

Department of Electrical and Computer Engineering

Computer Engineering

Course ECSE-322B

Problem Set 9

9 March 2008

1. Most disk drives, both hard and soft, are designed to record over only part of the available surface.
 - (a) Explain why this is so.
 - (b) Derive an expression for the inner radius, r , of the recording area of a disk (with an outer radius of R inches, t tracks per inch and a recording density of d bits per inch) such that the amount of data stored on the disk is maximized.
 - (c) What would be the effect in terms of disk performance and amount of data stored if the inner radius derived in part (b) was halved?
 - (d) What would be the effect in terms of disk performance and amount of data stored if the inner radius derived in part (b) was increased by 50%?
2. Why is it advisable to defragment a disk and what causes fragmentation in the first place?
3. A common disk size is 3.5 inches in diameter. If the innermost track is recorded 0.75 inches from the centre and the outermost track is recorded 1.65 inches from the centre, what is the density of bits on the surface of the disk? Assume the surface contains 150 megabytes of data. What assumption did you make?
4. What are the access times of semiconductor memory, hard disks, and floppy disks?
5. Why do disks and tapes require that the media move past the read/write heads in order for data to be read?

6. A disk has 250 tracks and rotates at 2400 rpm. The average time for moving the head between adjacent tracks is 0.4 ms. What are the average seek and latency times of that disk, approximately?

7. A disk rotates at 3000 rpm and has an average seek time of 70 ms. What is the average time needed to read a file that is stored in 12 sectors, assuming that each of these sectors is on a different track?

8. A computer system is designed to accept several 3.5 inch hard disk drives. The disks are state of the art and use a recording density of 800 Mbits/square inch. One surface on each disk is to be used for timing information and thus is unavailable for storing data and the disks are formatted to store 1024 bytes per sector. The disks are designed to use a recording area which has an inner radius of 0.75 inches and an outer radius of 1.75 inches. If the address structure for accessing the disk drives is as follows:

3 bits for the disk address

4 bits for the surface address

11 bits for the track address

4 bits for the sector address

what is the maximum amount of disk space that can be installed on the computer?