Animesh Patni
A20403240

# CS-525 Advance Database Organisation:

Problem Set: 1

Submitted By: Animesh Patni

## Problem 1:

What is the most important differences between a hard disk and a SSD?

| Points | Hard Disk Drive | Solid State Drive |
|---|---|---|
| **Cost** | Cheap | Expensive |
| **Battery Life** | Draws more battery as compared to SSD | Consumes less battery |
| **Boot up time** | Boot up time is not that fast | Boot up time is pretty fast |
| **Storage Type** | Uses Magnetic storage to store and retrieve data | Uses Non-Volatile Storage |
| **Performance** | Not as fast as SSD | Mush Faster than HDD |
| **Noise** | There are moving parts so there is some noise. | There are no moving parts, so there would be no noises as such. |
| **Affect to Magnet** | Might erase the whole data | SSD is magnet safe. |
| **Write Speed** | 50-120MBs/sec: Range | Above 200 MBs/sec and up to 550MBs/sec |
| **Form Factor** | Available in standard 7mm to 9.5 mm design. | Thinnest of the available storage options available |
| **Durability** | Not as durable as SSD | More Durable. |
| **File Opening Speed** | Not as fast as SSD | Much faster as compared to HDD |

## Problem 2:

The Megatron 777 disk has the following characteristics:

1. There are ten surfaces, with 10,000 tracks each.

2. Tracks hold an average of 1000 sectors of 512 bytes each.

3. 20% of each track is used for gaps.

4. The disk rotates at 10,000 rpm.

5. The time it takes the head to move n tracks is 1 + 0.001n milliseconds.

6. The surface is 3.5-inch diameter with innermost part of each surface of radius 0.75 inch.

Animesh Patni
A20403240

**Answer the following questions about the Megatron 777:**

2.a. What is the capacity of the disk?

The Total Capacity of the Disk is: (10 surfaces) *(10,000 tracks) *(1000 Sectors) *(512 Bytes) = **51.2 GBs**

2.b. If all tracks hold the same number of sectors, what is the minimum and maximum density of bits in the sectors of a track? Hint: Circumference of Circle =π × diameter = 2π × radius

The Min Density of bits = (1000 * 512 * 8)/ (π * 3.5 * 0.8) = **465878.071 bits/inch.**

The Max Density of bits = (1000 * 512 * 8)/ (2 * π * 0.75 * 0.8) = **1087048.832 bits/inch.**

2.c. What is the maximum seek time?

The Max Seek Time will occur when the head move across all the tracks. Thus, using the information giving in point 5: 1 + 0.001n milliseconds, with n = 10,000.

Therefore: 1 + 0.001(10,000) = **11 milliseconds.**

2.d. What is the maximum rotational latency?

So, for the Max Rotational Latency we have RPM: 10,000 and rotation of full 360 degree i.e. 1.

Thus, (1/10000) *60 = 0.006 = **6 milliseconds.**

2.e. If a block is 16, 384 bytes (i.e., 32 sectors), what is the transfer time of a block?

16,384 bytes that is 32 Sectors.

A block occupies 32 sectors that's is head must pass over 32 sectors and 31 gaps.

A gap occupies 20% of the circle, so therefore out of 360 Degree gap occupies:

0.2 * 360 = 72 Degrees.

Remaining (360-72) = 288 Degrees are covered by sectors.

Total degrees covered by both sectors and gaps: [(72*31)/1000] + [(288*32)/1000] = 11.448 degrees.

Time for one rotation is 6 ms.

Transfer Time = (total degrees * time for one rotation) = (11.448/360) * 6 = **0.1908 milliseconds.**

2.f. What is the average seek time?

There are approx. 10000/3 = 3333 Cylinders that are to be covered.

Therefore, Avg. Seek Time = 1+0.001*3333 = **4.333 milliseconds.**

2.g. What is the average rotational latency?

On an average the rotation would be 180 degrees.

The time for one rotation is 6 ms.

So, for 180 degrees it would be 0.5*6 **= 3 ms.**

## Problem 3:

Consider a disk with a sector size of 512 bytes, 2000 tracks per surface, 50 sectors per track, five double-sided platters, and average seek time of 10 msec.

3.a. What is the capacity of a track in bytes? What is the capacity of each surface? What is the capacity of the disk?

Capacity of Tracks in bytes: sector/track * bytes/sector = 50 * 512 = **25600 bytes**

Capacity of Each Surface: tracks/surface * bytes/track = 2000 * 25600 = **51200000 bytes**

Capacity of Disk: surfaces/disk * bytes/surface = 51200000 * 5 * 2 = **512000000 bytes**

3.b. How many cylinders does the disk have?

The number of cylinders = number of tracks per disk = **2000.**

3.c. Give examples of valid block sizes. Is 256 bytes a valid block size? 2048? 51200?

The block size should always be the multiple of sector size.

**256 is not a valid bloc size.**

**2048 is a valid block size.**

**51200 is not as it cannot exceed the max capacity.**

3.d. If the disk platters rotate at 5400 rpm (revolutions per minute), what is the maximum rotational delay?

The max rotational delay means taking the whole 360 degrees across the disk.

So, (1/5400) *60 = **0.011 seconds.**

The average would be just the half which is 0.011/2 = **0.006 seconds.**

3.e. If one track of data can be transferred per revolution, what is the transfer rate?

Transfer Rate: 25600/0.011 **= 2327272.**