1. Answer the following questions about hard drives:
   1. Explain each of the following hard drive components:
      1. Platter

A ‘layer’ of an HDD in between read/write heads.

* + 1. Cylinder

Cylinders are groupings of all sectors of the platters in that boundary. There are as many cylinders as there are tracks. The entire collection of platters starting from track 0 is one giant cylinder containing smaller cylinders. One of the three things needed to access a certain record.

* + 1. Track

A circular path around the HDD. The outermost track is called track 0.

* + 1. Sector

A ‘chunk’ of the entire HDD. Resembles a slice of pie.

* + 1. Block

A group of records between gaps on the tape of a hard drive. The spacing is to give the tape time to stop from the highspeed it is scanned.

* + 1. Read/Write Head

These small heads read and write data to the HDD.

* + 1. Arm

Access arms move read and write heads.

* + 1. Spindle

The shaft which holds all the platters of the HDD in place and rotates

* 1. Where on a platter is **Track 0** located?

Track 0 is the outermost track of a disk.

* 1. How many read/write heads exist in a hard drive containing four (4) platters?

Eight; There are 2 read/write heads per platter.

* 1. Explain each of the three (3) factors of **Access Time**:
     1. Seek Time

The time required to position the read/write head on the proper track. This is the slowest factor of all three.

* + 1. Search Time (rotational delay)

The time it takes to rotate the disk until the requested record is under the read/write heads.

* + 1. Transfer Time

The time needed to transfer data from secondary storage to main memory (such as RAM). The fastest of all three.

* 1. Given the following hard drive characteristics, calculate **Total Access Time**:
     1. Track order to access data: 10, 5 and 15 (assume read/write head is located at **Track 0**)
     2. Average Seek Time: 0.75 ms per track
     3. Average Search Time (rotational delay): 8.4 ms
     4. Average Transfer Time (100 bytes): 0.1 ms
     5. Sizes of Data: 5 - 300 bytes, 10 - 150 bytes, 15 - 500 bytes

For Track 10:

0.75 \* 10 = 7.5 Seek time + 8.4 Search time + 0.15 Data Transfer = 16.05ms

For Track 5:

0.75 \* 5 = 3.75 Seek + 8.4 Search + 0.3 Transfer = 12.45 ms

For Track 15:

0.75 \* 10 = 7.5 Seek + 8.4 Search + 0.5 Transfer = 16.4 ms

Total Access Time = **44.9 ms**

1. List and explain the three (3) primary differences between a hard drive and an optical disc.

* Magnetic disks spin at a constant speed while Optical disks adjust speed to compensate for sector locations.
* Magnetic disks have concentric tracks of sectors, Optical discs have a single spiraling track.
* Magnetic disks use read and write heads for data manipulation and optical discs use a laser.

1. Answer the following questions about **RAID**:
   1. What does the acronym RAID stand for?

Redundant Array of Inexpensive Disks

* 1. Which RAID Level is **not** considered a true form of RAID?

Level 0 as it provides no error correction or redundancy.

* 1. Which RAID Level does **not** provide data redundancy or error correction?

Level 0

* 1. Given two (2) **500 GB** hard drives configured as **RAID Level 0**, how much

usable drive space exists?

1 TB

* 1. Given two (2) **500 GB** hard drives configured as **RAID Level 1**, how much usable drive space exists?

500 GB

* 1. Given three (3) **500 GB** hard drives configured as **RAID Level 5**, how much usable drive space exists?

1 TB

* 1. Which **RAID Level** (0, 1 or 5) would create the **maximum** amount of usable drive space and provide **data redundancy** and **fault tolerance**?

RAID 5

1. Explain the following file elements:
   1. Field

A group of bytes that are related and can be identified with a name, type and size.

* 1. Record

A group of related fields.

* 1. File

Group of related records which can contain information by programs to generate reports.

* 1. Database

Group of related files that are connected at various levels to offer flexible access to the data.

* 1. Program File

File that contains instructions for running programs.

* 1. Data File

File that contain data.

* 1. Directory

Special files that contain listings of filenames and their attributes.

* 1. Subdirectory

Directory created by users within boundaries of existing directories. Also called a ‘Folder’.

1. List and explain the eight (8) types of information typically stored in a file descriptor.

* Filename: The unique name of a file.
* File type: Organization and usage of the file.
* File size: The amount of space used by storing a file.
* File location: The first physical block where the file is located.
* Date / Time of creation: When the file was created.
* Owner: The one who either initially created a file.
* Protection Information: Restrictions and permissions on who may access a file.
* Max record size: The fixed or maximum size of the file.

1. Explain the primary differences between an **absolute** filename and a **relative** filename.

An **Absolute Filename** is the typically long name that has the path information to the file in question.

**Relative filenames** indicate names without path information when the file appears in certain folders.

1. Answer the following qustions about **fixed-length** and **variable-length** records:
   1. What is the primary difference between fixed- and variable-length records?

**Fixed-length** records are the easiest to access and left over data is truncated which corrupts the data, and if the record is too large storage space is wasted.

**Variable-Length** records don’t leave empty storage and don’t truncate, making them easier to read. However, this makes them harder to access because it’s hard to calculate where the records are located.

* 1. What happens if a data element is smaller than the fixed-length of the respective field?

The leftover is truncated and corrupts the data.

* 1. What happens if a data element is larger than the fixed-length of the respective field?

Storage space is wasted.