CSc 360
Operating Systems
Mass Storage
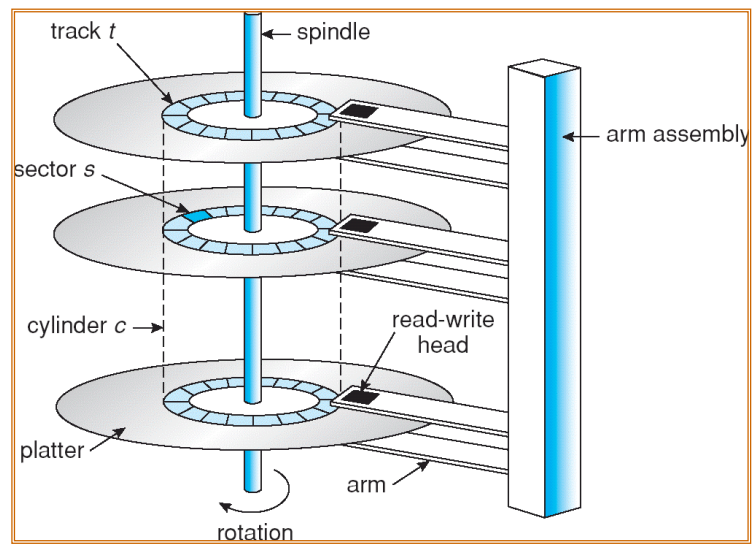
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Magnetic disk

Mass storage

- Magnetic disk
  - performance: data rate, access time
  - interface: ATA, SATA, SCSI, FC, etc
  - address: geometry (cylinder, track, sector)
- Magnetic tape
- Network attached storage (NAS)
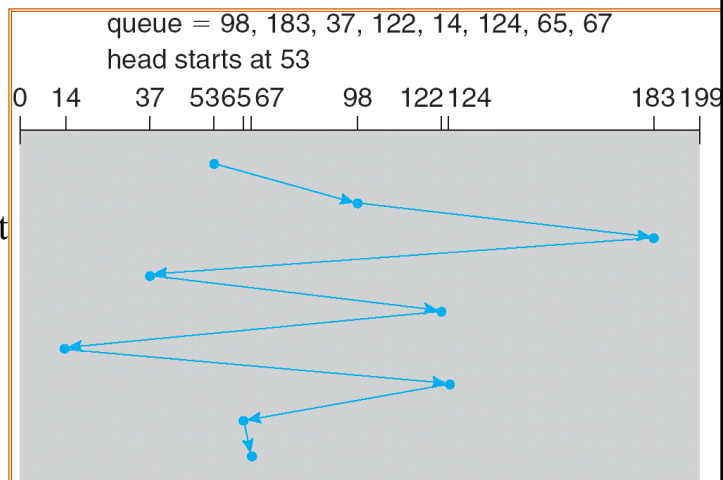 - iSCSI
- Storage area network (SAN)

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Disk scheduling

- FCFS
- Example
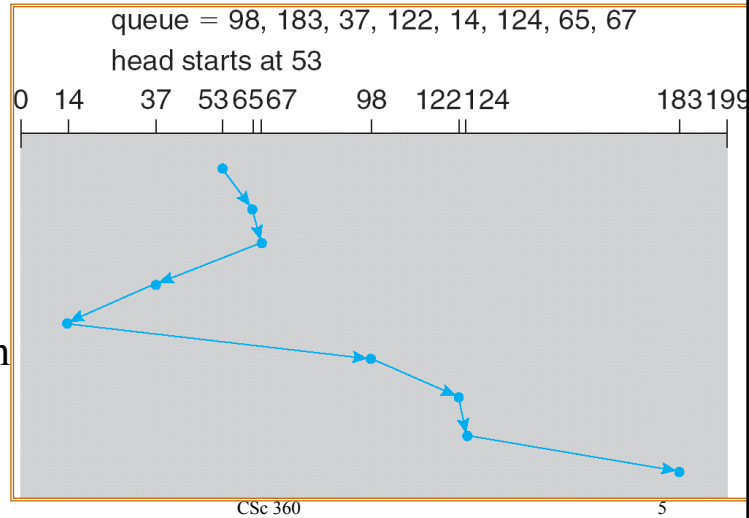 - total head movement
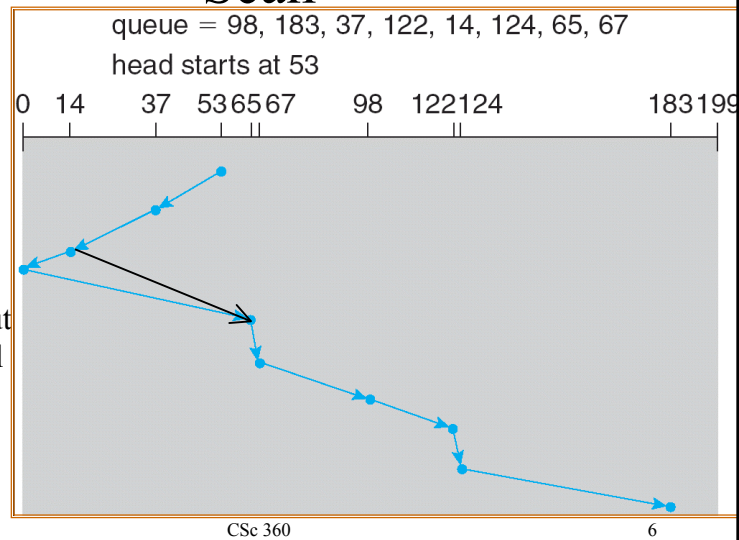 - 640 cylinders

queue = 98, 183, 37, 122, 14, 124, 65, 67
head starts at 53

0   14   37   53 65 67   98   122 124   183 199

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Shortest seek time first

- STTF
  - similar to SJF
- Example
  - 236 cyl
- Starvation

queue = 98, 183, 37, 122, 14, 124, 65, 67
head starts at 53

| 0 | 14 | 37 | 53 | 65 | 67 | 98 | 122 | 124 | 183 | 199 |

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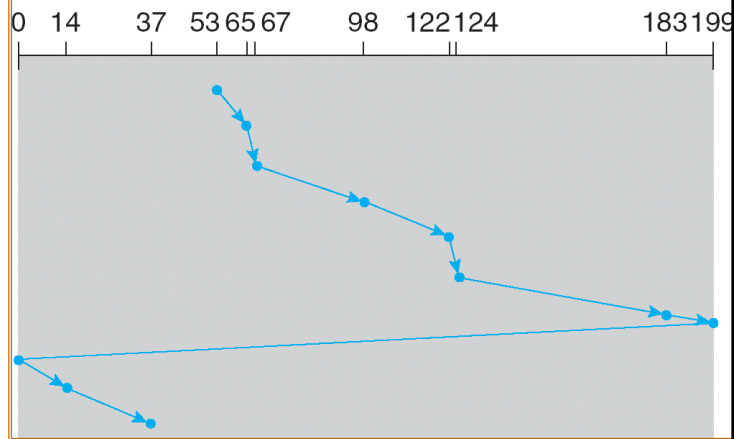# Scan

- AKA
  - elevator
- Example
  - 236 cyl
    - shortcut 208 cyl

queue = 98, 183, 37, 122, 14, 124, 65, 67
head starts at 53

| 0 | 14 | 37 | 53 | 65 | 67 | 98 | 122 | 124 | 183 | 199 |

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Circular scan

- Circular list of cylinders
- Example
  - 382 cyl!
  - fairness

queue = 98, 183, 37, 122, 14, 124, 65, 67

head starts at 53

0 14   37   53 65 67   98   122 124   183 199

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Circular look

- No need to reach the end
- Choice?
  - requests
    - dynamic
    - type
  - file allocation

queue   98, 183, 37, 122, 14, 124, 65, 67

head starts at 53

0 14   37   53 65 67   98   122 124   183 199

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Disk management

- Physical formatting
  - creating physical sector structures
- Partition
- Logical formatting
  - creating an empty file system
- Boot block
- Handle bad sectors: sector sparing, slipping

Swap-space management

- Swap space
  - disk space as an extension of main memory
- Swap-space location
  - a regular big file
  - swap partition
- Swap-space management
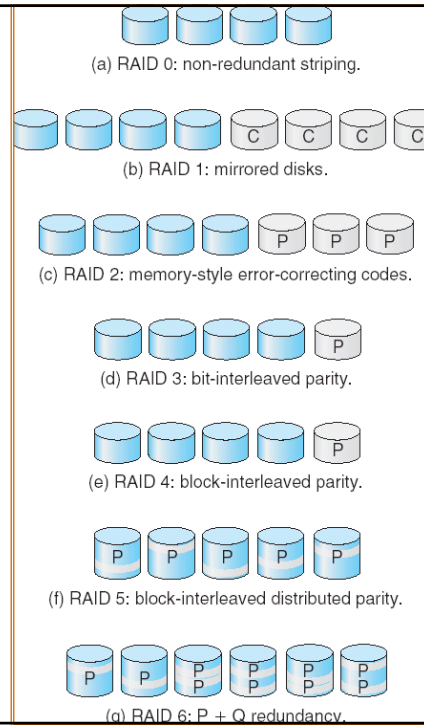 - text vs data segment
  - proactive vs reactive allocation

RAID

- Performance through parallelism
  - stripping
- Reliability through redundancy
  - mirroring
  - error correcting

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(a) RAID 0: non-redundant striping.

(b) RAID 1: mirrored disks.

(c) RAID 2: memory-style error-correcting codes.

(d) RAID 3: bit-interleaved parity.

(e) RAID 4: block-interleaved parity.

(f) RAID 5: block-interleaved distributed parity.

(g) RAID 6: P + Q redundancy.

This lecture

- Mass storage
  - disk organization
    - geometry address
  - disk head scheduling
    - FCFS, SSTF, SCAN, C-SCAN, C-LOOK
  - swap-space
  - RAID

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