Wayne State University

CSC 4421 - Winter 2025
Computer Operating Systems Labs Lab

05 - File System

Points Possible: 100

Tasks * (100 points)

For this Lab, create a single Microsoft Word .docx document or compile to .pdf. Name the file "L06 aa0000" (replacing aa000 with your access ID). **Make sure the document has a .docx or .pdf file extension.** When you are ready to submit, submit only this document to blackboard, there is no need to place it in a folder or compress it with .zip.

At the beginning of the document, list the following information:

HH2781

Rensildi Kalanxhi

CSC 4420

Winter 2025

Lab06

For each of the following steps listed below:

Label the number of each step / part of the assignment in your .docx document. (e.g., 1, 2, 3, ...)

Include a screenshot of your terminal output for each execution of *df* .

Indicate what is happening at each step, what is depicted in each screen shot.

Answer any and all questions.

1. **[Screen Shot, Answer - Explanation]** *df* is a command that displays the amount of disk space available on the file system containing each file name argument. Read man page of *df* command. Run the command

   df to find out how many disk blocks are available and how many are in use. Does the sum of these equals the total number of disk blocks on the disk? If not, explain why there is a difference.

```
voldemort@MSI:/mnt/c/Users/rkala$ df
Filesystem      1K-blocks      Used Available Use% Mounted on
none              4021848         0   4021848   0% /usr/lib/modules/5.15.167.4-microsoft-standard-WSL2
none              4021848         4   4021844   1% /mnt/wsl
drivers         976435196 848118780 128316416  87% /usr/lib/wsl/drivers
/dev/sdc       1055762868   2126064 999933332   1% /
none              4021848        72   4021776   1% /mnt/wslg
none              4021848         0   4021848   0% /usr/lib/wsl/lib
rootfs            4018356      2372   4015984   1% /init
none              4021848       508   4021340   1% /run
none              4021848         0   4021848   0% /run/lock
none              4021848         0   4021848   0% /run/shm
tmpfs                4096         0      4096   0% /sys/fs/cgroup
none              4021848        76   4021772   1% /mnt/wslg/versions.txt
none              4021848        76   4021772   1% /mnt/wslg/doc
C:\             976435196 848118780 128316416  87% /mnt/c
tmpfs              804368        16    804352   1% /run/user/1000
```

   Yes the sum does equals the total number of disk blocks on the disk.

2. Next run the command *df -i* to find out how many inodes are available and in use. **[Screen Shot]**

   For the C:\ drive it shows that there are 999 Inodes, the IUsed is showing -999001 and for IFree is showing 1000000. From what I am observing it seems as IFree is being subtracted from Inodes (999 – 1000000 = -999001). For the following questions I will answer while observing other Filesystems such as tmpfs or /dev/sdc.

```
voldemort@MSI:/mnt/c/Users/rkala$ df -i
Filesystem       Inodes   IUsed    IFree IUse% Mounted on
none            1005462       4  1005458    1% /usr/lib/modules/5.15.167.4-microsoft-standard-WSL2
none            1005462       2  1005460    1% /mnt/wsl
drivers             999 -999001  1000000     - /usr/lib/wsl/drivers
/dev/sdc       67108864   54514 67054350    1% /
none            1005462      40  1005422    1% /mnt/wslg
none            1005462       4  1005458    1% /usr/lib/wsl/lib
rootfs          1004589      12  1004577    1% /init
none            1005462     514  1004948    1% /run
none            1005462       2  1005460    1% /run/lock
none            1005462       1  1005461    1% /run/shm
tmpfs              1024      19     1005    2% /sys/fs/cgroup
none            1005462      50  1005412    1% /mnt/wslg/versions.txt
none            1005462      50  1005412    1% /mnt/wslg/doc
C:\                999 -999001  1000000     - /mnt/c
tmpfs           201092      34   201058    1% /run/user/1000
```

3. Now create a new file with just a few characters in it, and again run *df* and *df -i* commands. **[Screen Shot x2]**

```
voldemort@MSI:/mnt/c/Users/rkala$ df
Filesystem      1K-blocks      Used Available Use% Mounted on
none              4021848         0   4021848   0% /usr/lib/modules/5.15.167.4-microsoft-standard-WSL2
none              4021848         4   4021844   1% /mnt/wsl
drivers         976435196 847893420 128541776  87% /usr/lib/wsl/drivers
/dev/sdc       1055762868   2126068 999933328   1% /
none              4021848        76   4021772   1% /mnt/wslg
none              4021848         0   4021848   0% /usr/lib/wsl/lib
rootfs            4018356      2372   4015984   1% /init
none              4021848       508   4021340   1% /run
none              4021848         0   4021848   0% /run/lock
none              4021848         0   4021848   0% /run/shm
tmpfs                4096         0      4096   0% /sys/fs/cgroup
none              4021848        76   4021772   1% /mnt/wslg/versions.txt
none              4021848        76   4021772   1% /mnt/wslg/doc
C:\             976435196 847893420 128541776  87% /mnt/c
tmpfs              804368        16    804352   1% /run/user/1000
```

```
voldemort@MSI:/mnt/c/Users/rkala$ df -i
Filesystem       Inodes   IUsed    IFree IUse% Mounted on
none            1005462       4  1005458    1% /usr/lib/modules/5.15.167.4-microsoft-standard-WSL2
none            1005462       2  1005460    1% /mnt/wsl
drivers             999 -999001  1000000     - /usr/lib/wsl/drivers
/dev/sdc       67108864   54514 67054350    1% /
none            1005462      40  1005422    1% /mnt/wslg
none            1005462       4  1005458    1% /usr/lib/wsl/lib
rootfs          1004589      12  1004577    1% /init
none            1005462     516  1004946    1% /run
none            1005462       2  1005460    1% /run/lock
none            1005462       1  1005461    1% /run/shm
tmpfs              1024      19     1005    2% /sys/fs/cgroup
none            1005462      50  1005412    1% /mnt/wslg/versions.txt
none            1005462      50  1005412    1% /mnt/wslg/doc
C:\                999 -999001  1000000     - /mnt/c
tmpfs           201092      34   201058    1% /run/user/1000
```

4. Explain the effect of creating this new file. **[Answer - Explanation]**

In df command the available of 1K-blocks have increased by 10292. While in df -I command no Inodes have been used.

5. Now increase the size of this new file by entering a large number (> 5000) of characters, and again run df and df –i commands. Do you notice a difference? **[Screen Shot x2, Answer - Explanation]**

   After adding around 5000 characters in the file, there was 34532 1k-blocks used. Meanwhile Inodes have not been used at all.

```
voldemort@MSI:/mnt/c/Users/rkala$ df
Filesystem      1K-blocks      Used Available Use% Mounted on
none              4021848         0   4021848   0% /usr/lib/modules/5.15.167.4-microsoft-standard-WSL2
none              4021848         4   4021844   1% /mnt/wsl
drivers         976435196 847927952 128507244  87% /usr/lib/wsl/drivers
/dev/sdc       1055762868   2117140 999942256   1% /
none              4021848        76   4021772   1% /mnt/wslg
none              4021848         0   4021848   0% /usr/lib/wsl/lib
rootfs            4018356      2372   4015984   1% /init
none              4021848       508   4021340   1% /run
none              4021848         0   4021848   0% /run/lock
none              4021848         0   4021848   0% /run/shm
tmpfs                4096         0      4096   0% /sys/fs/cgroup
none              4021848        76   4021772   1% /mnt/wslg/versions.txt
none              4021848        76   4021772   1% /mnt/wslg/doc
C:\             976435196 847927952 128507244  87% /mnt/c
tmpfs              804368        16    804352   1% /run/user/1000
```

```
voldemort@MSI:/mnt/c/Users/rkala$ df -i
Filesystem       Inodes   IUsed    IFree IUse% Mounted on
none            1005462       4  1005458    1% /usr/lib/modules/5.15.167.4-microsoft-standard-WSL2
none            1005462       2  1005460    1% /mnt/wsl
drivers             999 -999001  1000000     - /usr/lib/wsl/drivers
/dev/sdc       67108864   54514 67054350    1% /
none            1005462      40  1005422    1% /mnt/wslg
none            1005462       4  1005458    1% /usr/lib/wsl/lib
rootfs          1004589      12  1004577    1% /init
none            1005462     516  1004946    1% /run
none            1005462       2  1005460    1% /run/lock
none            1005462       1  1005461    1% /run/shm
tmpfs              1024      19     1005    2% /sys/fs/cgroup
none            1005462      50  1005412    1% /mnt/wslg/versions.txt
none            1005462      50  1005412    1% /mnt/wslg/doc
C:\                999 -999001  1000000     - /mnt/c
tmpfs           201092      34   201058    1% /run/user/1000
```

6. Repeat the last step, this time entering (> 50,000) characters. **[Screen Shot x2, Answer - Explanation]**

After adding 50000 characters the usage of 1K-blocks decreased by 10000 resulting in only 20664 used. No Inodes have been used or freed even after adding 50000 characters.

```
voldemort@MSI:/mnt/c/Users/rkala$ df
Filesystem      1K-blocks      Used Available Use% Mounted on
none              4021848         0   4021848   0% /usr/lib/modules/5.15.167.4-microsoft-standard-WSL2
none              4021848         4   4021844   1% /mnt/wsl
drivers         976435196 847948616 128486580  87% /usr/lib/wsl/drivers
/dev/sdc       1055762868   2117144 999942252   1% /
none              4021848        80   4021768   1% /mnt/wslg
none              4021848         0   4021848   0% /usr/lib/wsl/lib
rootfs            4018356      2372   4015984   1% /init
none              4021848       508   4021340   1% /run
none              4021848         0   4021848   0% /run/lock
none              4021848         0   4021848   0% /run/shm
tmpfs                4096         0      4096   0% /sys/fs/cgroup
none              4021848        76   4021772   1% /mnt/wslg/versions.txt
none              4021848        76   4021772   1% /mnt/wslg/doc
C:\             976435196 847948616 128486580  87% /mnt/c
tmpfs              804368        16    804352   1% /run/user/1000
```

```
voldemort@MSI:/mnt/c/Users/rkala$ df -i
Filesystem       Inodes   IUsed    IFree IUse% Mounted on
none            1005462       4  1005458    1% /usr/lib/modules/5.15.167.4-microsoft-standard-WSL2
none            1005462       2  1005460    1% /mnt/wsl
drivers             999 -999001  1000000     - /usr/lib/wsl/drivers
/dev/sdc       67108864   54514 67054350    1% /
none            1005462      40  1005422    1% /mnt/wslg
none            1005462       4  1005458    1% /usr/lib/wsl/lib
rootfs          1004589      12  1004577    1% /init
none            1005462     516  1004946    1% /run
none            1005462       2  1005460    1% /run/lock
none            1005462       1  1005461    1% /run/shm
tmpfs              1024      19     1005    2% /sys/fs/cgroup
none            1005462      50  1005412    1% /mnt/wslg/versions.txt
none            1005462      50  1005412    1% /mnt/wslg/doc
C:\                999 -999001  1000000     - /mnt/c
tmpfs           201092      34   201058    1% /run/user/1000
```

7. Repeat the last step, this time entering (> 500,000) characters. **[Screen Shot x2, Answer - Explanation]**

After increasing the number of characters to 500000 there were 1K-blocks more that were being used. As for the Inodes usage, it did not change at all in any of the drivers.

```
voldemort@MSI:/mnt/c/Users/rkala$ df
Filesystem      1K-blocks      Used Available Use% Mounted on
none              4021848         0   4021848   0% /usr/lib/modules/5.15.167.4-microsoft-standard-WSL2
none              4021848         4   4021844   1% /mnt/wsl
drivers         976435196 848168680 128266516  87% /usr/lib/wsl/drivers
/dev/sdc       1055762868   2117152 999942244   1% /
none              4021848        88   4021760   1% /mnt/wslg
none              4021848         0   4021848   0% /usr/lib/wsl/lib
rootfs            4018356      2372   4015984   1% /init
none              4021848       508   4021340   1% /run
none              4021848         0   4021848   0% /run/lock
none              4021848         0   4021848   0% /run/shm
tmpfs                4096         0      4096   0% /sys/fs/cgroup
none              4021848        76   4021772   1% /mnt/wslg/versions.txt
none              4021848        76   4021772   1% /mnt/wslg/doc
C:\             976435196 848168680 128266516  87% /mnt/c
tmpfs              804368        16    804352   1% /run/user/1000
```

```
voldemort@MSI:/mnt/c/Users/rkala$ df -i
Filesystem       Inodes   IUsed    IFree IUse% Mounted on
none            1005462       4  1005458    1% /usr/lib/modules/5.15.167.4-microsoft-standard-WSL2
none            1005462       2  1005460    1% /mnt/wsl
drivers             999 -999001  1000000     - /usr/lib/wsl/drivers
/dev/sdc       67108864   54514 67054350    1% /
none            1005462      40  1005422    1% /mnt/wslg
none            1005462       4  1005458    1% /usr/lib/wsl/lib
rootfs          1004589      12  1004577    1% /init
none            1005462     516  1004946    1% /run
none            1005462       2  1005460    1% /run/lock
none            1005462       1  1005461    1% /run/shm
tmpfs              1024      19     1005    2% /sys/fs/cgroup
none            1005462      50  1005412    1% /mnt/wslg/versions.txt
none            1005462      50  1005412    1% /mnt/wslg/doc
C:\                 999 -999001  1000000     - /mnt/c
tmpfs            201092      34   201058    1% /run/user/1000
```

8. Explain the effect of increasing the size of the new file. **[Answer - Explanation]**

In the beginning when the increase was not big, more 1k-blocks became available, the reason could be because those 1k-blocks shared the space with each other making more availability. But when the characters drastically increased, more 1k-blocks were being used. In conclusion the number of I nodes did not change because they track files, but 1k-blocks check the space usage of file content.

Grading:

1. (*80 points) Five points for each **[Screen Shot]** and each **[Answer - Explanation]**. There are 16 total, for 80 points.

2. (*20 points) For a complete solution (all 16 **[Screen Shot]** and **[Answer - Explanation]**), a document that is well formed, includes the specified information at the beginning of the document, and is saved with the appropriate file name and document type (.docx or .pdf).