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Doubt Clearing Session

Comprehensive Course on Operating System for GATE - 2024/25

Vishvadeep Gothi • Lesson 42 • June 6, 2023

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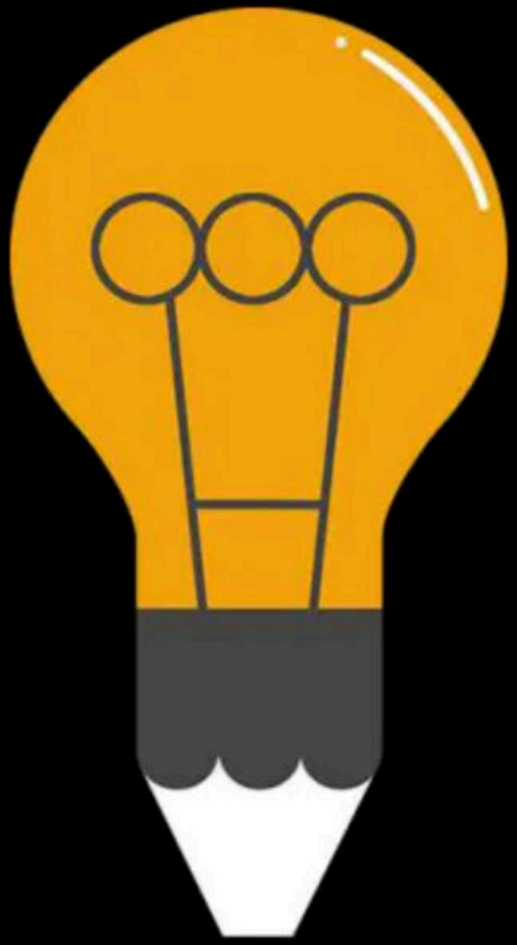


Operating System
Disk Scheduling

By: Vishvadeep Gothi

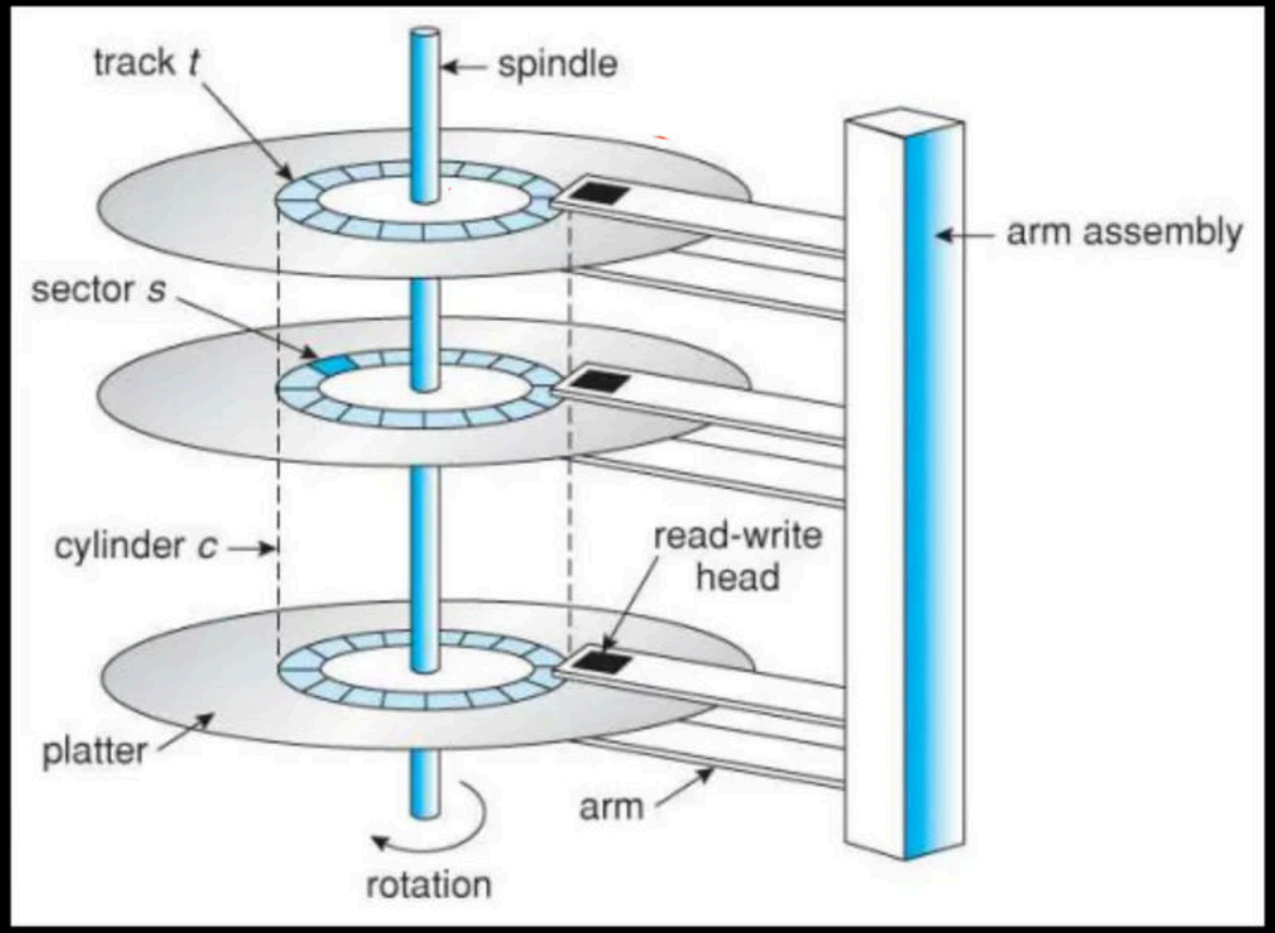
OS Revision

9 - 10:30 PM wed

Thu - Sat ⇒ 2:30 - 6 PM

3 hours

Disk


track t
spindle
arm assembly
sector s
cylinder c
read-write
head
platter
arm
rotation

Cylinder

- Collection of tracks of same radius from all surfaces

Disk Scheduling

- Done by operating systems to schedule I/O requests arriving for the disk

Disk Scheduling Algorithms

1. FCFS (First Come First Serve)
2. SSTF (Shortest Seek Time First)
3. Scan
4. C-Scan (Circular-Scan)
5. Look
6. C-Look (Circular-Look)

FCFS (First Come First Serve)

Suppose the order of request is: 72, 160, 33, 130, 14, 6, 180

The Read/Write arm is at 50

FCFS (First Come First Serve)

Suppose the order of request is: 72, 160, 33, 130, 14, 6, 180

Number of head movements = 642

FCFS (First Come First Serve)

Advantages:

- Every request gets a fair chance
- No indefinite postponement

Disadvantages:

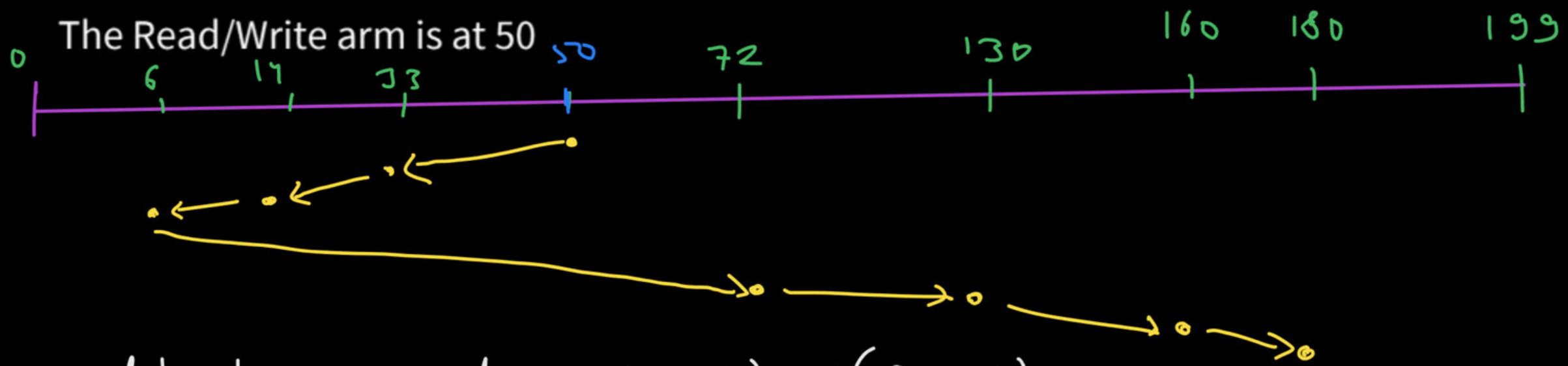
- Does not try to optimize seek time
- May not provide the best possible service

SSTF (Shortest Seek Time First)

→ serve the nearest cylinder request first

Suppose the order of request is: 72, 160, 33, 130, 14, 6, 180

The Read/Write arm is at 50



no. of head movements = (50 - 6) + (180 - 6)

= 218

SSTF (Shortest Seek Time First)

Suppose the order of request is: 72, 160, 33, 130, 14, 6, 180

Number of head movements = [illegible] = 218

SSTF (Shortest Seek Time First)

Advantages:

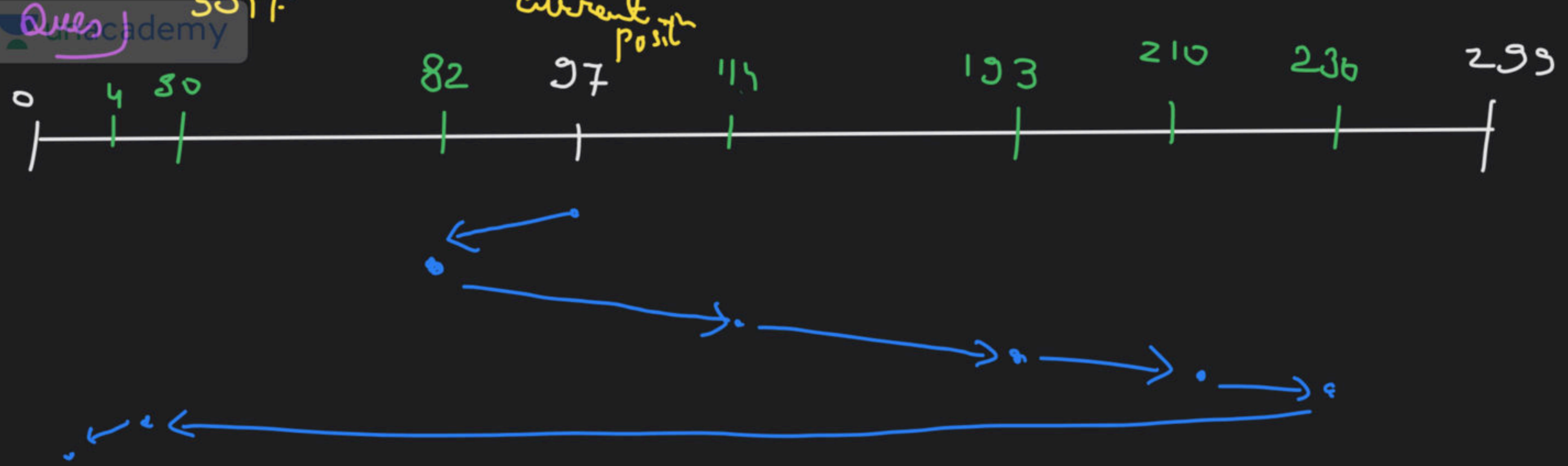
- Average Response Time decreases
- Throughput increases

Disadvantages:

- Overhead to calculate seek time in advance
- Can cause Starvation for a request if it has higher seek time as compared to incoming requests
- High variance of response time as SSTF favors only some requests

Ques

SSTF



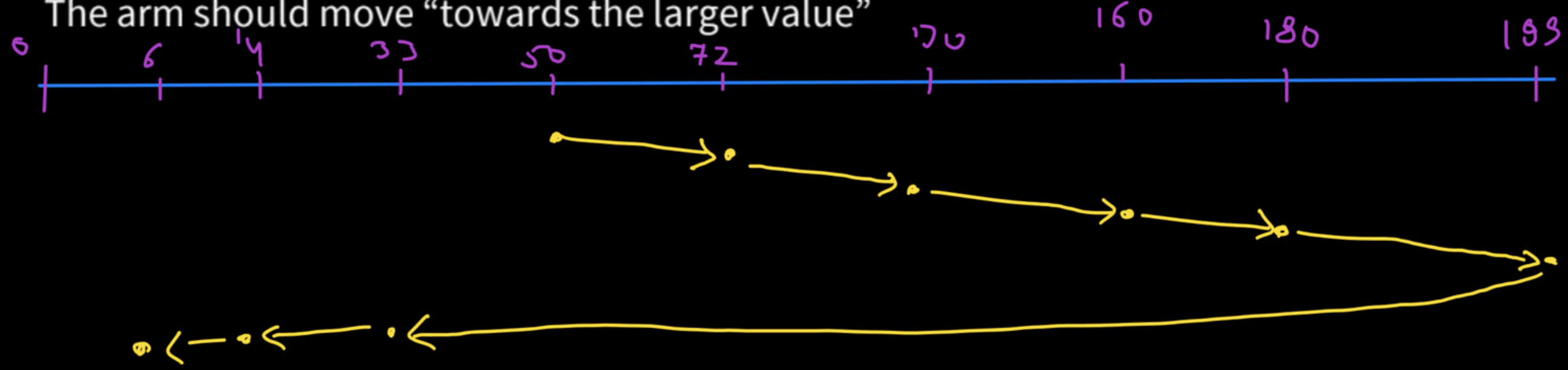
$15 + 148 + 226 = 389$

Scan (Elevator)

Suppose the order of request is: 72, 160, 33, 130, 14, 6, 180

The Read/Write arm is at 50,

The arm should move “towards the larger value”



no. of head movements = (199 − 50) + (199 − 6)

= 149 + 193 = 342

Scan

Advantages:

- High throughput
- Low variance of response time
- Average response time

Disadvantages:

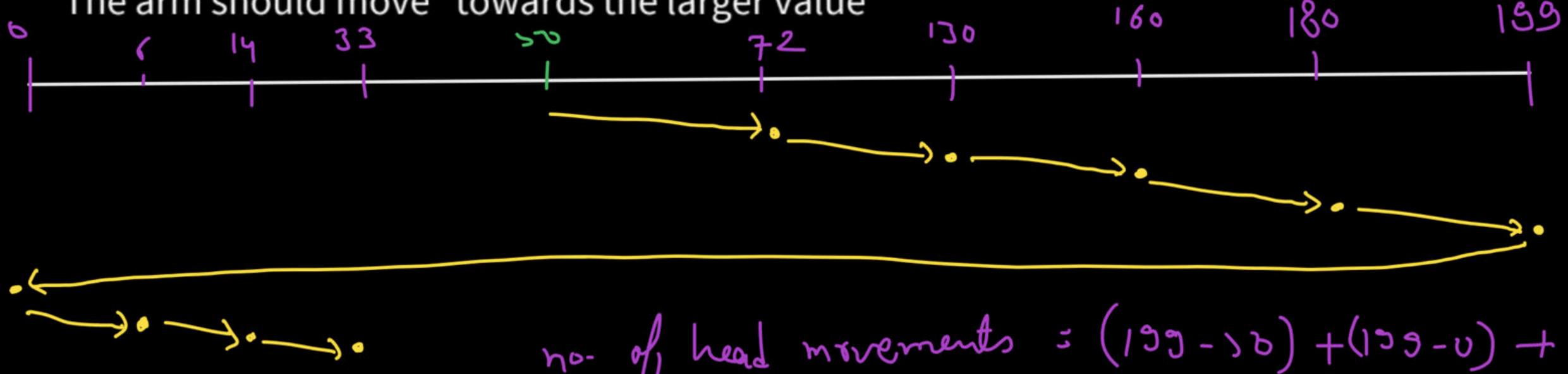
- Long waiting time for requests for locations just visited by disk arm

C-Scan (circular - scan)

Suppose the order of request is: 72, 160, 33, 130, 14, 6, 180

The Read/Write arm is at 50,

The arm should move “towards the larger value”



no. of head movements = (199 - 50) + (199 - 0) + (33 - 0)

= 381

C-Scan

Advantages:

- Provides more uniform wait time compared to SCAN

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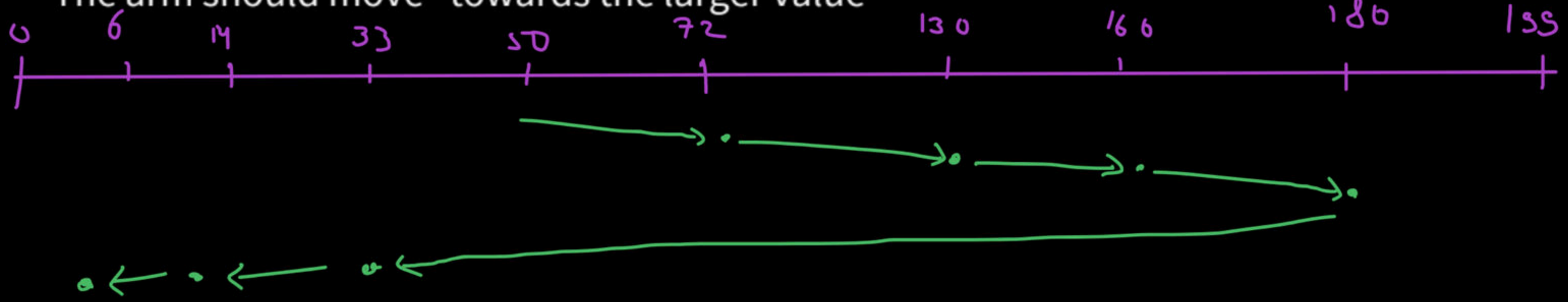
Look

Suppose the order of request is: 72, 160, 33, 130, 14, 6, 180

The Read/Write arm is at 50,

The arm should move “towards the larger value”



no. of head movements = (180 − 50) + (180 − 6)

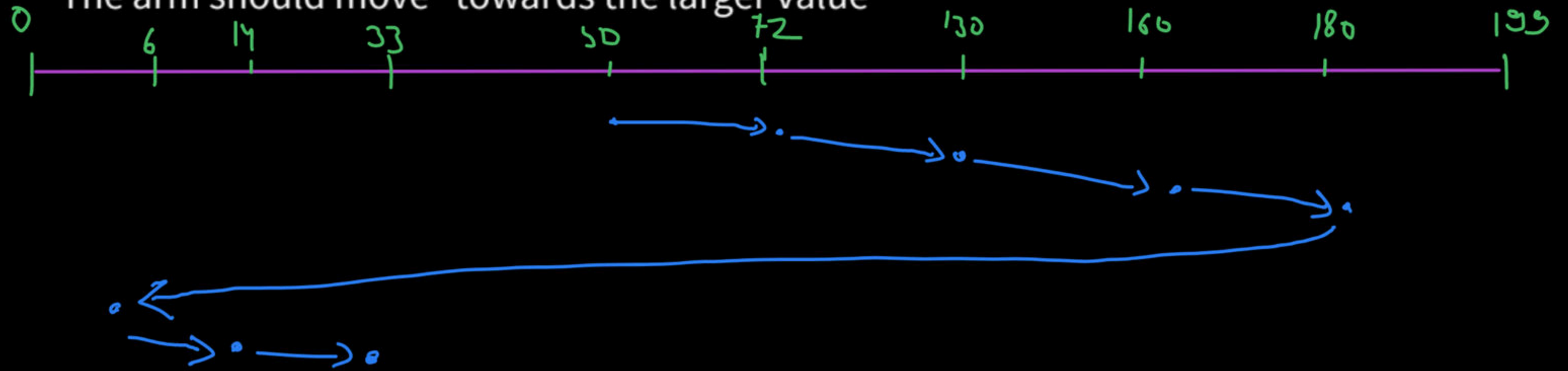
= 304

C-Look (Circular- look)

Suppose the order of request is: 72, 160, 33, 130, 14, 6, 180

The Read/Write arm is at 50,

The arm should move “towards the larger value”



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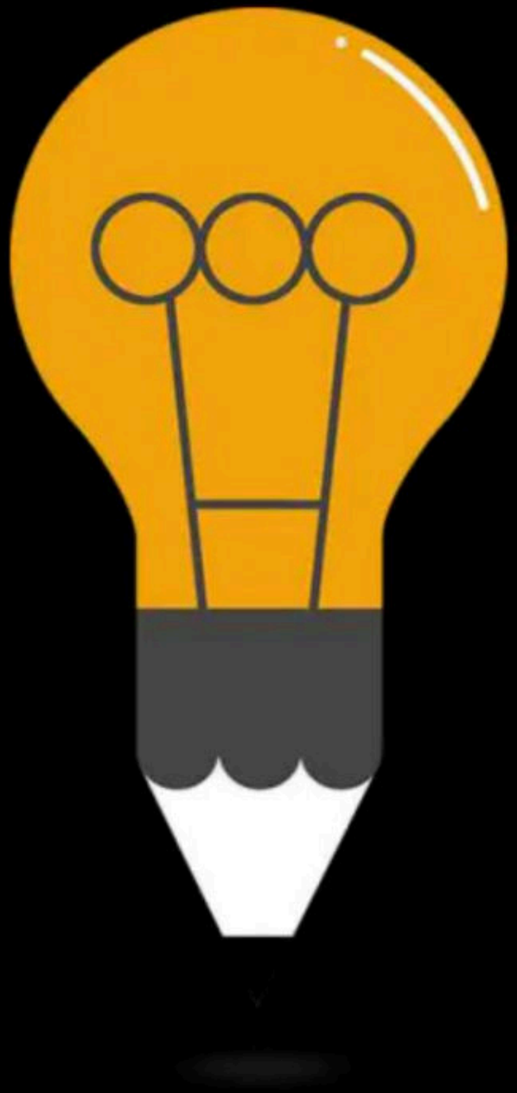

Operating System
Disk Scheduling PYQs

By: Vishvadeep Gothi

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1989

Provide short answers to the following questions:

Disk requests come to disk driver for cylinders $10, 22, 20, 2, 40, 6$ and 38, in that order at a time when the disk drive is reading from cylinder 20. The seek time is 6 msec per cylinder. Compute the total seek time if the disk arm scheduling algorithm is.

A. First come first served.
B. Closest cylinder next.

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1990

Assuming the current disk cylinder to be 50 and the sequence for the cylinders to be $1, 36, 49, 65, 53, 12, 3, 20, 55, 16, 65$ and 78 find the sequence of servicing using

1. Shortest seek time first (SSTF) and
2. Elevator disk scheduling policies.

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1995

The head of a moving head disk with 100 tracks numbered 0 to 99 is currently serving a request at track 55. If the queue of requests kept in FIFO order is

$$10, 70, 75, 23, 65$$

which of the two disk scheduling algorithms FCFS (First Come First Served) and SSTF (Shortest Seek Time First) will require less head movement? Find the head movement for each of the algorithms.

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1997

The correct matching for the following pairs is:

(A) Disk Scheduling	(1) Round robin
(B) Batch Processing	(2) SCAN
(C) Time-sharing	(3) LIFO
(D) Interrupt processing	(4) FIFO

A. A-3 B-4 C-2 D-1

B. A-4 B-3 C-2 D-1

C. A-2 B-4 C-1 D-3

D. A-3 B-4 C-3 D-2

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1999

Which of the following disk scheduling strategies is likely to give the best throughput?

A. Farthest cylinder next

B. Nearest cylinder next

C. First come first served

D. Elevator algorithm

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2004

Consider an operating system capable of loading and executing a single sequential user process at a time. The disk head scheduling algorithm used is First Come First Served (FCFS). If FCFS is replaced by Shortest Seek Time First (SSTF), claimed by the vendor to give 50% better benchmark results, what is the expected improvement in the I/O performance of user programs?

A. 50%
B. 40%
C. 25%
D. 0%

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2004

A disk has 200 tracks (numbered 0 through 199). At a given time, it was servicing the request of reading data from track 120, and at the previous request, service was for track 90. The pending requests (in order of their arrival) are for track numbers.

30 70 115 130 110 80 20 25.

How many times will the head change its direction for the disk scheduling policies SSTF(Shortest Seek Time First) and FCFS (First Come Fist Serve)?

A. 2 and 3
B. 3 and 3
C. 3 and 4
D. 4 and 4

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2007

The head of a hard disk serves requests following the shortest seek time first (SSTF) policy. The head is initially positioned at track number 180.

Which of the request sets will cause the head to change its direction after servicing every request assuming that the head does not change direction if there is a tie in SSTF and all the requests arrive before the servicing starts?

A. $11, 139, 170, 178, 181, 184, 201, 265$
B. $10, 138, 170, 178, 181, 185, 201, 265$
C. $10, 139, 169, 178, 181, 184, 201, 265$
D. $10, 138, 170, 178, 181, 185, 200, 265$

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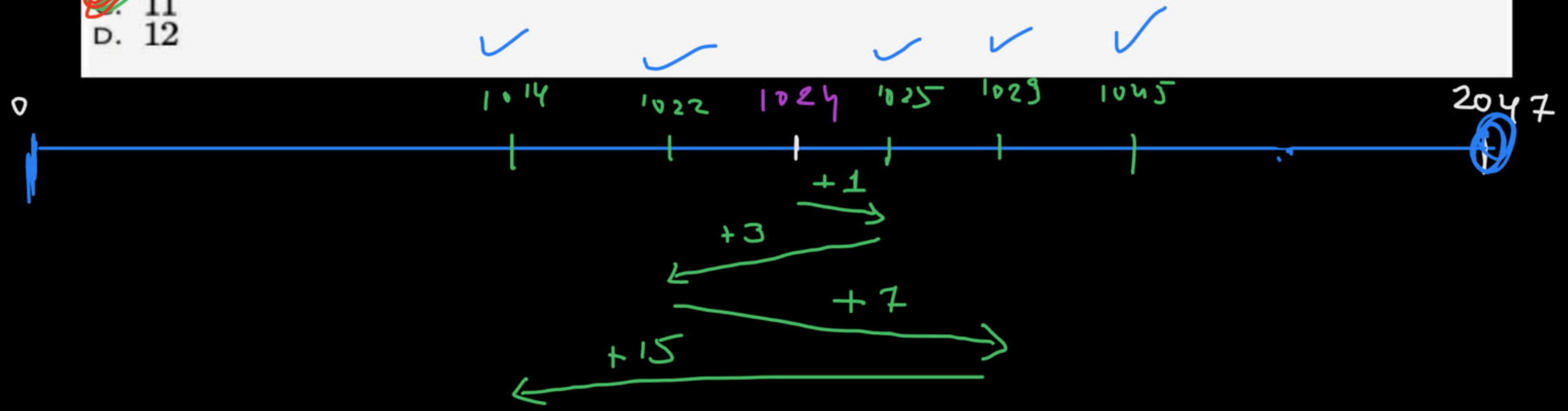
1, 3, 7, 15, 31, 63, 127, 255, 511, 1023

2007

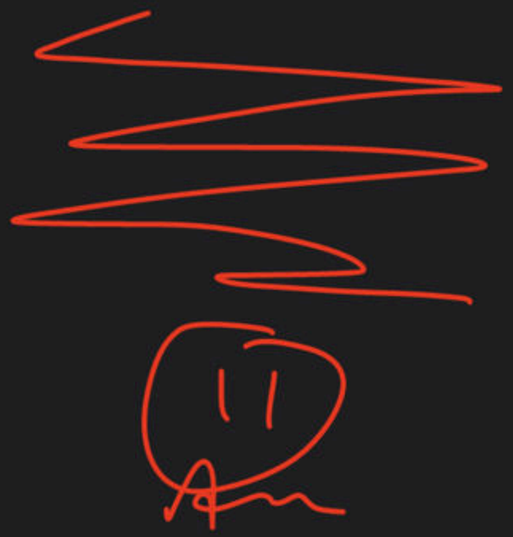
The head of a hard disk serves requests following the shortest seek time first (SSTF) policy. The head is initially positioned at track number 180.

What is the maximum cardinality of the request set, so that the head changes its direction after servicing every request if the total number of tracks are 2048 and the head can start from any track?

A. 9
B. 10
C. 11
D. 12




0
342
854
982
1014
1022
1024
1025
1029
1045
1109
1365
2047
682



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2009

Consider a disk system with 100 cylinders. The requests to access the cylinders occur in following sequence:

$4, 34, 10, 7, 19, 73, 2, 15, 6, 20$

Assuming that the head is currently at cylinder 50, what is the time taken to satisfy all requests if it takes $1ms$ to move from one cylinder to adjacent one and shortest seek time first policy is used?

A. $95\ ms$
B. $119\ ms$
C. $233\ ms$
D. $276\ ms$

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2014

Suppose a disk has 201 cylinders, numbered from 0 to 200. At some time the disk arm is at cylinder 100, and there is a queue of disk access requests for cylinders $30, 85, 90, 100, 105, 110, 135$ and 145. If Shortest-Seek Time First (SSTF) is being used for scheduling the disk access, the request for cylinder 90 is serviced after servicing _____ number of requests.

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2015

Suppose the following disk request sequence (track numbers) for a disk with 100 tracks is given:

$45, 20, 90, 10, 50, 60, 80, 25, 70.$

Assume that the initial position of the R/W head is on track 50. The additional distance that will be traversed by the R/W head when the Shortest Seek Time First (SSTF) algorithm is used compared to the SCAN (Elevator) algorithm (assuming that SCAN algorithm moves towards 100 when it starts execution) is_____tracks.

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2016

Cylinder a disk queue with requests for I/O to blocks on cylinders $47, 38, 121, 191, 87, 11, 92, 10$. The C-LOOK scheduling algorithm is used. The head is initially at cylinder number 63, moving towards larger cylinder numbers on its servicing pass. The cylinders are numbered from 0 to 199. The total head movement (in number of cylinders) incurred while servicing these requests is_____.

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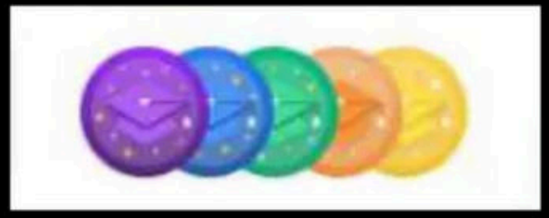
Happy Learning.!



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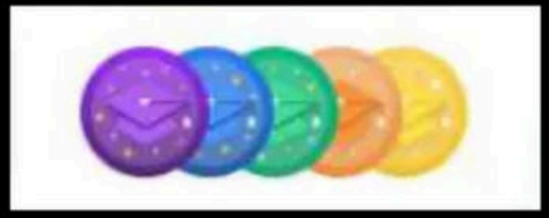
Happy Learning.!



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Quiz - 6

(1)

$$\text{Page no.} = \left\lfloor \frac{(\text{add.})_{10}}{\text{page size}} \right\rfloor = \frac{}{4096}$$

$$\frac{12576}{4096} = 0$$

Ans = 9

Page Ref. 0, 2, 2, 0, 1, 3, 2, 3, 3, 2, 1

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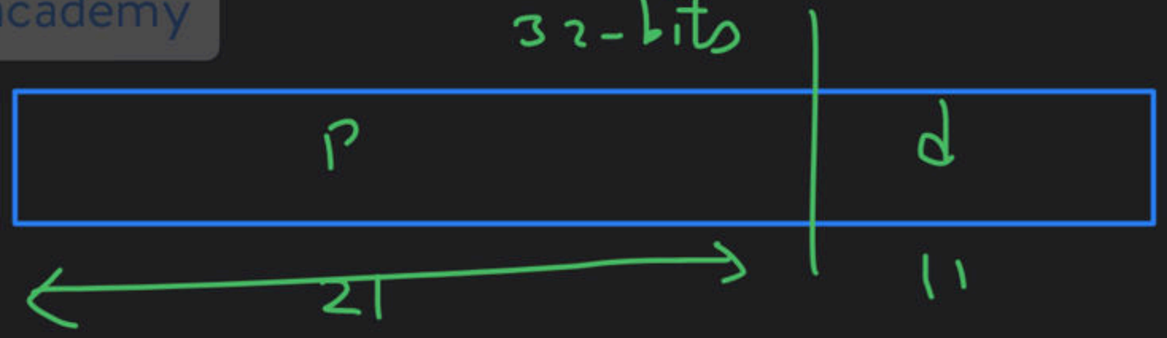
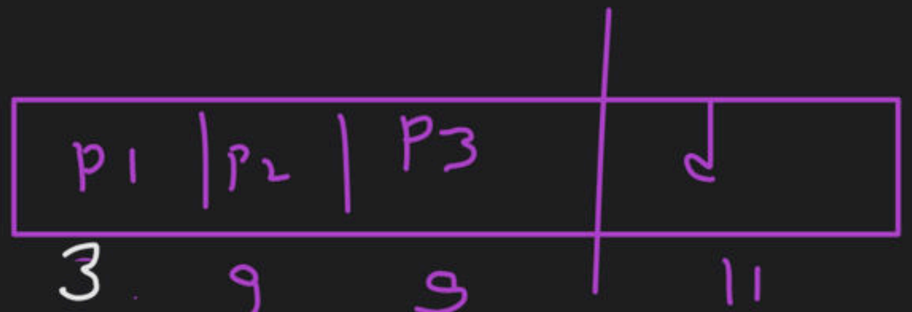
(2)



P.T.E. = 4B

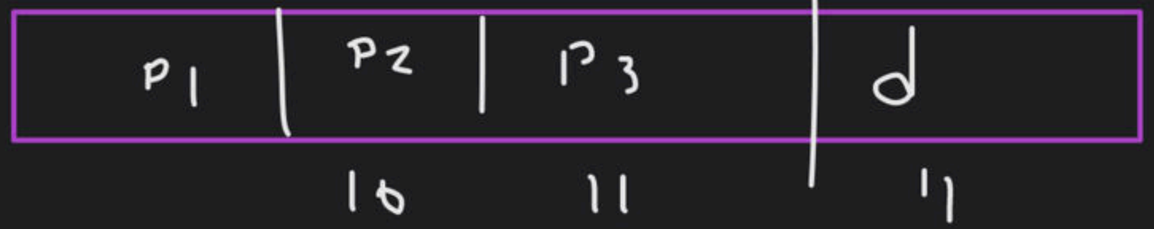


$1 + 8 + 8 * 2^9 = 4105$

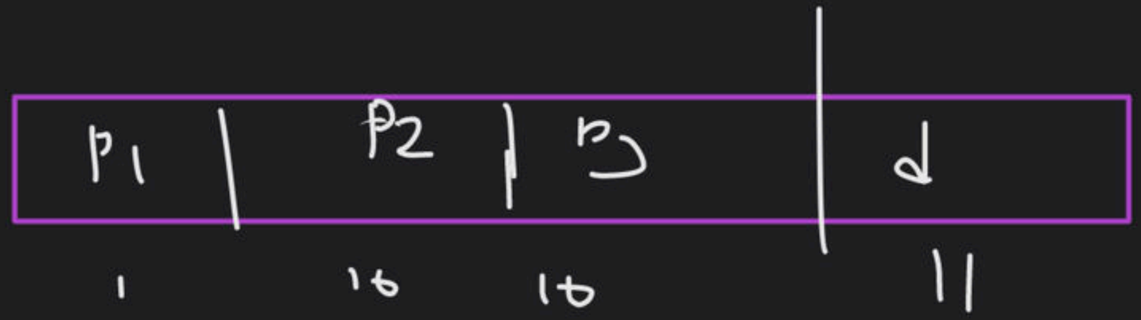
P.T. size $= 4105 * 2kB$

$= 8210\ kB$

P.T.E. = 1B ✗



P.T.E. = 2B



$1 + 2 + 2 * 2^{10} = 2051$

$2051 * 2kB = 4102\ B$

short trick =>

8 210 KB $\Rightarrow$ 8 MB

if single level paging

P.T - size = no. of pages * P.T.E.

8MB = 2^{21} * P.T.E.

P.T.E. = 2^2 Bytes

= 4 Bytes

3

$0.67 * 190 + 0.16 * 1848 + 0.11 * 2948 + 0.6 * 5946$

$= 1104.02$ nsec

---

4 7, 2, 7, 1, 9, 7, 5, 9, 3, 1, 4, 3

7	7		7	9	9	9		3	3	3	
	2		2	2	7	7		7	1	1	
			1	1	1	5		5	3	4	
✓	✓	✗	✓	✓	✓	✓	✗	✓	✓	✓	✗

$\frac{3}{12} = \frac{1}{4}$

$= 25\%$

(5) b, d

(6) $256 - 7 = 249$ blocks

$249 * 2KB = 498$

< 10% Accuracy