OPERATING SYSTEMS

Storage Management - 3

Nitin V Pujari
Faculty, Computer Science
Dean - IQAC, PES University

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Storage Management - 3: Mass Storage Structure

Nitin V Pujari
Faculty, Computer Science
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Course Syllabus - Unit 3

Unit 4: Storage Management

Mass-Storage Structur - Mass-Storage overview, Disk Scheduling, Swap-Space Management, RAID structure. File System Interface - file organization/structure and access methods, directories, sharing File System Implementation/Internals: File control Block (inode), partitions & mounting, Allocation methods.

Case Study: Linux/Windows File Systems

OPERATING SYSTEMS

Course Outline

37	Mass-Storage Structure: Mass-Storage overview	12.1	82.1
38	Disk Scheduling – FCFS, SSTF, SCAN, C-SCAN, LOOK	12.4	
39	Swap-Space Management, RAID Structure	12.6,12.7	
40	File Concept, File Structure, Access Methods	10.1-10.2	
41	Directory and Disk Structure	10.3	
42	File-System Mounting, File Sharing, Protecting	10.4-10.6	
43	Implementing File-Systems: File control Block (inode), partitions & mounting	11.1,11.2	
44	Disk Space Allocation methods: Contiguous, Linked, Indexed	11.4	
45	Case Study: Unix/Linux File systems	11.8	
46	NFS	16.7	

Topic Outline

- Disk Scheduling
- First Come First Serve Disk Scheduling - FCFS
- Shortest Seek Time First Disk Scheduling - SSTF

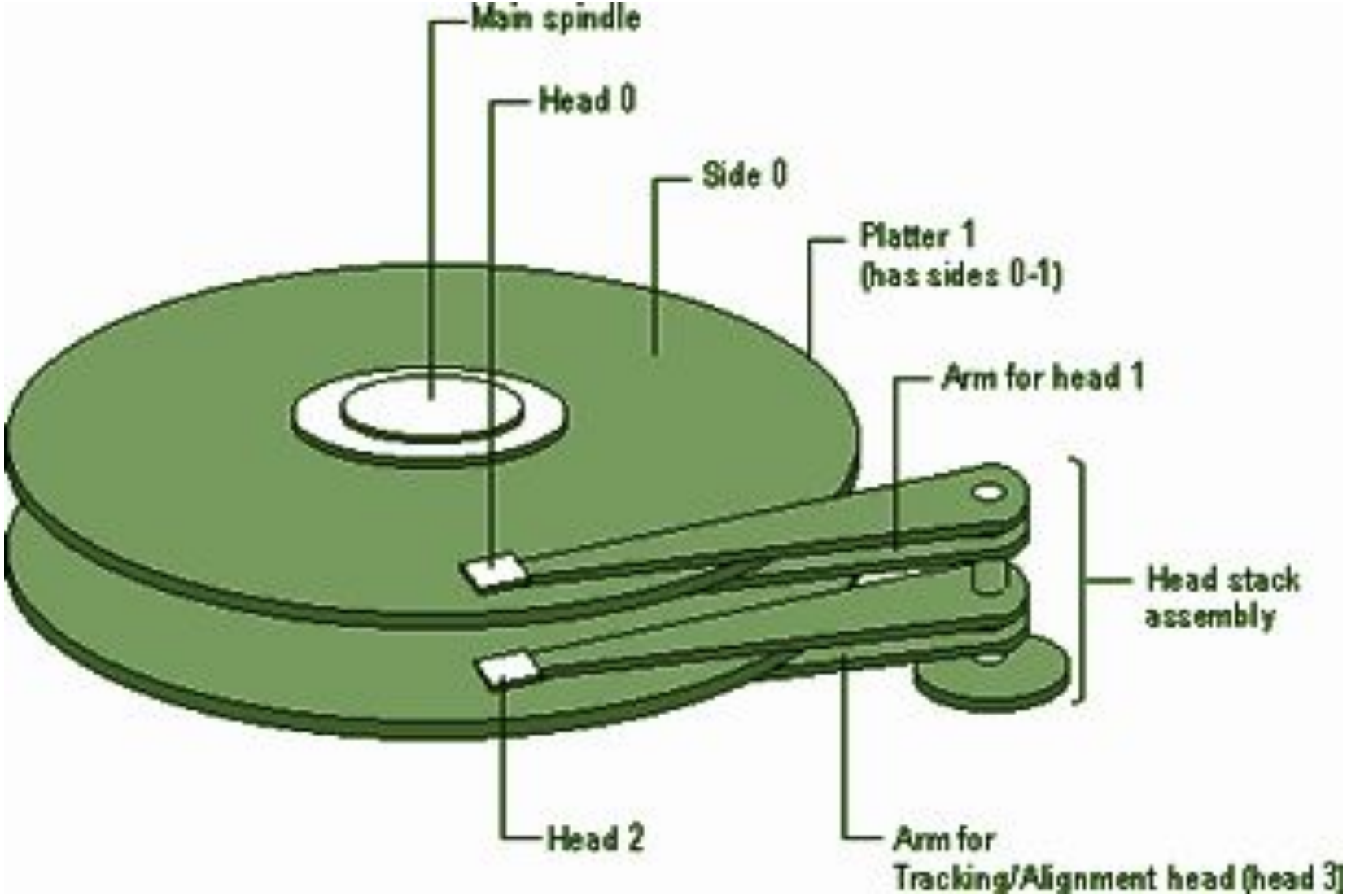
Disk Scheduling

- The operating system is responsible for using hardware efficiently — for the disk drives, this means having a fast access time and disk bandwidth
- Minimize seek time
- Seek time seek distance
- 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
- There are many sources of disk I/O request
  - OS
  - System processes
  - Users processes

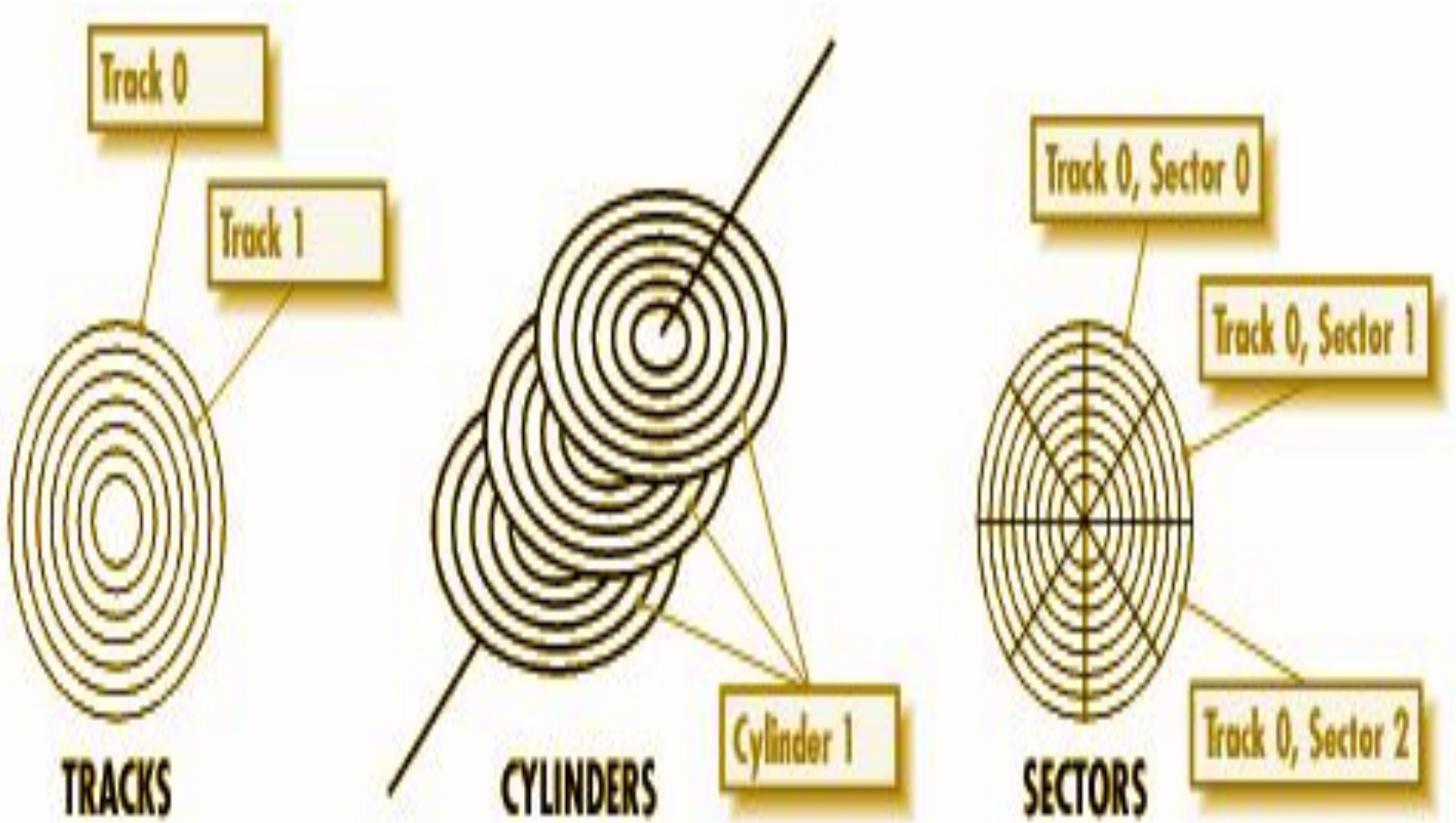
Disk Scheduling

- I/O request includes input or output mode, disk address, memory address, number of sectors to transfer
- OS maintains queue of requests, per disk or device
- Idle disk can immediately work on I/O request, busy disk means work must queue
  - Optimization algorithms only make sense when a queue exists
- Note that drive controllers have small buffers and can manage a queue of I/O requests (of varying “depth”)
- Several algorithms exist to schedule the servicing of disk I/O requests
- The analysis is true for one or many platters
- Seek Distance is in terms of **Cylinders**

Disk Scheduling



Disk Scheduling



Disk Scheduling

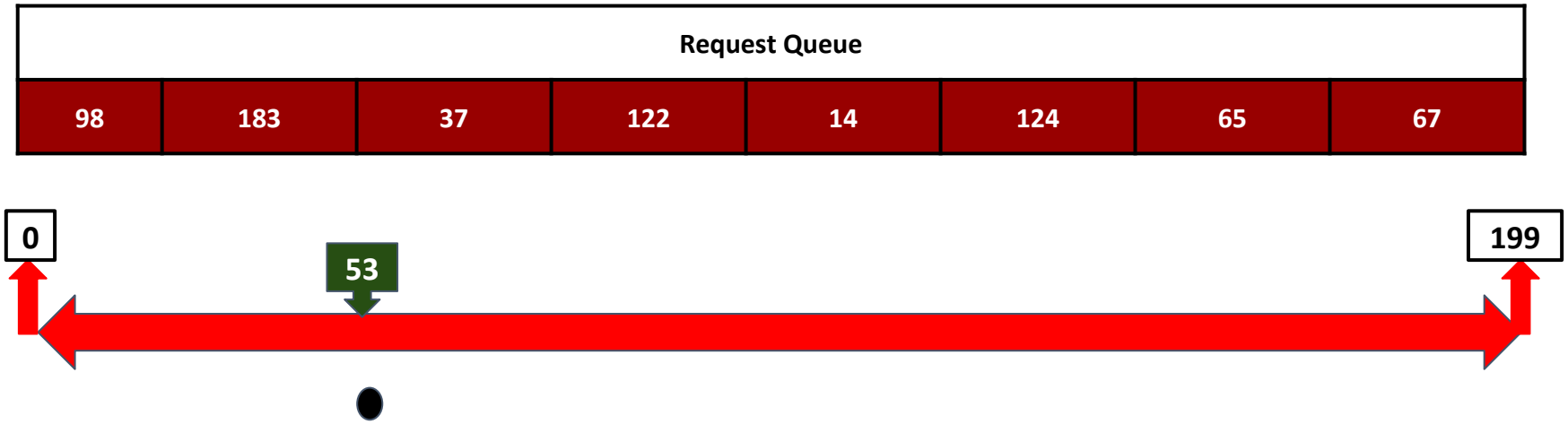
- We illustrate scheduling algorithms with a request queue (0-199)

- **98, 183, 37, 122, 14, 124, 65, 67**

    - Head pointer 53

First Come First Serve - FCFS Disk Scheduling

- Request Queue => 0 .. 199
- 98, 183, 37, 122, 14, 124, 65, 67
- Head pointer initially @ 53 currently pointing @98



Seek Distance = 0

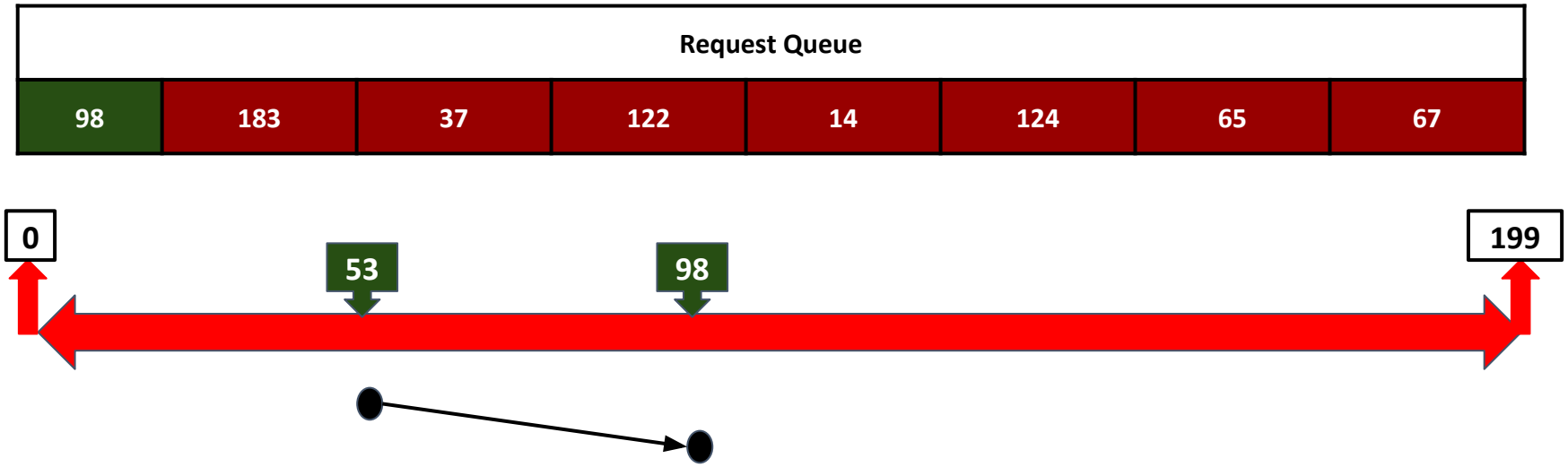
Seek Distance = Seek Distance + abs (Current Cylinder Number - New Cylinder Number)

Seek Distance = 0 + abs()

Seek Distance =

First Come First Serve - FCFS Disk Scheduling

- Request Queue => 0 .. 199
- 98, 183, 37, 122, 14, 124, 65, 67



Seek Distance = 0

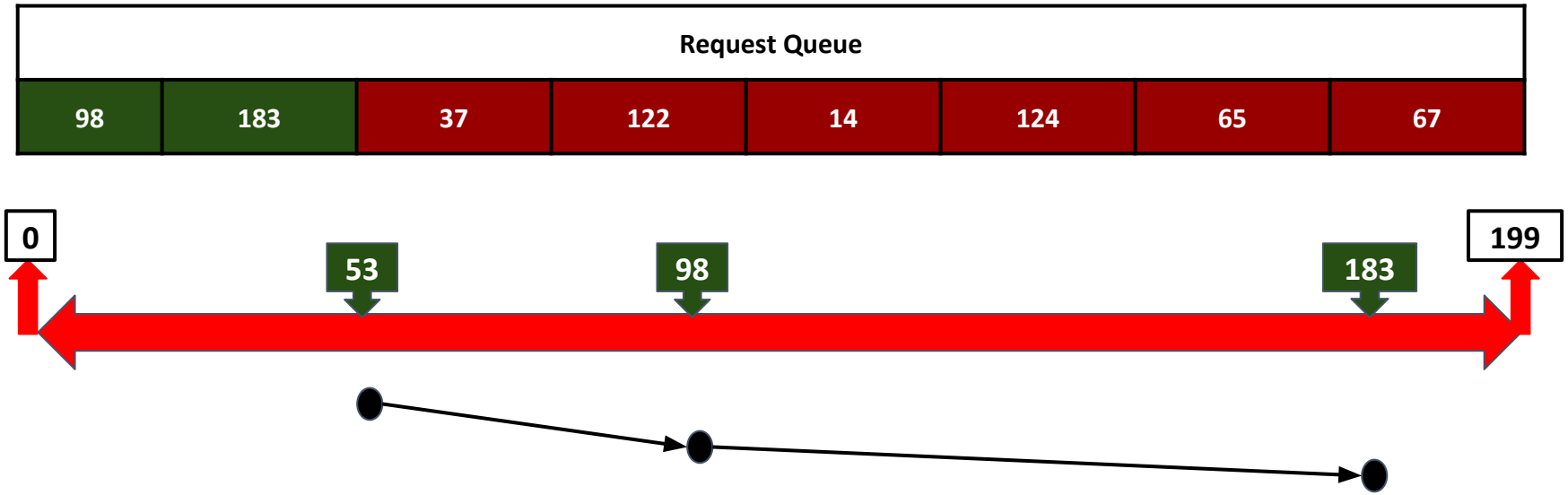
Seek Distance = Seek Distance + abs (Current Cylinder Number - New Cylinder Number)

Seek Distance = 0 + abs(53 - 98)

Seek Distance = 45

First Come First Serve - FCFS Disk Scheduling

- Request Queue => 0 .. 199
- 98, 183, 37, 122, 14, 124, 65, 67

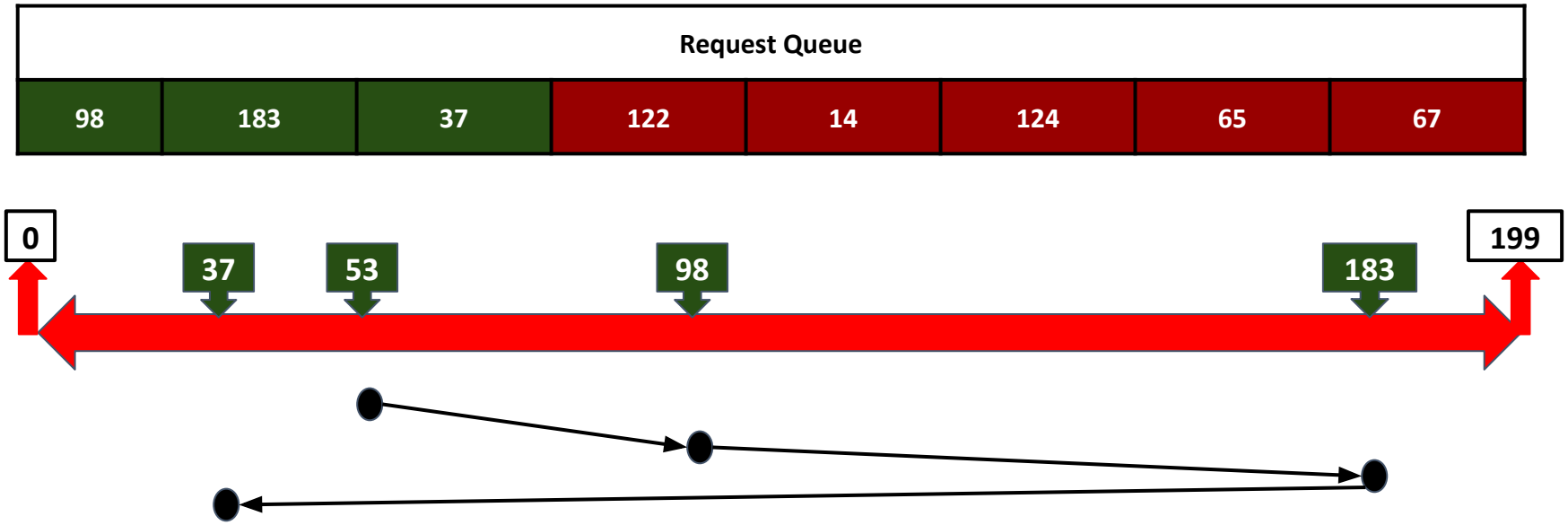


Seek Distance = 45

Seek Distance = Seek Distance + abs (Current Cylinder Number - New Cylinder Number)
Seek Distance = 45 + abs(98 - 183)
Seek Distance = 130

First Come First Serve - FCFS Disk Scheduling

- Request Queue => 0 .. 199
- 98, 183, 37, 122, 14, 124, 65, 67



Seek Distance = 130

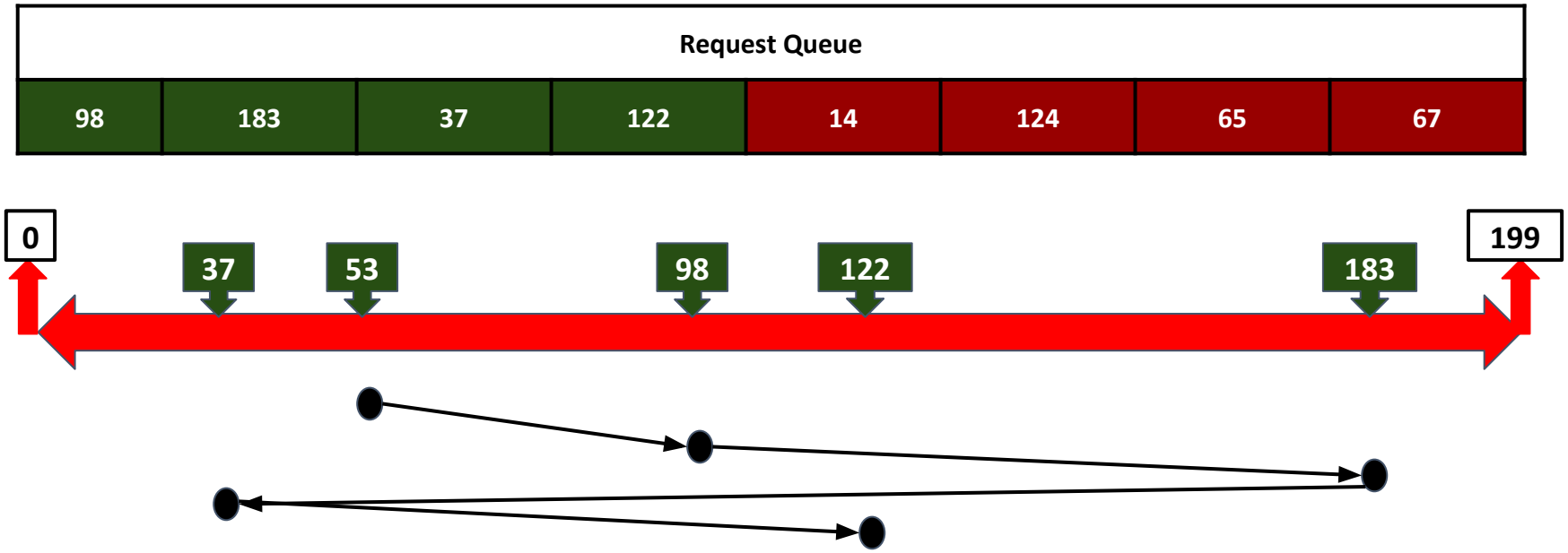
Seek Distance = Seek Distance + abs (Current Cylinder Number - New Cylinder Number)

Seek Distance = 130 + abs(183-37)

Seek Distance = 276

First Come First Serve - FCFS Disk Scheduling

- Request Queue => 0 .. 199
- 98, 183, 37, 122, 14, 124, 65, 67



Seek Distance = 276

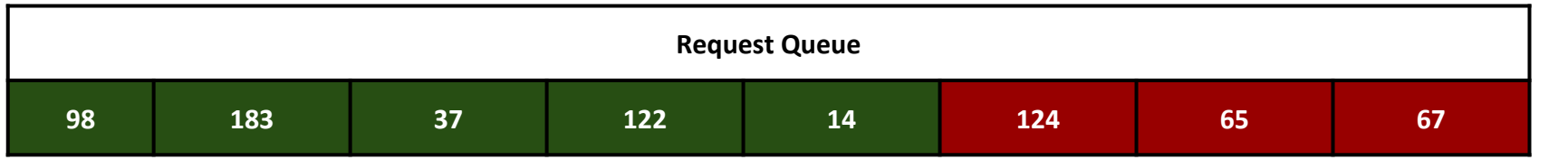
Seek Distance = Seek Distance + abs (Current Cylinder Number - New Cylinder Number)

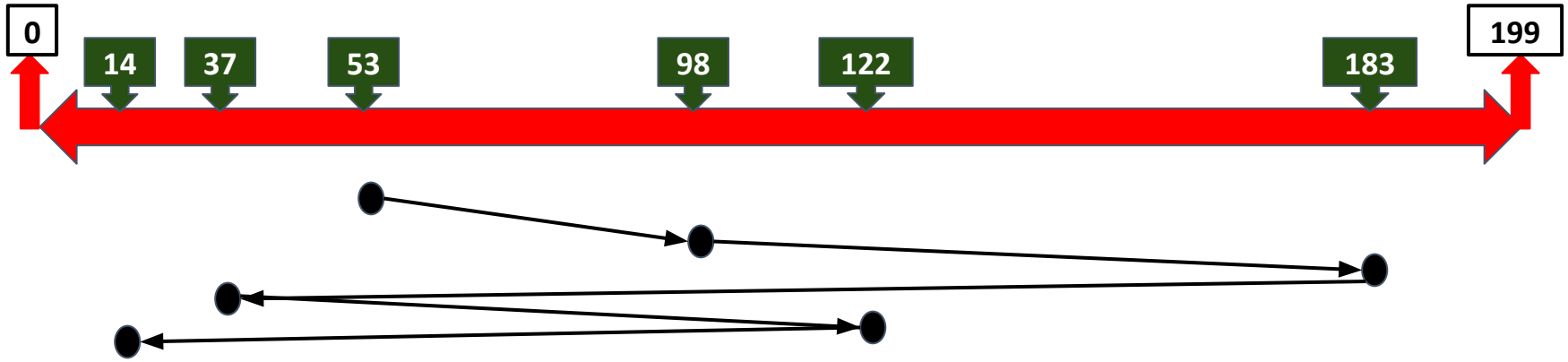
Seek Distance = 276 + abs(37-122)

Seek Distance = 361

First Come First Serve - FCFS Disk Scheduling

- Request Queue => 0 .. 199
- 98, 183, 37, 122, 14, 124, 65, 67



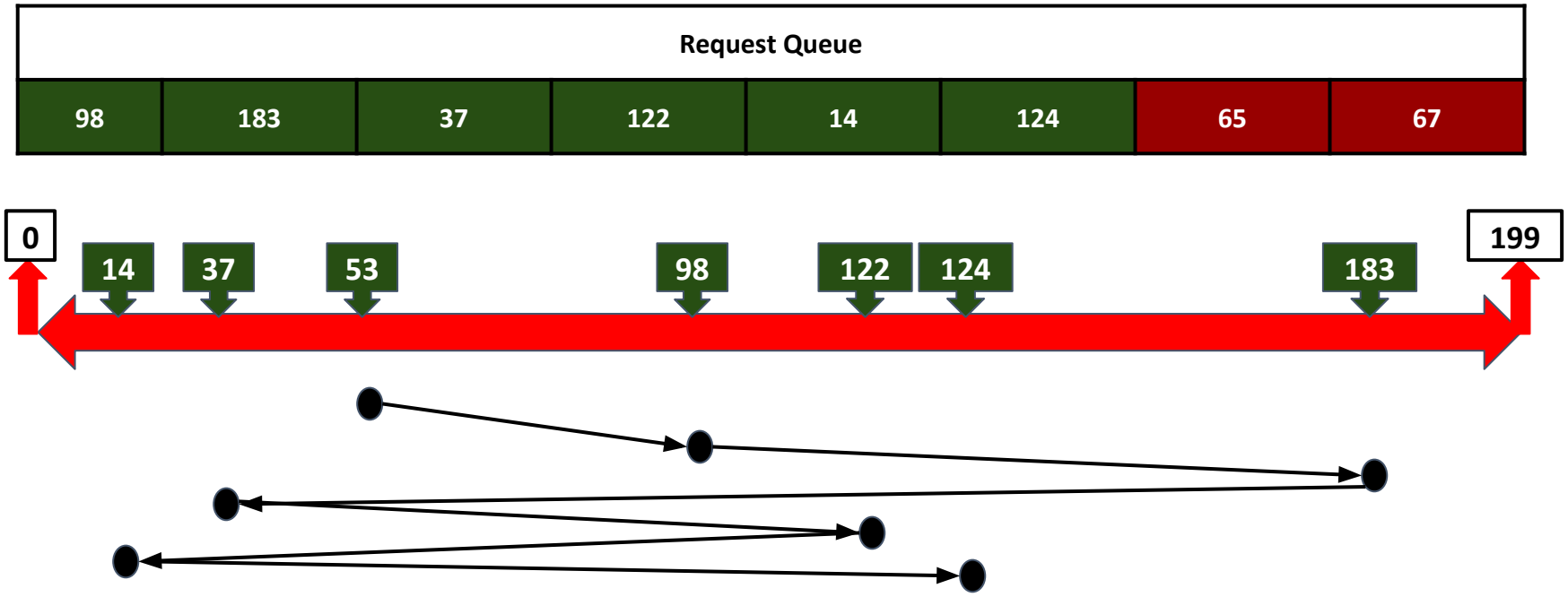


Seek Distance = 361

Seek Distance = Seek Distance + abs (Current Cylinder Number - New Cylinder Number)
Seek Distance = 361 + abs(122-14)
Seek Distance = 469

First Come First Serve - FCFS Disk Scheduling

- Request Queue => 0 .. 199
- 98, 183, 37, 122, 14, 124, 65, 67



Seek Distance = 469

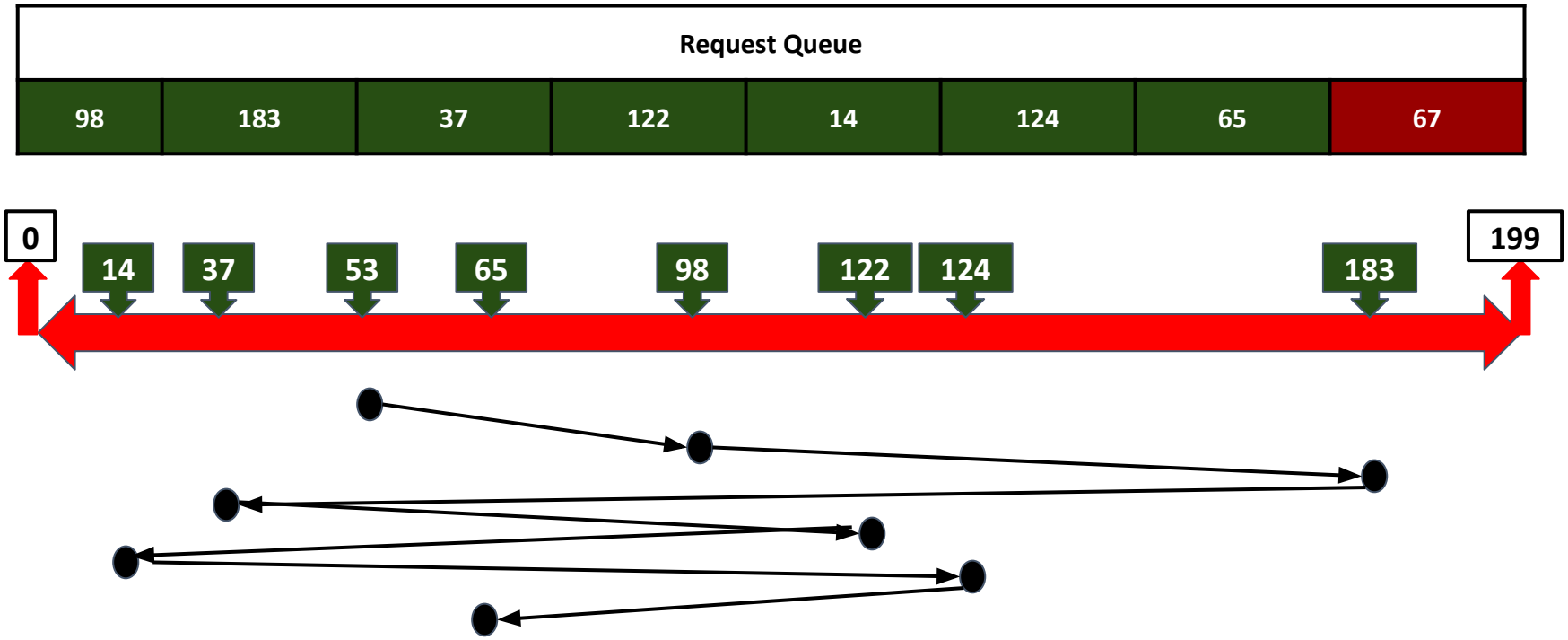
Seek Distance = Seek Distance + abs (Current Cylinder Number - New Cylinder Number)

Seek Distance = 469 + abs(14-124)

Seek Distance = 579

First Come First Serve - FCFS Disk Scheduling

- Request Queue => 0 .. 199
- 98, 183, 37, 122, 14, 124, 65, 67



Seek Distance = 579

Seek Distance = Seek Distance + abs (Current Cylinder Number - New Cylinder Number)

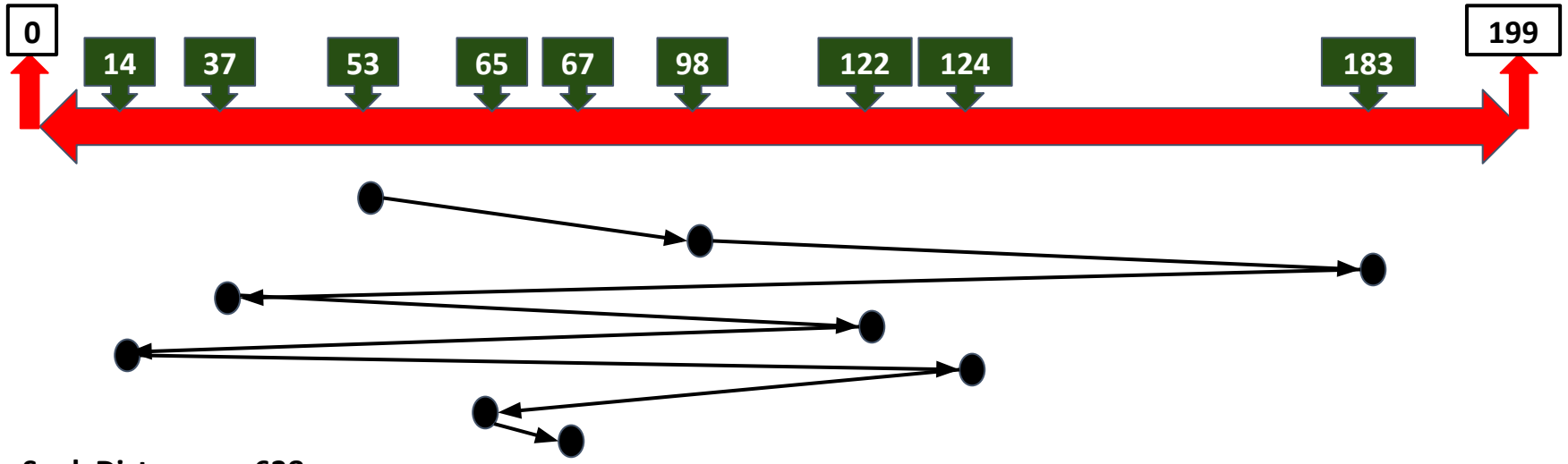
Seek Distance = 579 + abs(124-65)

Seek Distance = 638

First Come First Serve - FCFS Disk Scheduling

- Request Queue => 0 .. 199
- 98, 183, 37, 122, 14, 124, 65, 67

Request Queue							
98	183	37	122	14	124	65	67



Final Total Head Movement in terms of Cylinders => 640

Seek Distance = 638

Seek Distance = Seek Distance + abs (Current Cylinder Number - New Cylinder Number)
Seek Distance = 638 + abs(65-67)
Seek Distance = 640

Shortest Seek Time First - SSTF Disk Scheduling

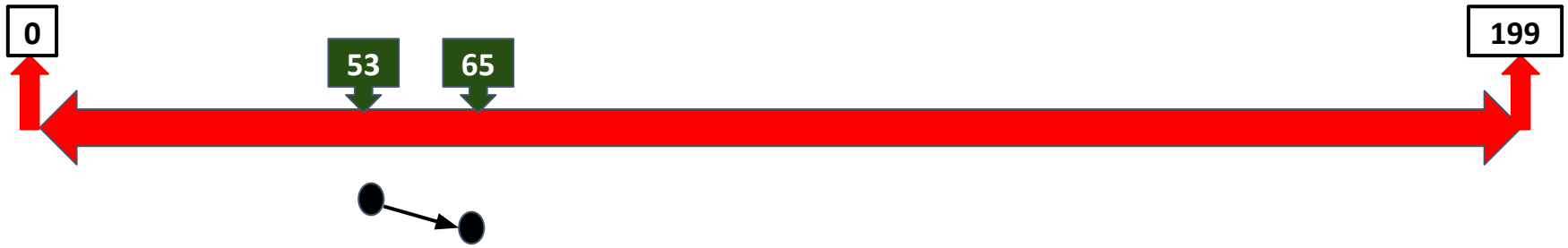
- Shortest Seek Time First selects the request with the minimum seek time from the current head position

- SSTF scheduling is a form of SJF scheduling; may cause starvation of some requests

Shortest Seek Time First - SSTF Disk Scheduling

- Request Queue => 0 .. 199
- 98, 183, 37, 122, 14, 124, 65, 67
- Head pointer initially @ 53

	Request							
Distance from Current Head Position @ 53	98	183	37	122	14	124	65	67
	45	130	16	69	39	71	12	14



Seek Distance = 0

Seek Distance = Seek Distance + abs (Current Cylinder Number - New Cylinder Number)

Seek Distance =0 + abs(53-65)

Seek Distance = 12

Shortest Seek Time First - SSTF Disk Scheduling

- Request Queue => 0 .. 199
- 98, 183, 37, 122, 14, 124, 65, 67
- Head pointer initially @ 53

	Request							
Distance from Current Head Position @ 65	98	183	37	122	14	124	65	67
	33	118	28	57	51	59	S	2

Seek Distance = 12

Seek Distance = Seek Distance + abs (Current Cylinder Number - New Cylinder Number)
Seek Distance =12 + abs(65-67)
Seek Distance = 14

Shortest Seek Time First - SSTF Disk Scheduling

- Request Queue => 0 .. 199
- 98, 183, 37, 122, 14, 124, 65, 67
- Head pointer initially @ 53

	Request							
Distance from Current Head Position @ 67	98	183	37	122	14	124	65	67
	31	116	30	55	53	57	S	S

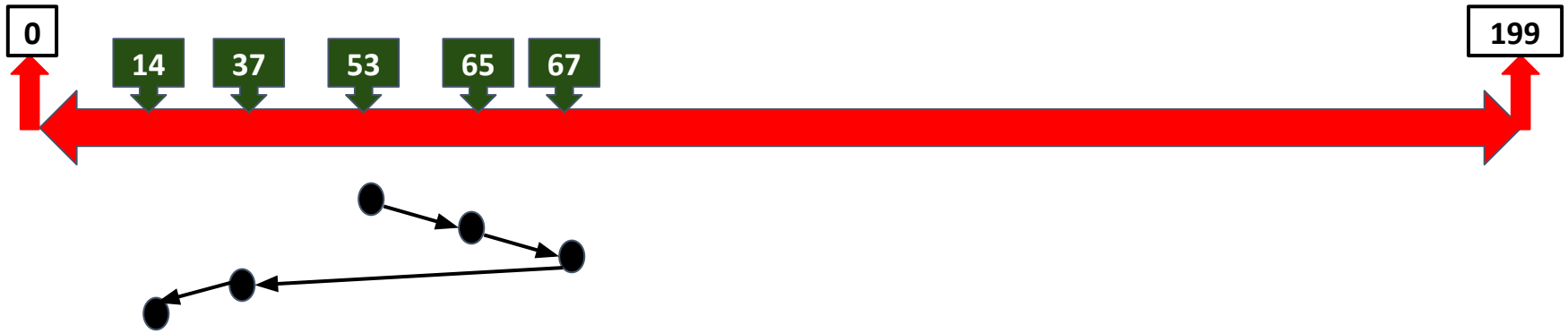
Seek Distance = 14

Seek Distance = Seek Distance + abs (Current Cylinder Number - New Cylinder Number)
Seek Distance =14 + abs(67-37)
Seek Distance = 44

Shortest Seek Time First - SSTF Disk Scheduling

- Request Queue => 0 .. 199
- 98, 183, 37, 122, 14, 124, 65, 67
- Head pointer initially @ 53

	Request							
Distance from Current Head Position @ 37	98	183	37	122	14	124	65	67
	61	146	S	85	23	87	S	S



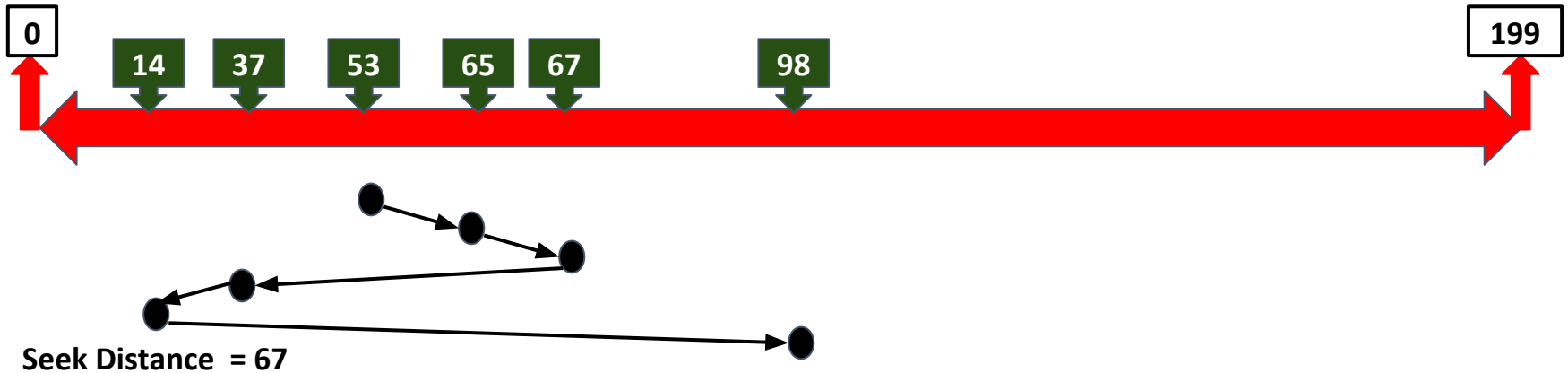
Seek Distance = 44

Seek Distance = Seek Distance + abs (Current Cylinder Number - New Cylinder Number)
Seek Distance =44 + abs(37-14)
Seek Distance = 67

Shortest Seek Time First - SSTF Disk Scheduling

- Request Queue => 0 .. 199
- 98, 183, 37, 122, 14, 124, 65, 67
- Head pointer initially @ 53

	Request							
Distance from Current Head Position @ 14	98	183	37	122	14	124	65	67
	84	169	S	108	S	110	S	S



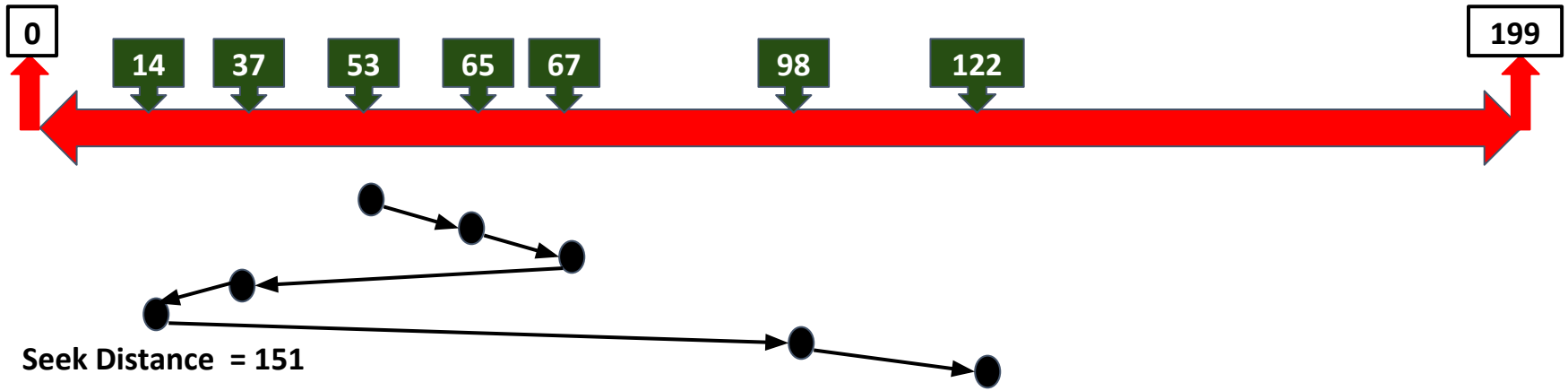
Seek Distance = 67

Seek Distance = Seek Distance + abs (Current Cylinder Number - New Cylinder Number)
Seek Distance =67 + abs(14-98)
Seek Distance = 151

Shortest Seek Time First - SSTF Disk Scheduling

- Request Queue => 0 .. 199
- 98, 183, 37, 122, 14, 124, 65, 67
- Head pointer initially @ 53

	Request							
Distance from Current Head Position @ 98	98	183	37	122	14	124	65	67
	S	85	S	24	S	26	S	S



Seek Distance = 151

Seek Distance = Seek Distance + abs (Current Cylinder Number - New Cylinder Number)

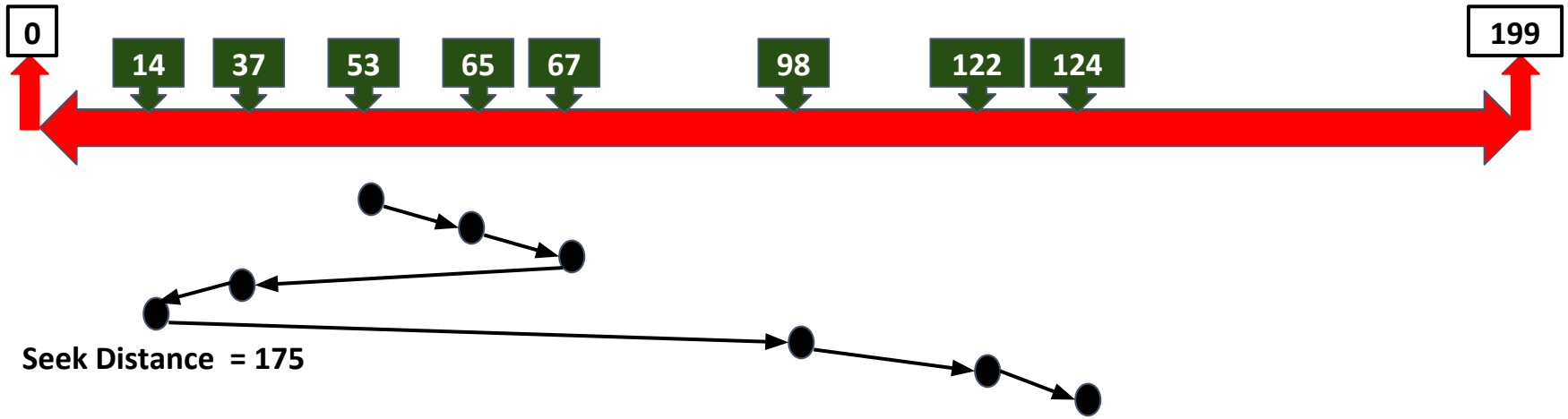
Seek Distance =151 + abs(98-122)

Seek Distance = 175

Shortest Seek Time First - SSTF Disk Scheduling

- Request Queue => 0 .. 199
- 98, 183, 37, 122, 14, 124, 65, 67
- Head pointer initially @ 53

	Request							
Distance from Current Head Position @ 122	98	183	37	122	14	124	65	67
	S	61	S	S	S	2	S	S



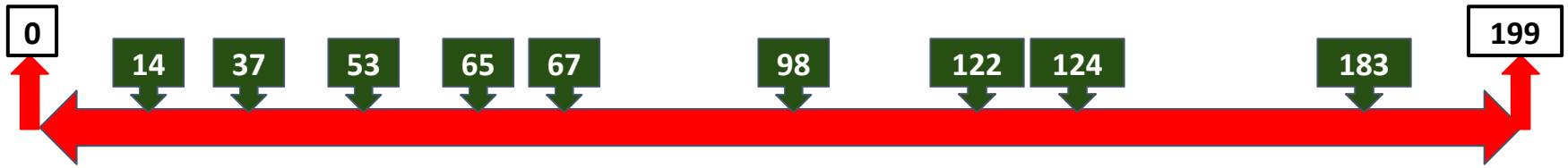
Seek Distance = 175

Seek Distance = Seek Distance + abs (Current Cylinder Number - New Cylinder Number)
Seek Distance =175 + abs(122-124)
Seek Distance = 177

Shortest Seek Time First - SSTF Disk Scheduling

- Request Queue => 0 .. 199
- 98, 183, 37, 122, 14, 124, 65, 67
- Head pointer initially @ 53

	Request							
Distance from Current Head Position @ 124	98	183	37	122	14	124	65	67
	S	59	S	S	S	S	S	S



Seek Distance = 177

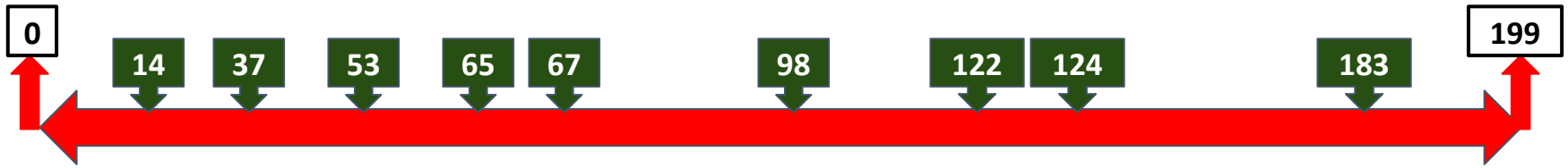
Seek Distance = Seek Distance + abs (Current Cylinder Number - New Cylinder Number)
Seek Distance =177 + abs(124-183)
Seek Distance = 236

Shortest Seek Time First - SSTF Disk Scheduling

- Request Queue => 0 .. 199
- 98, 183, 37, 122, 14, 124, 65, 67
- Head pointer initially @ 53

	Request							
Distance from Current Head Position @ 183	98	183	37	122	14	124	65	67
	S	S	S	S	S	S	S	S

Final Total Head Movement in terms of Cylinders => 236



Seek Distance = 177

Seek Distance = Seek Distance + abs (Current Cylinder Number - New Cylinder Number)
Seek Distance =177 + abs(124-183)
Seek Distance = 236

THANK YOU

Nitin V Pujari
Faculty, Computer Science
Dean - IQAC, PES University

nitin.pujari@pes.edu

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