

## Test Problems

5.1 Suppose that the head of a moving head disk with 200 tracks, 0 to 199, is currently serving a request at 143 and has just finished a request at track 125. The queue of request is kept in FIFO order 86, 147, 91, 177, 94, 150, 102, 175, 130. What is the total number of head movement needed to specify these requests for the following disk scheduling algorithms?

- a. SSTF scheduling
- b. SCAN scheduling

5.2 Suppose it takes a disk an average of 10 milliseconds to get to a specific sector and that once it is there, it can transfer 2Mbytes per specific, and that the average job is 3,00,000 bytes long. How long does it take to swap one job out and another job in?

5.3 On a disk with 1000 cylinders, numbers 0 to 999, compute the number of tracks the disk arm must move to satisfy all the requests in the disk queue. Assume the last request serviced was at track 345 and the head is moving toward track 0. The queue in FIFO order contains requests for the following tracks : 123, 874, 692, 475, 105, 376. Perform the computation for the following scheduling algorithms :

- |           |      |
|-----------|------|
| a. FIFO   | 2013 |
| b. SSTF   | 1298 |
| c. SCAN   | 1219 |
| d. LOOK   | 1009 |
| e. C-SCAN | 1967 |
| f. C-LOOK | 1507 |

5.4 A disk has 8 sectors per track and spins at 600 rpm. It takes the controller 10ms from the end of one I/O operation before it can issue a subsequent one. How long does it take to read all 8 sectors using the following interleaving systems?

- |                        |        |
|------------------------|--------|
| a. No interleaving     | 800 ms |
| b. Single interleaving | 200ms  |
| c. Double interleaving | 275ms  |

5.5 On a system using a disk cache, the mean access time is dependent on the mean cache access time, the mean disk and the hit rate. For the following what is mean access time?

- a. Cache: 1 ms ; disk : 100 ms ; hit rate : 25%;
- b. Cache: 1 ms ; disk : 100 ms ; hit rate : 50%;

(A) 75.25                      (B) 50.50

5.6 When an object is subjected to a constant acceleration  $a$ , the relationship between distance  $d$  and time  $t$  is given by  $d = \frac{1}{2} at^2$ . Suppose that, during a seek, a disk drive having 5000 cylinders numbered from 0 to 4999, accelerates the disk arm at a constant rate for the first half of the seek, then decelerates the disk arm at the same rate for the second half of the seek. Assume that the disk can perform a seek to an adjacent cylinder in 1 millisecond and a full stroke seek over all 5000 cylinders in 18 milliseconds.

- a. The distance of a seek is the number of cylinders that the head moves. Explain why the seek time is proportional to the square root of the seek distance.
- b. Write an equation for the seek time as a function of the seek distance. This equation should be of the form  $t = \sqrt{x + y} \cdot L$ , where  $t$  is the time in milliseconds, and  $L$  is the seek distance in cylinders.
- c. Assume that currently the request at cylinder 143 is being served and previous request was at cylinder 125. Given, the queue of pending requests in FIFO order is 86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130. Calculate total seek time for the schedules FCFS (First Come First Serve) and SSTF (Shortest Seek Time First). Also find which schedule is faster.
- d. The *percentage speedup* is the time saved divided by the original time. What is the percentage speedup of the faster schedule over the slower one. Ignore the overhead of rotational latency and data transfer.

5.7 Describe skeleton of a design of a key board having button for a delete word operation. The delete word operation requires that the cursor is positioned at the end of the word and delete word key deletes the word.

- 5.8 A display terminal has 1200\*800 pixels. Initially we may have a display window of 600\*400 pixels. On this window we have text on display with 60 characters per line. A character may occupy a 8\*12(height in pixel) box. How many lines of text can be maximally displayed on this and if it takes 10 microseconds to put a character on the screen, how long will it take to scroll down by 1 line on the window.
- 5.9 On a certain disk drive we have observed a 1millisecond seek time per cylinder of movement. Given that we have one reading head for each disk and requests are pending to read from cylinder numbers 15, 20, 10, 3 and 5. If the arm currently is located on cylinder 20 which of the following would yield the fastest retrieval.
- First come first served
  - Elevator algorithm if we were following to first move towards higher cylinder number and then return.
  - Nearest cylinder first strategy is used.
- 5.10 A disk has 16 sectors of 1024 bytes on each track. Suppose the disk rotation is at 600 rpm, how long does it take to
- read an entire track
  - what is the volume of data that can be stored on disk if it has 10 tracks
- 5.11 If the read-head is about a quarter rotation away-what is the .....before we can read the desired sector.
- 5.12 A typical terminal line has a certain band rate. Consider such a line with 9600 band rate. It is possible to connect multiple terminals to such a line and multiplex the input. Suppose the sampling rate is 0.1microsecond and we need 10 samples to determine if a data was a 0 or 1. How many terminals can be supported on this line?
- 5.13 A DMA controller uses main memory buffer. It employs cycle stealing to deposit an input data to this buffer. Suppose the external device uses 9600 bands transfer rate. Also suppose the primary memory transfer rate is 100 million words/second with every 5<sup>th</sup> instruction cycle stolen. How long will it take to transfer 10K data from the external device to the buffer?