

# Computer Architecture—Homework V

## 107 Fall semester, Chapter 6 & 7

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6.3 Consider a magnetic disk drive with 8 surfaces, 256 tracks per surface, and 32 sectors per track. Sector size is 1KB. The average seek time is 8ms, the track-to-track access time is 1.5ms, and the drive rotates at 3,000rpm. Successive tracks in a cylinder can be read without head movement.

- (a) What is the disk capacity?
- (b) What is the average access time?
- (c) Assume this file is stored in successive sectors and tracks of successive cylinders, starting at sector 0, track 0, of cylinder  $i$ . Estimate the time required to transfer a 2.5MB file.
- (d) What is the burst transfer time?

6.4 Consider a single-platter disk with the following parameters:

- rotation speed: 3,600rpm;
- number of tracks on one side of platter: 3,000;
- number of sectors per track: 300;
- seek time: 1ms for every hundred tracks traversed.

Let the disk receive a request to access a random sector on a random track and assume the disk head starts at track 0.

- (a) What is the average seek time?
- (b) What is the average rotational latency?
- (c) What is the transfer time for a sector?
- (d) What is the total average time to satisfy a request?

6.6 Consider a disk that rotates at 3,600rpm. The seek time to move the head between adjacent tracks is 2ms. There are 64 sectors per track, which are stored in linear order from sector 0 through sector 63. The head sees the sectors in ascending order. Assume the read/write head is positioned at the start of sector 1 on track 8. There is a main memory buffer large enough to hold an entire track. Data is transferred between disk locations by reading from the source track into the main memory buffer and then writing the data from the buffer to the target track.

- (a) How long will it take to transfer sector 1 on track 8 to sector 1 on track 9?
- (b) How long will it take to transfer all the sectors of track 8 to the corresponding sectors of track 9?

7.12 DMA module is transferring data to memory using cycle stealing, from a device that transmits data at a rate of 19,200 bps. The speed of the CPU is 1MIPS. By how much would the DMA module affect the performance of the CPU? (*Hint:* Ignore data read/write operations and assume the processor only fetches instructions.)