- Access Time for fixed-head devices
  - 1. Access time = Search time + Transfer time.
  - 2. Access time depends on the rotational speed and the position of the record relative to the position of the read/write head.
- Access Time for movable-head devices
  - 1. Access time = Seek time + Search time + Transfer time.
  - 2. Seek time: arm movement time, usually is much longer than search time and transfer time.
  - 3. Search time: rotational delay.
  - 4. Transfer time: data transfer time.

Ex. 10 records, 100 bytes each

Average seek time: 25 ms

Average search time: 8.4 ms

transfer time (rate): 0.00094 ms/byte

Without blocking:

for 1 record: $25 + 8.4 + 0.00094 \times 100 = 33.494$

for 10 records: $10 * 33.494 = 334.94$ ms for 10 records.

With block (group 10 records in 1 block)

$25 + 8.4 + (0.00094 \times 100) \times 10$

$= 33.4 + 0.94$

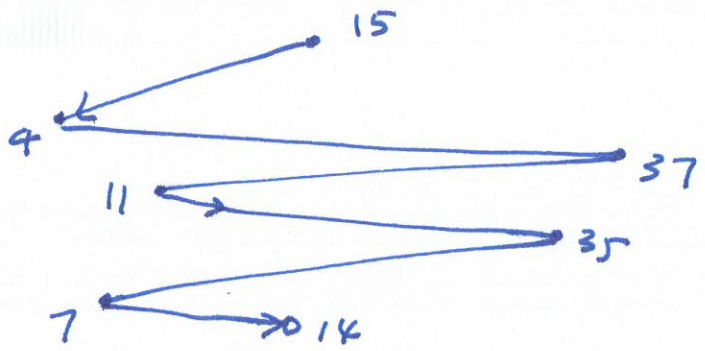
$= 34.34$ ms for 10 records.

4. Device Handler Seek Strategies

- First Come First Serve (FCFS)

set-up:

head at track 15, requests: 4, 37, 11, 35, 7, 14

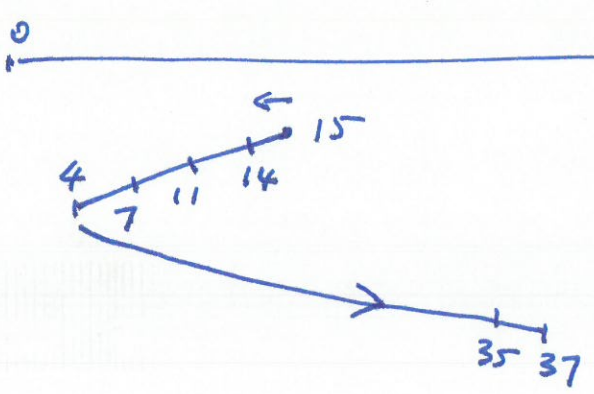


total # of tracks visited:

$11 + 33 + 26 + 24 + 28 + 7 = 129$ tracks

(35-7) (14-7)

- Shortest Seek Time First (SSTF)—the request at the track closest to the one being served is the next to be served.



4, 37, 11, 35, 7, 14

total # of tracks visited:

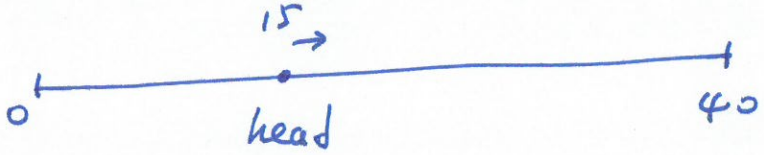
$(15-14)+3+4+3+31+2 = 44$

or, $(15-4)+(37-4)$

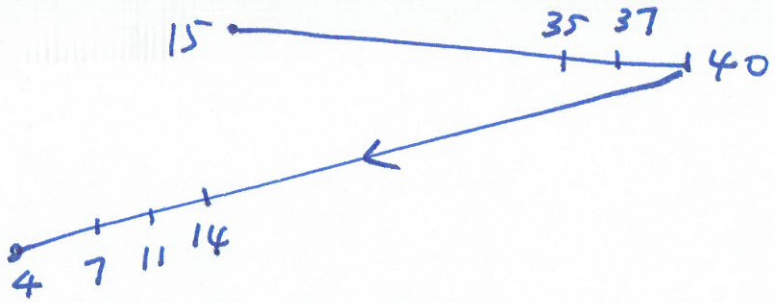
$= 11+33 = 44$ ✓

- SCAN—almost like round-robin.

Go between 0 and 40, serve requests on the way.

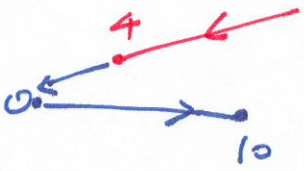


4, 37, 11, 35, 7, 14



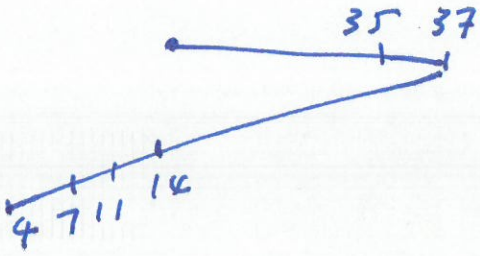
total # of tracks : 25 + (40-4)
= 25 + 36 = 61

Q: Now, if we have a request at 10, what we do?



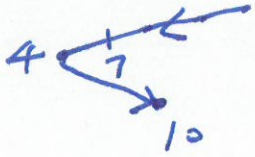
i.e., need to add up 14 (not 6).

- LOOK—similar to SCAN, except that it won't go all the way to track 0 (or the highest track) unless there is a request.



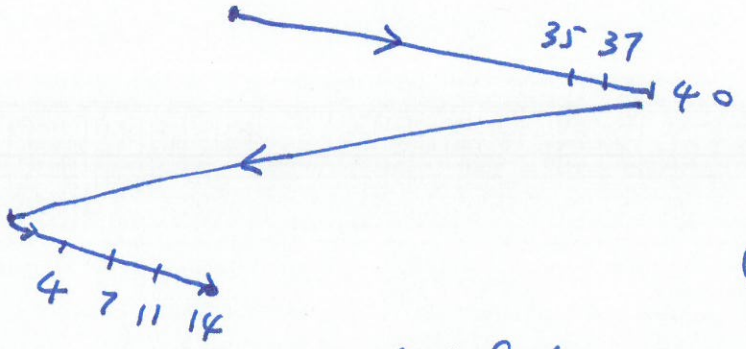
4, 37, 11, 35, 7, 14

if the next one is 10, they



- C-SCAN—similar to SCAN except that only when the head moves inward (toward the center) the requests are served.

4, 37, 11, 35, 7, 14



(40-35)

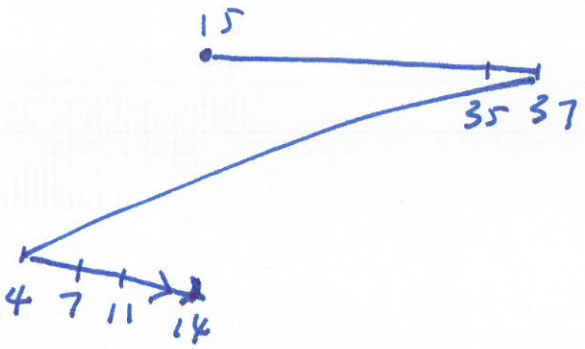
↓

total #: 20 + 5 + 40 + 4 + 3 + 4 + 3

= 79

- C-LOOK—similar to LOOK except that only when the head moves inward (toward the center) the requests are served.

4, 37, 11, 35, 7, 14

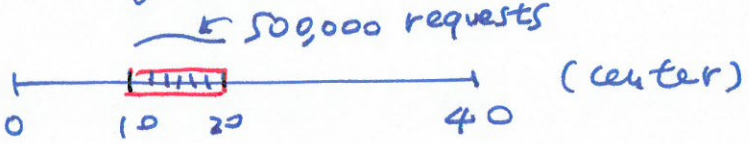


total # of tracks:

20 + 2 + 33 + 3 + 4 + 3 = 65.

- N-step-SCAN and FSCAN

- Arm stiffness: With SSTF, LOOK, C-LOOK, it is possible that the arm may not move for a long time (over some interval).



- N-step-SCAN: it segments the disk request queue into sub-queues of length N. Sub-queues are processed one at a time, using SCAN.

  N → large, N-step-SCAN ⟶ SCAN

  N → too small (say 1), N-step-SCAN ⟶ FCFS

- FSCAN: uses 2 sub-queues
  - When a scan begins all the requests are put in a queue.
  - During the scan serving the requests in the current queue, all new requests are put in the second queue. double buffering