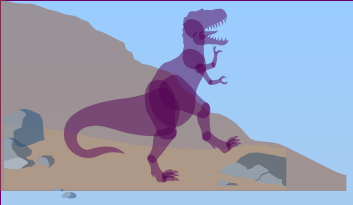
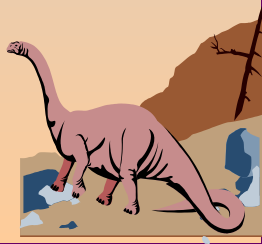
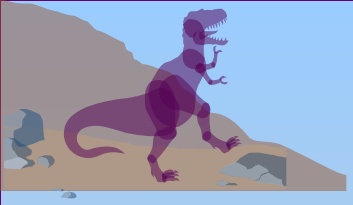


Chapter 12: Mass-Storage Systems

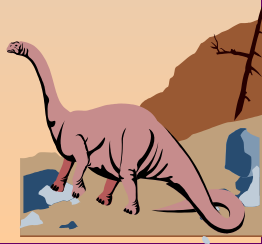
- Disk Structure
- Disk Scheduling
- Disk Management
- Swap-Space Management

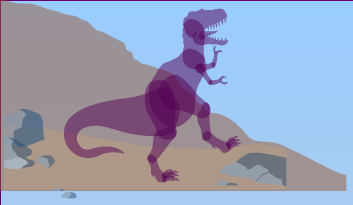




Disk Structure

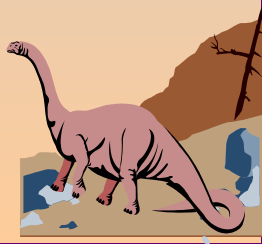
- Disk drives are addressed as large one-dimensional arrays of ***logical blocks***, where the logical block is the smallest unit of transfer.
- The one-dimensional array of logical blocks is mapped into the sectors of the disk sequentially.
  - Sector 0 is the first sector of the first track on the outermost cylinder.
  - Mapping proceeds in order through that track, then the rest of the tracks in that cylinder, and then through the rest of the cylinders from outermost to innermost.
- It is not always possible to convert the block number to correct sector number and track number due to the following reasons:
  - Most disks have some defective sectors.
  - Number of sectors per track is not constant.





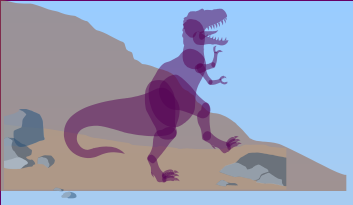
Disk Structure (contd.)

- Constant Linear Velocity (CLV)
  - Density of bits per track is uniform.
  - Farther a track from the centre, greater its length and more the number of sectors it can hold.
  - Drive increases its rotation speed as it moves from outer to inner tracks to keep the same rate of data being transferred.
  - Used by CD-ROM and DVD-ROM drives.
- Constant Angular Velocity (CAV)
  - Disk rotation speed is constant.
  - Density of bits decreases from inner to outer tracks to keep the data rate constant.
  - Used in hard-disk drives.



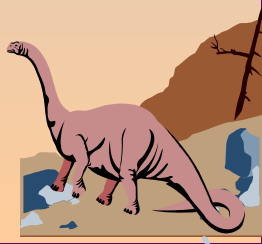
Disk Scheduling

- The OS is responsible for using hardware efficiently — for the disk drives, this means having a **fast access time and disk bandwidth**.
- Access time has two major components
  - ***Seek time*** is the time for the disk head to move to the desired track.
  - ***Rotational latency*** is the time for the disk head to rotate to the desired sector in the given track.
- Disk bandwidth is the total number of bytes transferred, divided by the total time between the first request for service and the completion of the last transfer.
- Access time and disk bandwidth can be improved by scheduling the service of disk I/O requests in good order.
- An I/O request should specify the following information:
  - If the operation is input or output?
  - What the disk address for the transfer is?
  - What the memory address for the transfer is?
  - What is the number of bytes to be transferred?
- If the device and controller are free, I/O request is serviced immediately, or otherwise the request is placed in the pending queue of the device.



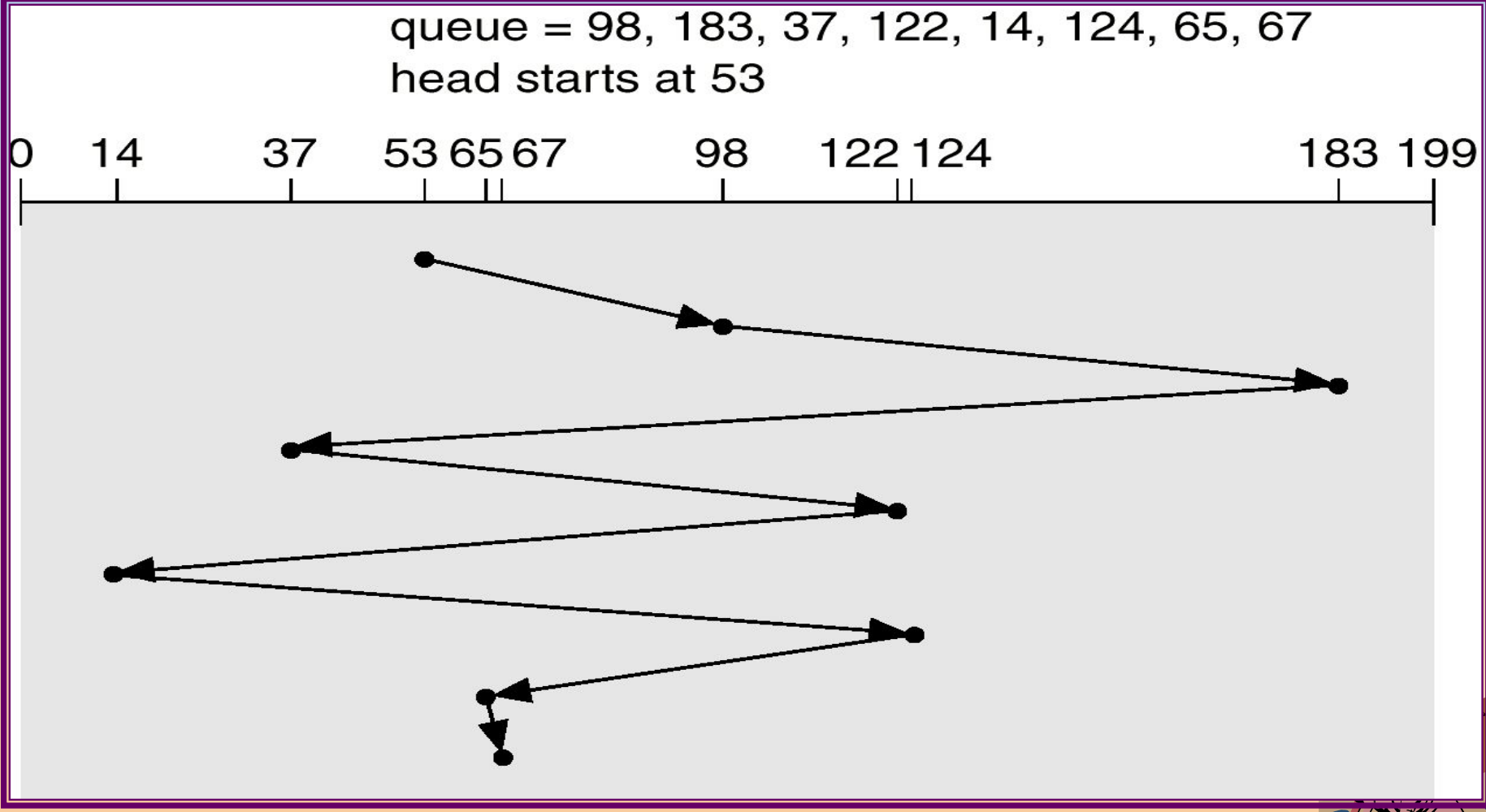
Disk Scheduling (Cont.)

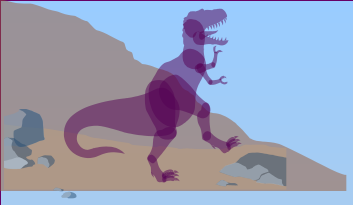
- Disk Scheduling Algorithms:
  - FCFS
  - SSTF
  - SCAN
  - C-SCAN
  - LOOK
  - C-LOOK
- Following is the block requests
  98, 183, 37, 122, 14, 124, 65, 67
- Head pointer 53



FCFS

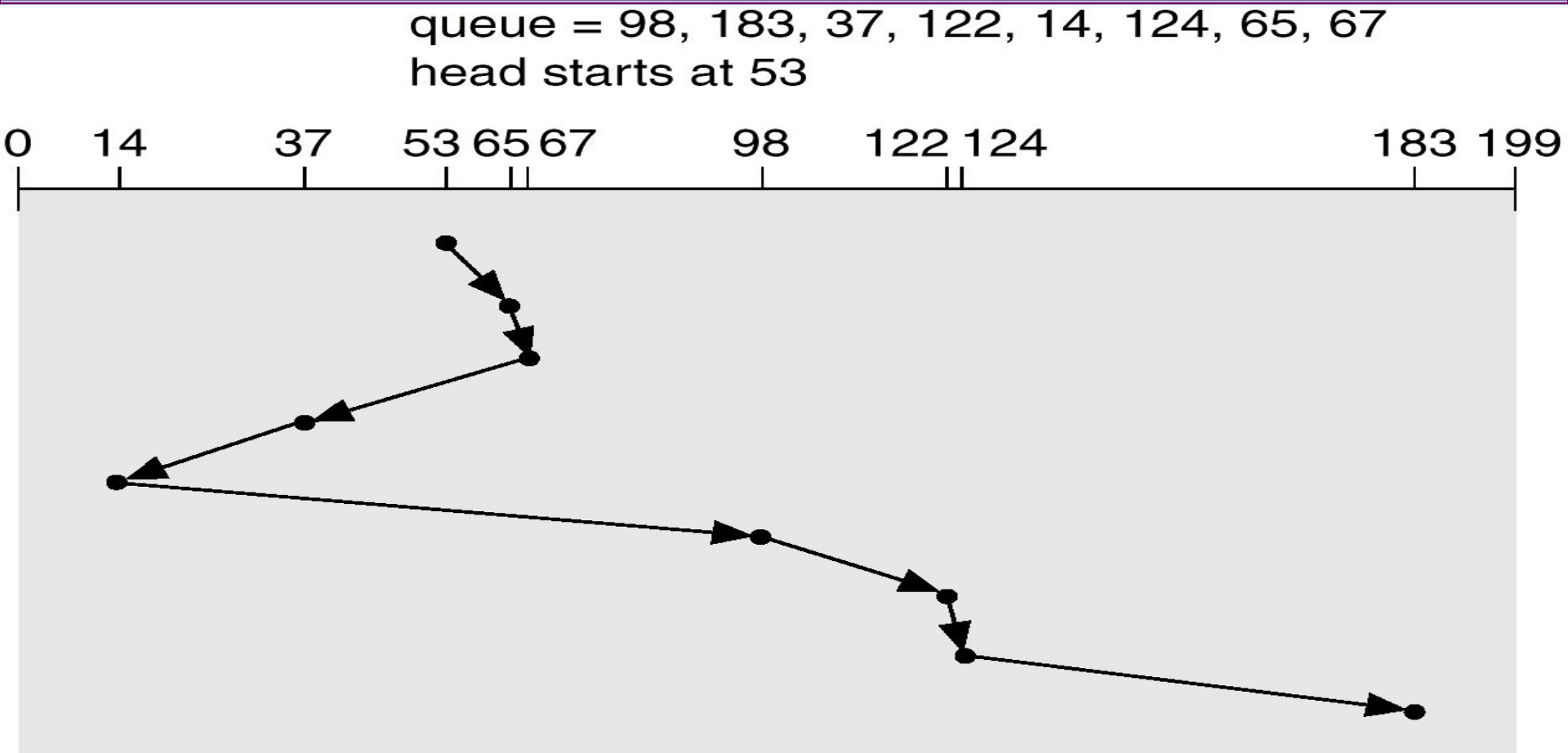
Illustration shows total head movement of 640 cylinders.





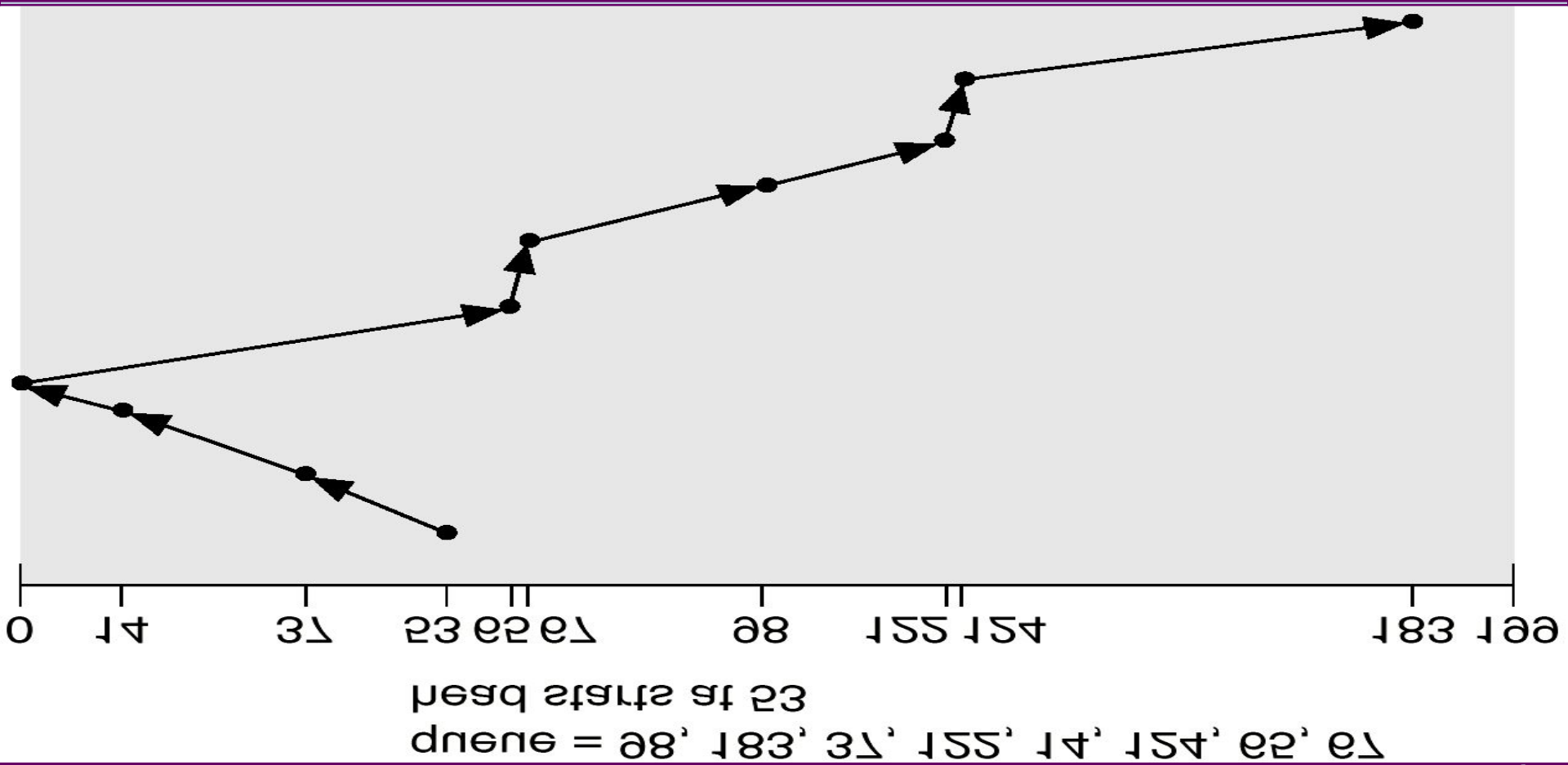
SSTF

- Selects the request with the minimum seek time from the current head position.
- SSTF scheduling is a form of SJF scheduling; may cause starvation of some requests.



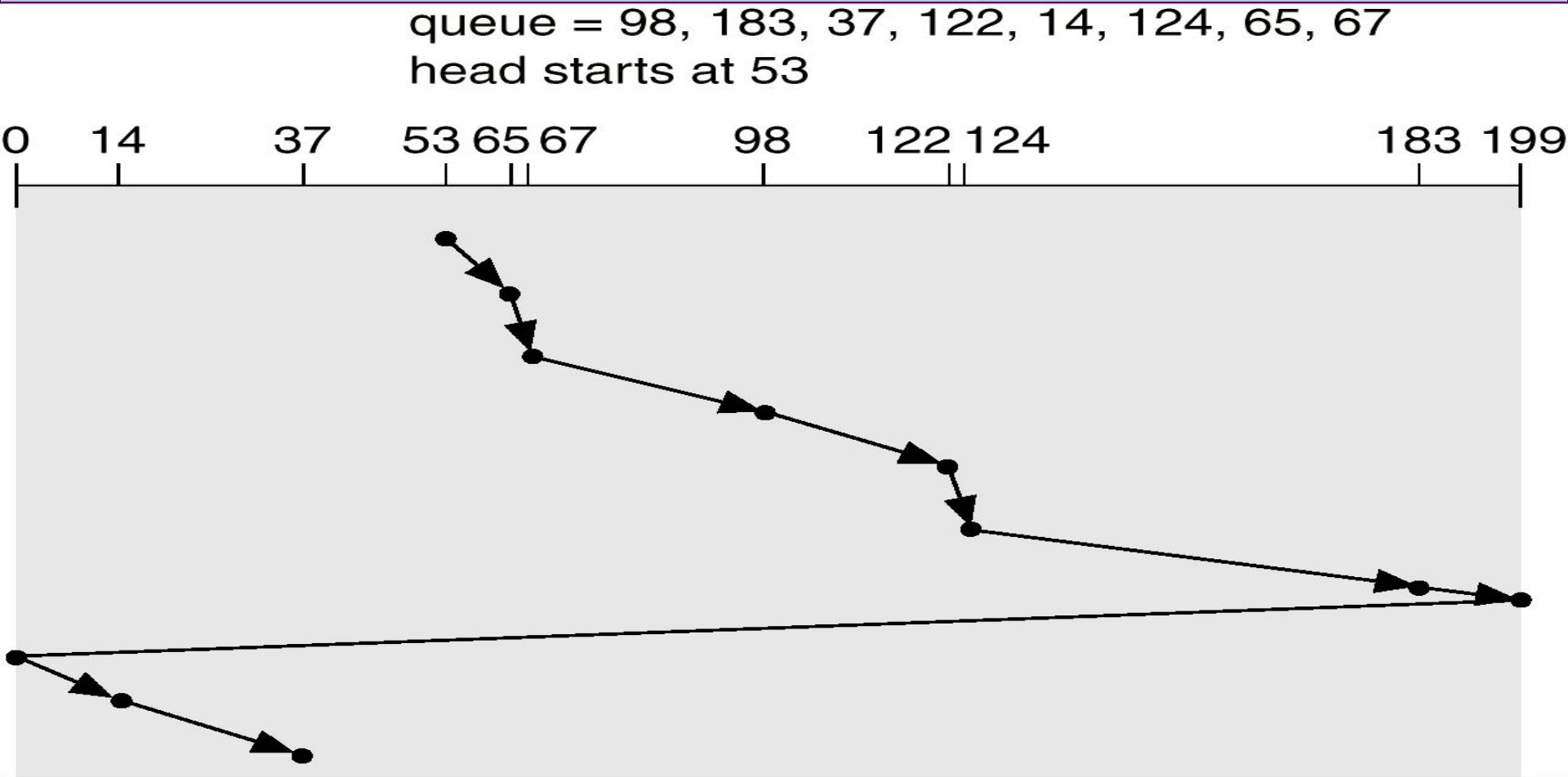
SCAN

- The disk arm starts at one end of the disk, and moves toward the other end, servicing requests until it gets to the other end of the disk, where the head movement is reversed and servicing continues.
- Sometimes called the *elevator algorithm*.
- Illustration shows total head movement of 208 cylinders.



C-SCAN

- The head moves from one end of the disk to the other. servicing requests as it goes. When it reaches the other end, however, it immediately returns to the beginning of the disk, without servicing any requests on the return trip.
- Treats the cylinders as a circular list that wraps around from the last cylinder to the first one.



LOOK & C-LOOK

- C-LOOK is Version of C-SCAN and LOOK is version of SCAN.
- Arm only goes as far as the last request in each direction, then reverses direction immediately, without first going all the way to the end of the disk.