



# Homework 8

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Operating Systems  
CS 3430









# FIFO



Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*		F							
2		A										
3				E		*						



# FIFO



Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*		F							
2		A					*					
3				E		*						



# FIFO

↓

Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*		F							
2		A					*					
3				E		*						



# FIFO

↓

Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*		F							
2		A					*	R				
3				E		*						





# FIFO

↓

Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*		F				*			
2		A					*	R				
3				E		*						



# FIFO

↓

Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*		F				*			
2		A					*	R				
3				E		*						



# FIFO

↓

Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*		F				*			
2		A					*	R				
3				E		*				A		



# FIFO

↓

Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*		F				*			
2		A					*	R			*	
3				E		*				A		



# FIFO

↓

Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*		F				*			
2		A					*	R			*	
3				E		*				A		



# FIFO

↓

Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*		F				*			E
2		A					*	R			*	
3				E		*				A		



# FIFO

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- 7 page faults

Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*		F				*			E
2		A					*	R			*	
3				E		*				A		



# FIFO

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4 compulsory cache misses

Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	<i>R</i>		*		<i>F</i>				*			<i>E</i>
2		<i>A</i>					*	<i>R</i>			*	
3				<i>E</i>		*				<i>A</i>		















# MIN



Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*		F							
2		A										
3				E		*						



# MIN



Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*		F							
2		A					*					
3				E		*						



# MIN



Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*		F							
2		A					*					
3				E		*						





# MIN



Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*		F							
2		A					*					
3				E		*		R				



# MIN



Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*		F				*			
2		A					*					
3				E		*		R				



# MIN



Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*		F				*			
2		A					*			*		
3				E		*		R				



# MIN



Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*		F				*			
2		A					*			*		
3				E		*		R			*	



# MIN

↓

Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*		F				*			E
2		A					*			*		
3				E		*		R			*	



# MIN

---

- 6 page faults

Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*		F				*			E
2		A					*			*		
3				E		*		R			*	











# LRU

---



Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*									
2		A			F							
3				E		*						



# LRU

---



Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*									
2		A			F							
3				E		*						



# LRU



Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*									
2		A			F							
3				E		*						



# LRU

---



Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*				A					
2		A			F							
3				E		*						



# LRU



Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*				A					
2		A			F							
3				E		*						



# LRU



Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*				A					
2		A			F							
3				E		*						



# LRU



Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*				A					
2		A			F			R				
3				E		*						





# LRU

---



Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*				A					
2		A			F			R				
3				E		*						



# LRU

↓

Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*				A					
2		A			F			R				
3				E		*						



# LRU



Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*				A					
2		A			F			R				
3				E		*			F			



# LRU

---



Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*				A			*		
2		A			F			R				
3				E		*			F			



# LRU

---

↓

Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*				A			*		
2		A			F			R			*	
3				E		*			F			



# LRU

---

↓

Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*				A			*		
2		A			F			R			*	
3				E		*			F			



# LRU

↓

Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*				A			*		
2		A			F			R			*	
3				E		*			F			



# LRU

---

↓

Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*				A			*		
2		A			F			R			*	
3				E		*			F			E





# LRU

---

- 7 page faults

Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		*				A			*		
2		A			F			R			*	
3				E		*			F			E







# LFU



Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		2									
2		A			F							
3				E		2						



# LFU



Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		2									
2		A			F		A					
3				E		2						



# LFU



Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		2					3				
2		A			F		A					
3				E		2						



# LFU



Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		2					3				
2		A			F		A		F			
3				E		2						



# LFU



Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		2					3				
2		A			F		A		F	A		
3				E		2						





# LFU

↓

Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		2					3			4	
2		A			F		A		F	A		
3				E		2						



# LFU

↓

Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		2					3			4	
2		A			F		A		F	A		
3				E		2						3



# LFU

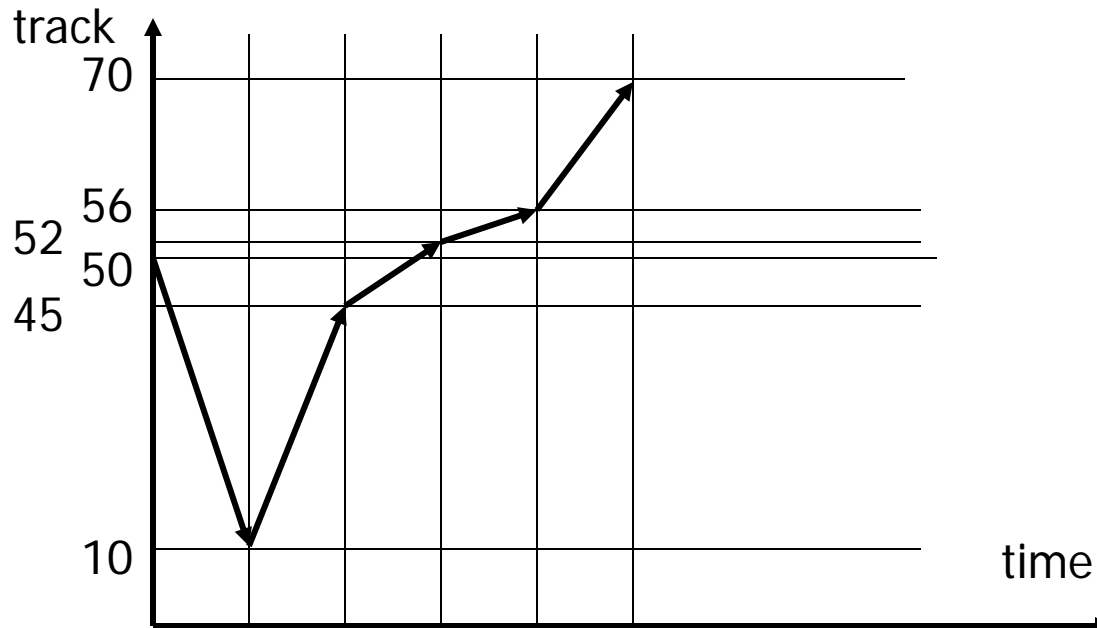
- 7 page faults

Memory page	R	A	R	E	F	E	A	R	F	A	R	E
1	R		2					3			4	
2		A			F		A		F	A		
3				E		2						3

↓

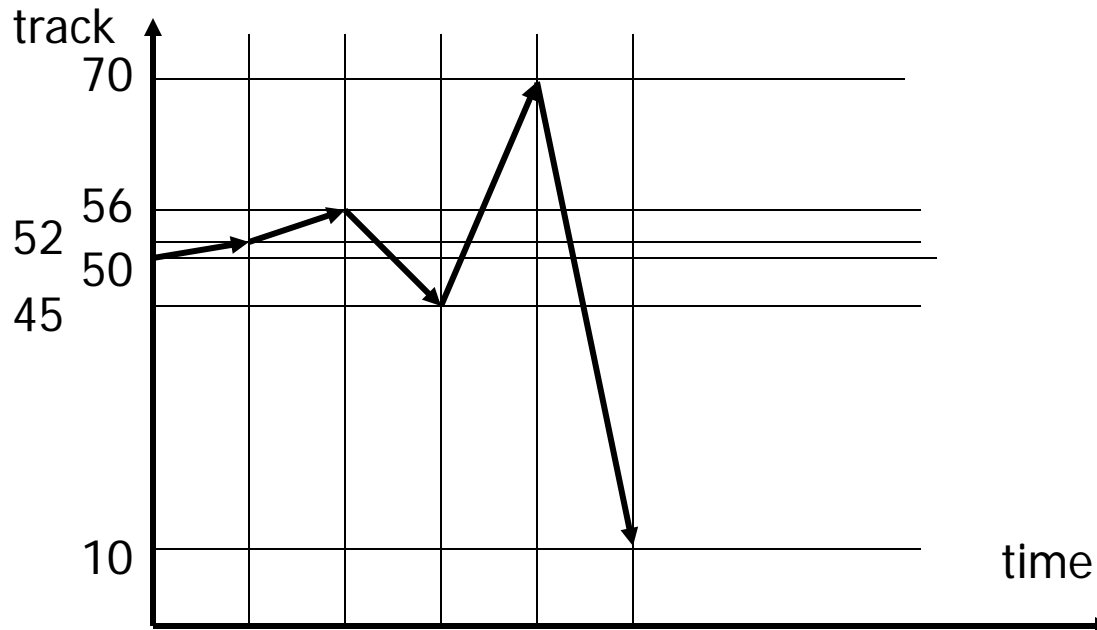
# FIFO Disk Scheduling Policy

- Request queue: 10, 45, 52, 56, 70
- Initial head position: 50



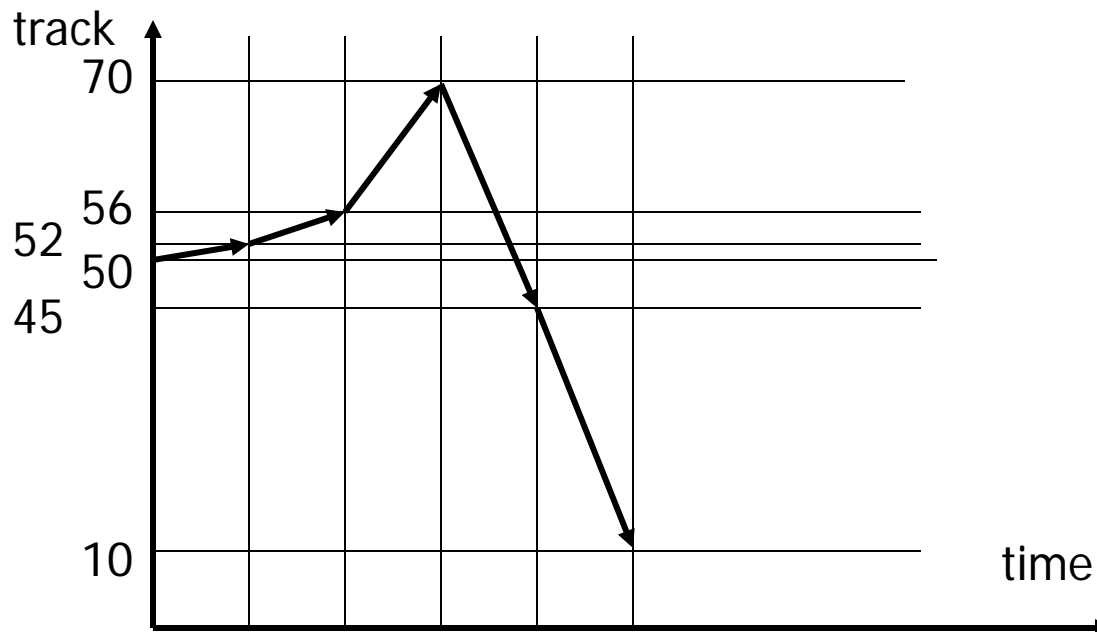
# SSTF Disk Scheduling Policy

- Request queue: 10, 45, 52, 56, 70
- Initial head position: 50



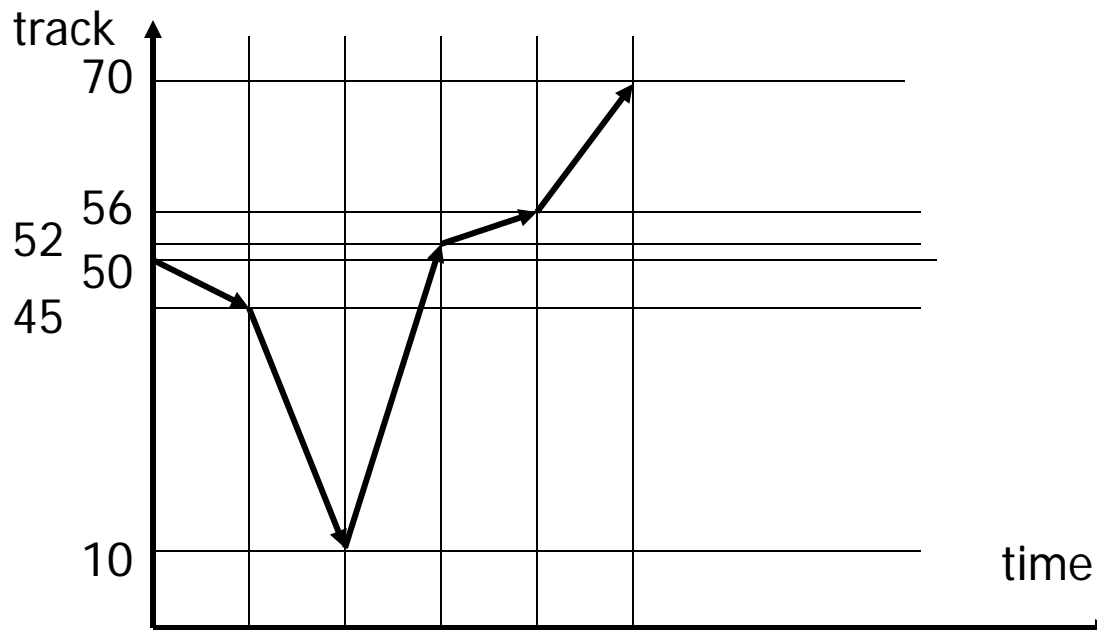
# SCAN Disk Scheduling Policy

- Request queue: 10, 45, 52, 56, 70
- Initial head position: 50



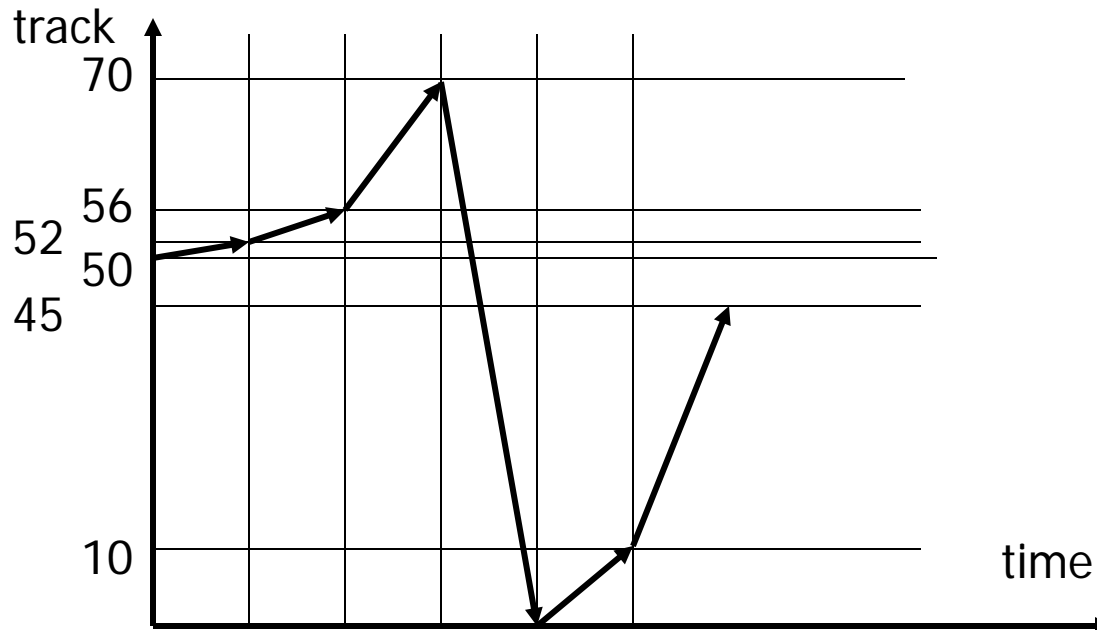
# SCAN Disk Scheduling Policy

- Request queue: 10, 45, 52, 56, 70
- Initial head position: 50



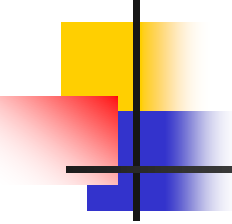
# C-SCAN Disk Scheduling Policy

- Request queue: 10, 45, 52, 56, 70
- Initial head position: 50





# A Single Disk Platter With 5 Tracks



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from\to	0	1	2	3	4
0	0	1	2	3	4
1	1	0	1	2	3
2	2	1	0	1	2
3	3	2	1	0	1
4	4	3	2	1	0

# A Single Disk Platter With 5 Tracks

- $1/25 \times (0 + 1 + 2 + 3 + 4)$   
+  $1/25 \times (1 + 0 + 1 + 2 + 3)$   
+  $1/25 \times (2 + 1 + 0 + 1 + 2)$   
+  $1/25 \times (3 + 2 + 1 + 0 + 1)$   
+  $1/25 \times (4 + 3 + 2 + 1 + 0)$   
=  $1/25 \times (10 + 7 + 6 + 7 + 10)$   
=  $1/25 \times (20 + 14 + 6) = 40/25 = 1.6$
- $1.6 / 5 = 0.32 \sim = 1/3$