**CS525-01/02/03 - Spring 2018**

**Problem Set 1**

**Problem 1**

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

The most important difference is their speed difference. This is because the way they access data based on their physical structure.

**Problem 2 1**

**• 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.**

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

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

The disk has 10 surfaces \* 10,000 tracks each = 100,000 total tracks. The average track has 1000 sectors \* 512 bytes = 512,000 bytes. Thus, the capacity = 512,000 bytes each track \* 100,000 tracks = 51.2 total GB.

**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**

Minimum Density Of Bits: 1000sectors \* 512bytes per sector \* 8bit / 3.5Pi = 3.7 \* bits/inch.

Maximum Density Of Bits: 1000sectors \* 512bytes per sector \* 8bit / (2\*0.75PI) = 8.7 \* bits/inch.

**2.c. What is the maximum seek time?**

When the head have to move between most far away tracks, the Max seek time occurs.

1 + 0.001 \* 10,000 tracks = 11 ms.

**2.d. What is the maximum rotational latency?**

A full rotation cost max rotational latency.

1 / 10,000 rpm = 0.006s.

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

Since one full rotation cost 6ms, useful rotation cost 6ms \* 0.8 = 4.8ms.

Thus, 32 sectors would cost 4.8/32 = 0.15ms to be transferred.

**2.f. What is the average seek time?**

Avg time = move 1 to 10, 000 tracks total time / 10 000 = 6ms

**2.g. What is the average rotational latency?**

Avg rotational latency = 60s / 10, 000 \* 0.5 = 3ms

Problem 32

Consider a disk with a sector size of 512 bytes, 2000 tracks per surface, 50 sectors per track, five double-sided latters, 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?**

Cap(track) = 50 \* 512 = 25,600 bytes.

Cap(Surface) = 2000 \* Cap(track) = 51.2 \* bytes

Cap(Disk) = 10 \* Cap(Surface) = 51.2 \* bytes.

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

Since the num of cylinders equal to num of tracks. Thus the number of cylinders =

2000tracks per surface \* 10 surface = 20000 tracks/cylinders.

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

Since the sector size is 512 bytes so the valid block size is the multiple of sector size. For example, 512bytes, 1024bytes etc..

So the 256 is not valid.

2048 is valid since 4 sectors is < maximum sectors per track

51200 is not valid since it require 100 sectors.

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

Max rotation delay = full rotation time = 60 / 5400 = 11.1ms

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

Since the cap(track) = 25,600 bytes so the transfer rate = 25600 /(60/5400) = 2304 bytes/ms