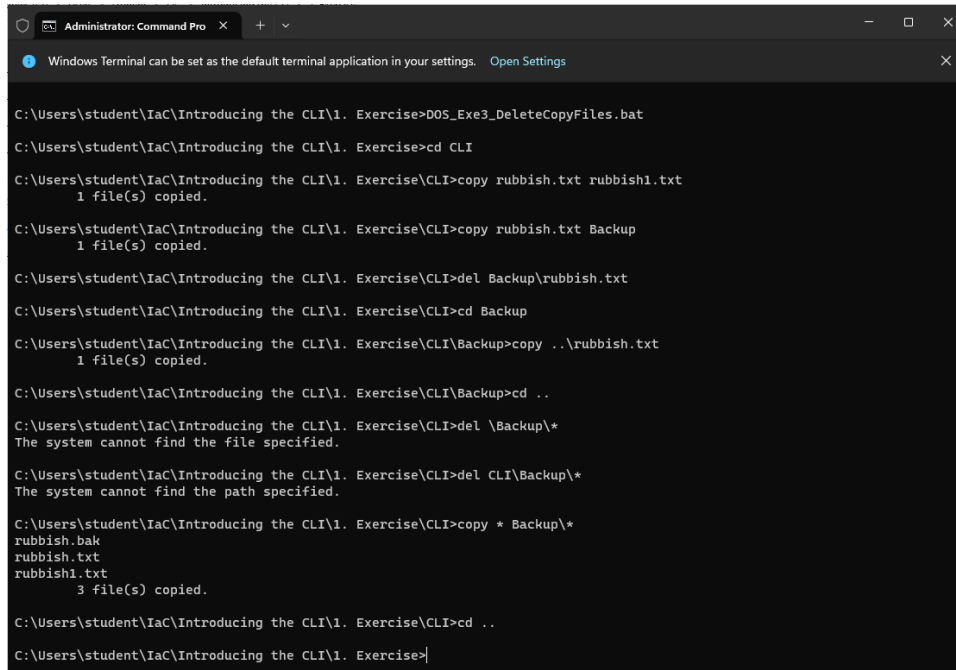
Exercise 2: Create, Move and Delete files.



```
C:\Users\student\IaC\Introducing the CLI\1. Exercise>DOS_Exe2_CreateMoveDeleteFiles.bat
Living easy, living free
Season tickets on a onw way ride
Asking nothing, leave me be
Taking everything in my stride
1 file(s) copied.
1 file(s) copied.
1 file(s) copied.
C:\Users\student\IaC\Introducing the CLI\1. Exercise>
```

Figure 2: DOS: Create, Move and Delete files.

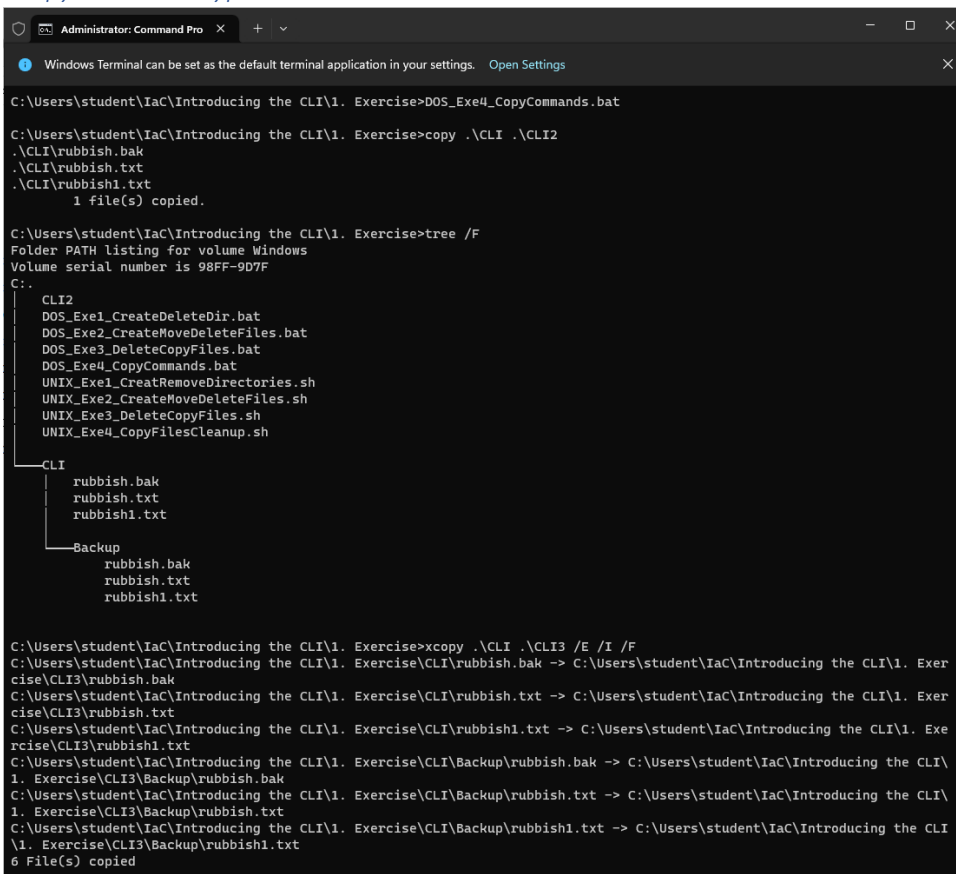
Exercise 3: Delete and Move files.



```
C:\Users\student\IaC\Introducing the CLI\1. Exercise>DOS_Exe3_DeleteCopyFiles.bat
C:\Users\student\IaC\Introducing the CLI\1. Exercise>cd CLI
C:\Users\student\IaC\Introducing the CLI\1. Exercise\CLI>copy rubbish.txt rubbish1.txt
1 file(s) copied.
C:\Users\student\IaC\Introducing the CLI\1. Exercise\CLI>copy rubbish.txt Backup
1 file(s) copied.
C:\Users\student\IaC\Introducing the CLI\1. Exercise\CLI>del Backup\rubbish.txt
C:\Users\student\IaC\Introducing the CLI\1. Exercise\CLI>cd Backup
C:\Users\student\IaC\Introducing the CLI\1. Exercise\CLI\Backup>copy ../rubbish.txt
1 file(s) copied.
C:\Users\student\IaC\Introducing the CLI\1. Exercise\CLI\Backup>cd ..
C:\Users\student\IaC\Introducing the CLI\1. Exercise\CLI>del \Backup\*
The system cannot find the file specified.
C:\Users\student\IaC\Introducing the CLI\1. Exercise\CLI>del CLI\Backup\*
The system cannot find the path specified.
C:\Users\student\IaC\Introducing the CLI\1. Exercise\CLI>copy * Backup\*
rubbish.bak
rubbish.txt
rubbish1.txt
3 file(s) copied.
C:\Users\student\IaC\Introducing the CLI\1. Exercise\CLI>cd ..
C:\Users\student\IaC\Introducing the CLI\1. Exercise>
```

Figure 3: DOS: Delete and Move files.

Exercise 4: Copy command types.



```
C:\Users\student\IaC\Introducing the CLI\1. Exercise>DOS_Exe4_CopyCommands.bat
C:\Users\student\IaC\Introducing the CLI\1. Exercise>copy .\CLI .\CLI2
.\CLI\rubbish.bak
.\CLI\rubbish.txt
.\CLI\rubbish1.txt
1 file(s) copied.
C:\Users\student\IaC\Introducing the CLI\1. Exercise>tree /F
Folder PATH listing for volume Windows
Volume serial number is 98FF-9D7F
C:.
|_ CLI2
|   |_ DOS_Exe1_CreateDeleteDir.bat
|   |_ DOS_Exe2_CreateMoveDeleteFiles.bat
|   |_ DOS_Exe3_DeleteCopyFiles.bat
|   |_ DOS_Exe4_CopyCommands.bat
|   |_ UNIX_Exe1_CreateRemoveDirectories.sh
|   |_ UNIX_Exe2_CreateMoveDeleteFiles.sh
|   |_ UNIX_Exe3_DeleteCopyFiles.sh
|   |_ UNIX_Exe4_CopyFilesCleanup.sh
|_ CLI
|   |_ rubbish.bak
|   |_ rubbish.txt
|   |_ rubbish1.txt
|_ Backup
|   |_ rubbish.bak
|   |_ rubbish.txt
|   |_ rubbish1.txt
C:\Users\student\IaC\Introducing the CLI\1. Exercise>xcopy .\CLI .\CLI3 /E /I /F
C:\Users\student\IaC\Introducing the CLI\1. Exercise\CLI\rubbish.bak -> C:\Users\student\IaC\Introducing the CLI\1. Exercise\CLI3\rubbish.bak
C:\Users\student\IaC\Introducing the CLI\1. Exercise\CLI\rubbish.txt -> C:\Users\student\IaC\Introducing the CLI\1. Exercise\CLI3\rubbish.txt
C:\Users\student\IaC\Introducing the CLI\1. Exercise\CLI\rubbish1.txt -> C:\Users\student\IaC\Introducing the CLI\1. Exercise\CLI3\rubbish1.txt
C:\Users\student\IaC\Introducing the CLI\1. Exercise\CLI\Backup\rubbish.bak -> C:\Users\student\IaC\Introducing the CLI\1. Exercise\CLI3\Backup\rubbish.bak
C:\Users\student\IaC\Introducing the CLI\1. Exercise\CLI\Backup\rubbish.txt -> C:\Users\student\IaC\Introducing the CLI\1. Exercise\CLI3\Backup\rubbish.txt
C:\Users\student\IaC\Introducing the CLI\1. Exercise\CLI\Backup\rubbish1.txt -> C:\Users\student\IaC\Introducing the CLI\1. Exercise\CLI3\Backup\rubbish1.txt
6 File(s) copied
```

Figure 4: DOS: Copy command types

UNIX Shell Results:

Exercise 1: Create and Delete directories.

```
pjmcmenamin@lab000001: ~ - x + v
Windows Terminal can be set as the default terminal application in your settings. Open Settings x

pjmcmenamin@lab000001:~/CLI/1. Exercise$ ll
total 40
drwxrwxr-x 2 pjmcmenamin pjmcmenamin 4096 Oct 30 22:12 /
drwxr-xr-x 5 pjmcmenamin pjmcmenamin 4096 Oct 23 23:08 ./
-rw-rw-r-- 1 pjmcmenamin pjmcmenamin 306 Oct 30 21:27 DOS_Exe1_CreateDeleteDir.bat
-rw-rw-r-- 1 pjmcmenamin pjmcmenamin 579 Oct 22 12:32 DOS_Exe2_CreateMoveDeleteFiles.bat
-rw-rw-r-- 1 pjmcmenamin pjmcmenamin 393 Oct 21 22:24 DOS_Exe3_DeleteCopyFiles.bat
-rw-rw-r-- 1 pjmcmenamin pjmcmenamin 389 Oct 21 22:25 DOS_Exe4_CopyCommands.bat
-rwxr-xr-x 1 pjmcmenamin pjmcmenamin 453 Oct 30 22:11 UNIX_Exe1_CreateRemoveDirectories.sh*
-rwxr-xr-x 1 pjmcmenamin pjmcmenamin 571 Oct 22 12:50 UNIX_Exe2_CreateMoveDeleteFiles.sh*
-rwxr-xr-x 1 pjmcmenamin pjmcmenamin 370 Oct 22 12:46 UNIX_Exe3_DeleteCopyFiles.sh*
-rwxr-xr-x 1 pjmcmenamin pjmcmenamin 361 Oct 22 13:45 UNIX_Exe4_CopyFilesCleanup.sh*
pjmcmenamin@lab000001:~/CLI/1. Exercise$ ./UNIX_Exe1_CreateRemoveDirectories.sh
./
├── CLI
│   ├── Backup
│   └── Test
├── DOS_Exe1_CreateDeleteDir.bat
├── DOS_Exe2_CreateMoveDeleteFiles.bat
├── DOS_Exe3_DeleteCopyFiles.bat
├── DOS_Exe4_CopyCommands.bat
├── UNIX_Exe1_CreateRemoveDirectories.sh
├── UNIX_Exe2_CreateMoveDeleteFiles.sh
├── UNIX_Exe3_DeleteCopyFiles.sh
└── UNIX_Exe4_CopyFilesCleanup.sh

3 directories, 8 files
pjmcmenamin@lab000001:~/CLI/1. Exercise$
```

Figure 5: Create and Delete directories.

Exercise 2: Create, Move and Delete files.

```
pjmcmenamin@lab000001: ~ - x + v
Windows Terminal can be set as the default terminal application in your settings. Open Settings x

pjmcmenamin@lab000001:~/CLI/1. Exercise$ ll
total 44
drwxrwxr-x 3 pjmcmenamin pjmcmenamin 4096 Oct 30 22:16 /
drwxr-xr-x 5 pjmcmenamin pjmcmenamin 4096 Oct 30 22:15 ./
drwxr-xr-x 3 pjmcmenamin pjmcmenamin 4096 Oct 30 22:22 CLI/
-rw-rw-r-- 1 pjmcmenamin pjmcmenamin 306 Oct 30 21:27 DOS_Exe1_CreateDeleteDir.bat
-rw-rw-r-- 1 pjmcmenamin pjmcmenamin 579 Oct 22 12:32 DOS_Exe2_CreateMoveDeleteFiles.bat
-rw-rw-r-- 1 pjmcmenamin pjmcmenamin 393 Oct 21 22:24 DOS_Exe3_DeleteCopyFiles.bat
-rw-rw-r-- 1 pjmcmenamin pjmcmenamin 389 Oct 21 22:25 DOS_Exe4_CopyCommands.bat
-rwxr-xr-x 1 pjmcmenamin pjmcmenamin 453 Oct 30 22:11 UNIX_Exe1_CreateRemoveDirectories.sh*
-rwxr-xr-x 1 pjmcmenamin pjmcmenamin 497 Oct 30 22:22 UNIX_Exe2_CreateMoveDeleteFiles.sh*
-rwxr-xr-x 1 pjmcmenamin pjmcmenamin 370 Oct 22 12:46 UNIX_Exe3_DeleteCopyFiles.sh*
-rwxr-xr-x 1 pjmcmenamin pjmcmenamin 361 Oct 22 13:45 UNIX_Exe4_CopyFilesCleanup.sh*
-rw-r--r-- 1 pjmcmenamin pjmcmenamin 0 Oct 30 22:17 rubbish.txt
pjmcmenamin@lab000001:~/CLI/1. Exercise$ ./UNIX_Exe2_CreateMoveDeleteFiles.sh
Living easy, living free
Season tickets on a onw way ride
Asking nothing, leave me be
Taking everything in my stride
./
├── CLI
│   ├── Backup
│   │   └── rubbish.bak
│   ├── rubbish.bak
│   └── rubbish.txt
├── DOS_Exe1_CreateDeleteDir.bat
├── DOS_Exe2_CreateMoveDeleteFiles.bat
├── DOS_Exe3_DeleteCopyFiles.bat
├── DOS_Exe4_CopyCommands.bat
├── UNIX_Exe1_CreateRemoveDirectories.sh
├── UNIX_Exe2_CreateMoveDeleteFiles.sh
├── UNIX_Exe3_DeleteCopyFiles.sh
├── UNIX_Exe4_CopyFilesCleanup.sh
└── rubbish.txt

2 directories, 12 files
pjmcmenamin@lab000001:~/CLI/1. Exercise$
```

Figure 6: Create, Move and Delete files.

Exercise 3: Delete and Move files.

```
pjmcmenamin@lab000001: ~/CLI/1. Exercise$ ll
total 44
drwxrwxr-x 3 pjmcmenamin pjmcmenamin 4096 Oct 30 22:41 /
drwxr-xr-x 5 pjmcmenamin pjmcmenamin 4096 Oct 30 22:15 ../
drwxr-xr-x 3 pjmcmenamin pjmcmenamin 4096 Oct 30 22:37 CLI/
-rw-rw-r-- 1 pjmcmenamin pjmcmenamin 306 Oct 30 21:27 DOS_Exe1_CreateDeleteDir.bat
-rw-rw-r-- 1 pjmcmenamin pjmcmenamin 579 Oct 22 12:32 DOS_Exe2_CreateMoveDeleteFiles.bat
-rw-rw-r-- 1 pjmcmenamin pjmcmenamin 393 Oct 21 22:24 DOS_Exe3_DeleteCopyFiles.bat
-rw-rw-r-- 1 pjmcmenamin pjmcmenamin 389 Oct 21 22:25 DOS_Exe4_CopyCommands.bat
-rwxr-xr-x 1 pjmcmenamin pjmcmenamin 453 Oct 30 22:11 UNIX_Exe1_CreateRemoveDirectories.sh*
-rwxr-xr-x 1 pjmcmenamin pjmcmenamin 497 Oct 30 22:22 UNIX_Exe2_CreateMoveDeleteFiles.sh*
-rwxr-xr-x 1 pjmcmenamin pjmcmenamin 354 Oct 30 22:37 UNIX_Exe3_DeleteCopyFiles.sh*
-rwxr-xr-x 1 pjmcmenamin pjmcmenamin 325 Oct 30 22:39 UNIX_Exe4_CopyFilesCleanup.sh*
pjmcmenamin@lab000001:~/CLI/1. Exercise$ ./UNIX_Exe3_DeleteCopyFiles.sh
./UNIX_Exe3_DeleteCopyFiles.sh: line 12: ll: command not found

CLI
├── Backup
│   ├── rubbish.txt
│   └── rubbish1.txt
├── rubbish.bak
├── rubbish.txt
└── rubbish1.txt
DOS_Exe1_CreateDeleteDir.bat
DOS_Exe2_CreateMoveDeleteFiles.bat
DOS_Exe3_DeleteCopyFiles.bat
DOS_Exe4_CopyCommands.bat
UNIX_Exe1_CreateRemoveDirectories.sh
UNIX_Exe2_CreateMoveDeleteFiles.sh
UNIX_Exe3_DeleteCopyFiles.sh
UNIX_Exe4_CopyFilesCleanup.sh

2 directories, 13 files
pjmcmenamin@lab000001:~/CLI/1. Exercise$
```

Figure 7: Delete and Move files.

Exercise 4: Copy files and Remove redundant directories.

```
pjmcmenamin@lab000001: ~/CLI/1. Exercise$ ./UNIX_Exe4_CopyFilesCleanup.sh
./
CLI
├── Backup
│   ├── rubbish.txt
│   └── rubbish1.txt
├── rubbish.bak
├── rubbish.txt
└── rubbish1.txt
CLI2
├── Backup
│   ├── rubbish.txt
│   └── rubbish1.txt
├── rubbish.bak
├── rubbish.txt
└── rubbish1.txt
CLI3
├── Backup
│   ├── rubbish.txt
│   └── rubbish1.txt
├── rubbish.bak
├── rubbish.txt
└── rubbish1.txt
DOS_Exe1_CreateDeleteDir.bat
DOS_Exe2_CreateMoveDeleteFiles.bat
DOS_Exe3_DeleteCopyFiles.bat
DOS_Exe4_CopyCommands.bat
UNIX_Exe1_CreateRemoveDirectories.sh
UNIX_Exe2_CreateMoveDeleteFiles.sh
UNIX_Exe3_DeleteCopyFiles.sh
UNIX_Exe4_CopyFilesCleanup.sh

6 directories, 23 files
./UNIX_Exe4_CopyFilesCleanup.sh: line 12: ll: command not found

DOS_Exe1_CreateDeleteDir.bat
DOS_Exe2_CreateMoveDeleteFiles.bat
DOS_Exe3_DeleteCopyFiles.bat
DOS_Exe4_CopyCommands.bat
UNIX_Exe1_CreateRemoveDirectories.sh
UNIX_Exe2_CreateMoveDeleteFiles.sh
UNIX_Exe3_DeleteCopyFiles.sh
UNIX_Exe4_CopyFilesCleanup.sh

0 directories, 8 files
```

Figure 8: Copy files and Remove redundant directories.