**\*Level 1: Windows File Systems**

Refer to the following document when answering the questions for Level 1.

<https://fossbytes.com/fat32-vs-ntfs-vs-exfat-difference-three-file-systems/>

1. What is the definition of a file system?

A file system is basically a set of rules used to decide how data is stored and fetched in a [storage device](http://fossbytes.com/how-do-hard-drives-work-and-store-tons-of-data/), be it a hard drive, flash drive, or something else. Like the conventional way we used to store data in our offices in different files, the same method is deployed in computing.

1. What are the three file systems used on Windows computers?

* FAT32 NFTS exFAT

1. What are the properties of the FAT file system?
   1. The FAT file system was the original Windows 95 file system. When was it introduced?

The story started in 1977 with the original 8-bit FAT file system intended as an antecedent to Microsoft’s [Standalone Disk Basic-80](https://en.wikipedia.org/wiki/Standalone_Disk_BASIC-80) which was launched for Intel’s 8080-based NCR 7200 in 1977/1978 – a data entry terminal with 8-inch floppy disks.

* 1. How is the FAT16 file system different from the FAT32 file system?

FAT32 surmounted the limited volume size offered by the FAT16 file system. The 32-bit File Allocation Table was released in August 1995, with the launch of Windows 95 operating system. FAT32 allows you to store files of size up to 4GB and the maximum disk size can go up to 16TB.

* 1. What is the file size limit of the FAT32 file system?

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* 1. What other devices currently use the FAT file system?

The FAT32 file system is perfect for storage devices like flash drives but you’ll have to make sure you don’t have an individual file larger than 4GB. It has been widely implemented beyond the realm of computers, like gaming consoles, HDTVs, DVD & Blu-Ray players, and practically any device with a USB port. All versions of Windows and Linux distributions support the FAT32 file system, even Apple’s MacOS provides complete support it.

1. What are the properties of the NTFS file system?
   1. The NTFS file system is what is used on current Windows computers. When was it introduced?

was introduced in 1993 with their Windows NT 3.1 operating system coming into existence.

* 1. How is the NTFS file system different from the FAT file system?

NTFS file system offers inexhaustible file size limits. As of now, it would be next to impossible for us to even reach somewhere near the boundary.

* 1. What is the file size limit of the NTFS file system?

 256 TB out the whopping 16 EB – 1KB

* 1. What is the disk size limit of the NTFS file system?
  2. What are some notable features of the NTFS file system?

Other notable features include reparse points, sparse file support, disk usage quotas, distributed link tracking, and file-level encryption. The NTFS file system supports backward compatibility with the previous versions.

* 1. What are some limitations regarding how other devices support the NTFS file system?  
       
     The NTFS file system is supported by Windows XP and later versions. Apple’s Mac OSX provides read-only support for an NTFS-formatted drive and only a few Linux variants are able to provide write support for NTFS.

1. Provide a summary of the exFAT file system.

The exFAT (Extended FAT) is another Microsoft proprietary file system which finds its use in ball games where the FAT32 feels out of breath. Most of the modern digital cameras use exFAT. High capacity SDXC memory cards are now pre-formatted with the exFAT file system, as it is lighter in contrast to NTFS and supports file of sizes, more than 4GB. So, if you have an exFAT SD card, you shall face no issues while copying full-length HD movies on it which is not the case with FAT32.High capacity SDXC memory cards are now pre-formatted with the exFAT, as it is lightweight in contrast to NTFS and supports file size more of than 4 GB. So, if you have an exFAT SD card you will have no issues while copying full-length HD movies on it which is not the case with FAT32.Currently, Microsoft holds the US Patent 8321439 for Quick File Name Lookup using Name hash. It is a method which escalates file search speed. They’ve not released a complete specification set for the exFAT file system, for which the vendors have to obtain a restricted license from Microsoft.Most of the countries recognize the US Patent Law and thus, any implementation of the exFAT file system is not possible for the vendors which intend it to be a part of an open-source operating system or a commercial software.Microsoft’s stubbornness to make the exFAT available freely has triggered the development of custom implementations of the file system. A FUSE-based version of the exFAT file system, named exfat-fuse, provides read/write operations for many Linux distributions including FreeBSD. A kernel-based implementation made by Samsung was accidentally leaked on GitHub but was later published officially.Launched in 2006, exFAT file system has the same 16 EB file size limit as NTFS, but it is way lighter as it doesn’t contain many of the extra features that the latter has. Talking about the compatibility, full read and write support is provided by Mac, Android, and Windows operating systems. But for Linux distributions, the appropriate software facilitates the support.

**Level 2: Windows NTFS Permissions**

Refer to the following document when answering the questions for Level 2.

<http://www.ntfs.com/ntfs-permissions.htm>

1. Read the information provided on the “Setting Permissions” page.
   1. Summarize how to view and set file and folder permissions.

In any Windows network, you can set sharing permissions for drives and folders. On that network, each user can choose to share entire drives or individual folders with the network. NTFS (NT File System) permissions are available to drives formatted with NTFS. The advantage with NTFS permissions is that they affect local users as well as network users and they are based on the permission granted to each individual user at the Windows logon, regardless of where the user is connecting. NTFS is the standard file system of Windows NT and all Windows operating systems that have come after it. Windows 2000 and older introduced some far-reaching changes that included control over inherited permissions and how permissions were configured to share files and folders. You use shared folders to provide network users with access to file resources. Administrators can use the NTFS utility to provide access control for files and folders, containers and objects on the network as a type of system security. Known as the "Security Descriptor", this information controls what kind of access is allowed for individual users and groups of users. Along with the additional functionality that NTFS provides comes the potential for complex configurations that can lead to administration headaches. If you don't have a thorough understanding of various permissions and their relationships, it can be difficult to sort out a permission problem when it occurs. For a more low-level description of NTFS SECURITY\_DESCRIPTOR, see Metafile $Secure in this guide.

1. Read the information provided on the “Advanced Permissions” page.
   1. List the advanced permissions that affect files.

* Traverse Folder/Execute File
* Read Attributes
* Read Extended Attributes
* Create Files/Write Data
* Write Attributes
* Write Extended Attributes
* Delete Subfolders and Files
* Delete
* Change Permissions
* Take Ownership
* Synchronize
  1. List the advanced permissions that affect folders.
* Traverse Folder/Execute File
* List Folder/Read Data
* Read Attributes
* Read Extended Attributes
* Create File/Write Data
* Create Folders/Append Data
* Write Attributes
* Write Extended Attributes
* Delete Subfolder and Files
* Delete
* Read permissions
* Change Permissions
* Take Ownership
* Synchronize

1. Read the information provided on the “Basic Permissions” page.
   1. The basic permissions are listed at the top of the columns in the table. List the 6 basic permissions.

* Basic Full Control
* Basic Modify
* Basic Read & Execute
* Basic List Folder Contents
* Basic Read
* Basic Write
  1. What basic permissions allow a user to write data to a file?
* Create Files/Wrote Data
* Create Folders/Append Data
* Write Attributes
* Write Extended Attributes

1. Why do you think there are separate permissions for reading and writing a file? Provide an example where you might want somebody to read a file but not be able to change it.

When there are situations when you want to send a file to someone but they are only allowed to read it and not edit it for example when a teacher sends a rubric to a student.

1. Why do you think there are separate permissions for listing folders and reading files? Provide an example where you might want somebody to be able to list a folder but not be able to read a file in the folder.

When the folder contains certain documents that you only want a person to read for example when you are working on an exam sheet and you need it for your students.

**Level 3: Windows Share Permissions**

Refer to the following document when answering the questions for Level 3.

<https://blog.netwrix.com/2018/05/03/differences-between-share-and-ntfs-permissions/>

1. What are share permissions?
   1. Who do share permissions affect?

They affect local users and network users

* 1. Who do share permissions not affect?

To users who log on locally

* 1. Summarize the 3 types of share permissions.

1. Summarize the main difference between NTFS and Share Permissions.

Read — Users can view file and subfolder names, read data in files, and run programs. By default, the “Everyone” group is assigned “Read” permissions.

Change — Users can do everything allowed by the “Read” permission, as well as add files and subfolders, change data in files, and delete subfolders and files. This permission is not assigned by default.

Full Control — Users can do everything allowed by the “Read” and “Change” permissions, and they can also change permissions for NTFS files and folders only. By default, the “Administrators” group is granted “Full Control” permissions.

1. Summarize how to view and change share permissions.

* **Assign permissions to groups, not user accounts** — Assigning permissions to groups simplifies management of shared resources. If a user’s role changes, you simply add them to the appropriate new groups and remove them from any groups that are no longer relevant.
* **Enforce the principle of least privilege** — Grant users the permissions they need and nothing more. For example, if a user needs to read the information in a folder but never has a legitimate reason to delete, create, or change files, make sure they have only the “Read” permission.
* **Use only NTFS permissions for local users** — Share permissions apply only to users who access shared resources over the network; they do not apply to users who log on locally.
* **Put objects with the same security requirements in the same folder** — For example, if users require the “Read” permission for several folders that are used by one department, store those folders in the same parent folder and share that parent folder, rather than sharing each folder individually.
* **Do not set the permissions for the “Everyone” group to “Deny”** — The “Everyone” group includes anyone who has access to shared folders, including the “Guest” account, with the exception of the “Anonymous Logon” group.
* **Avoid explicitly denying permissions to a shared resource** — Normally, you should explicitly deny permissions only when you want to override specific permissions that are already assigned.
* **Grant the “Administrators” group the “Full Control” permission to the parent shared folder** — This strategy enables administrators to manage permissions, export access lists, and track changes to all permissions, files and folders.
* **Keep a close eye on the membership of the “Administrators” group** — Users in this group have “Full Access” permissions to all of your shared files and folders. Therefore, you should carefully audit changes to its membership, using either [audit policy and the security event log](https://www.netwrix.com/how_to_detect_membership_changes_in_domain_admins_group.html?itm_source=blog&itm_medium=context&itm_campaign=permissions&itm_content=none&cID=70170000000kgEZ), or third-party software solutions that can notify you about any changes to this powerful group in real time, as well as facilitate regular attestation for all user permissions.

**Level 4: Your Files and Folders**

1. Organized your files and folders on your network drive to match your GitHub repository.
   1. Create a folder on your student drive for Computer Science Work
   2. Create sub-folders (e.g. Topic A, etc.) to match the folders on your GitHub repository
   3. Move your answer files and other work you have done for this course into the proper sub-folders.
   4. Show your organized folders/files to Mr. Nestor