I/O Systems-2

CS3600 Spring 2022

Disk Scheduling

- Disks are the most common mass storage devices.
- A ***track*** is one of many concentric rings on a magnetic disk surface.
- A ***sector*** is a portion of a track and is the smallest unit of data that can be read or written with a single r/w operation.

Rotational Delay Optimization.

- Blocks 1, 2, 6, and 100 on the same track t are requested in the order: 6, 100, 2, 1.
  - Without rotational delay optimization, accessing the 4 blocks will take _____ revolutions of the disk.
  - With rotational delay optimization, the 4 blocks can be accessed in _____ revolutions of the disk.

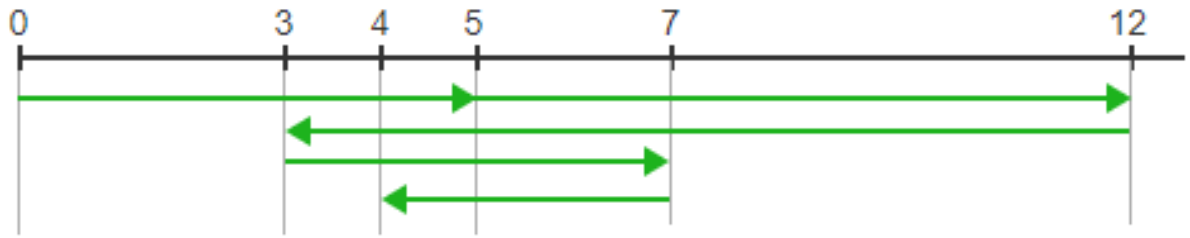
Seek Time Optimization.

- The r/w head is at track 0 and requests to access blocks on tracks 1, 10, and 3 arrive.
  - Without any seek optimization, the total distance traveled by the r/w head will be _____ tracks.

Shortest Seek Time First (SSTF)

Arriving requests: 5 12 3 7 4

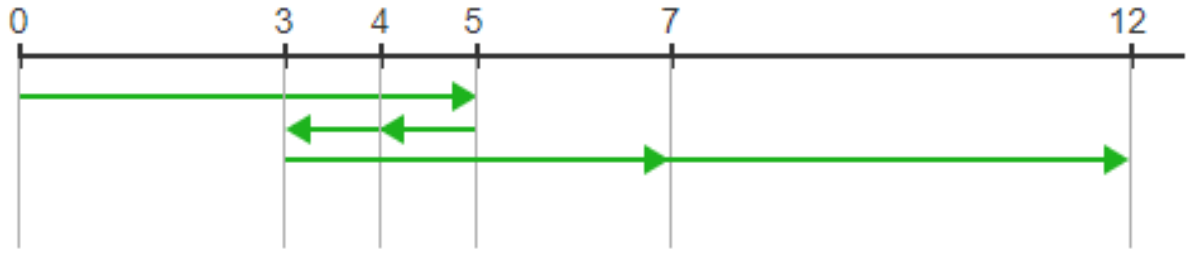
FIFO scheduling



Travel distance

28 tracks

SSTF scheduling



16 tracks

FIFO vs SSTF

- The r/w head is at track 30 when requests for tracks 20, 50, 10, and 60 arrive.
- The total travel distance of the r/w head is _____ tracks.
  - For FIFO
  - For SSTF

Scan & C-scan scheduling algorithms

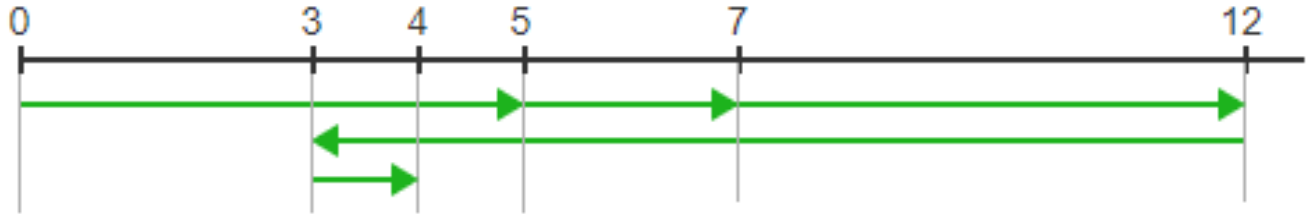
Arriving requests: 5 12 3 7 4

Scan scheduling

Travel distance

21 tracks

C-Scan scheduling



22 tracks

Scan & C-scan Scheduling Algorithms

- The r/w head is at track 30 and is moving up when requests for tracks 60, 40, 20, and 10 arrive.
  - Under Scan, the tracks will be serviced in the order _____.
  - Under C-Scan, the tracks will be serviced in the order _____.

Error Detection

- Even Parity Code
  - *The value of even parity bit should be zero, if even number of ones present in the binary code.*
  - *Otherwise, it should be one.*

Binary Code	Even Parity bit	Even Parity Code
000	0	0000
001	1	0011
010	1	0101
011	0	0110
100	1	1001
101	0	1010
110	0	1100
111	1	1111

Hamming code

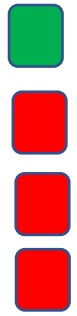
Parity bits are in the powers of 2 positions
The cross shows the bit position we consider

Bit position		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
Encoded data bits		p1	p2	d1	p4	d2	d3	d4	p8	d5	d6	d7	d8	d9	d10	d11	p16	d12	d13	d14	d15	
Parity bit coverage	p1	✗		✗		✗		✗		✗		✗		✗		✗		✗		✗		
	p2		✗	✗			✗	✗			✗	✗			✗	✗			✗	✗		…
	p4				✗	✗	✗	✗					✗	✗	✗	✗					✗	
	p8								✗	✗	✗	✗	✗	✗	✗	✗						
	p16																✗	✗	✗	✗	✗	

Hamming (15,11)

Bit position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
	1	**1**	**0**	**1**	**0**	**1**	**1**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**1**	
	P1	P2		P4				P8								
P1	?															
P2		?														
P4				?												
P8								?								

Parity Coverage



Q

1 1 0 0 1 1 0 0 1 1 0 0 1 0 1

Bit position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
	1	**1**	**0**	**0**	**1**	**1**	**0**	**0**	**1**	**1**	**0**	**0**	**1**	**0**	**1**	
	P1	P2		P4				P8								
P1																
P2																
P4																
P8																

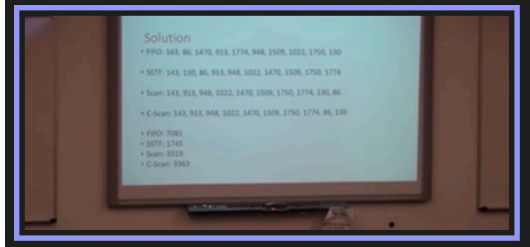
Q

- The r/w head of a disk is at track 143. The previous position was track 0.

  Requests to access the following tracks have arrived:

  143, 86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130

- For FIFO, SSTF, Scan, C-Scan algorithms
  - In which order will the tracks be visited using:
  - Starting from track 143, determine the number of tracks traversed by the r/w head under each algorithm to service all requests:



Solution

- FIFO: 143, 86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130
- SSTF: 143, 130, 86, 913, 948, 1022, 1470, 1509, 1750, 1774
- Scan: 143, 913, 948, 1022, 1470, 1509, 1750, 1774, 130, 86
- C-Scan: 143, 913, 948, 1022, 1470, 1509, 1750, 1774, 86, 130
- FIFO: 7081
- SSTF: 1745
- Scan: 3319
- C-Scan: 3363