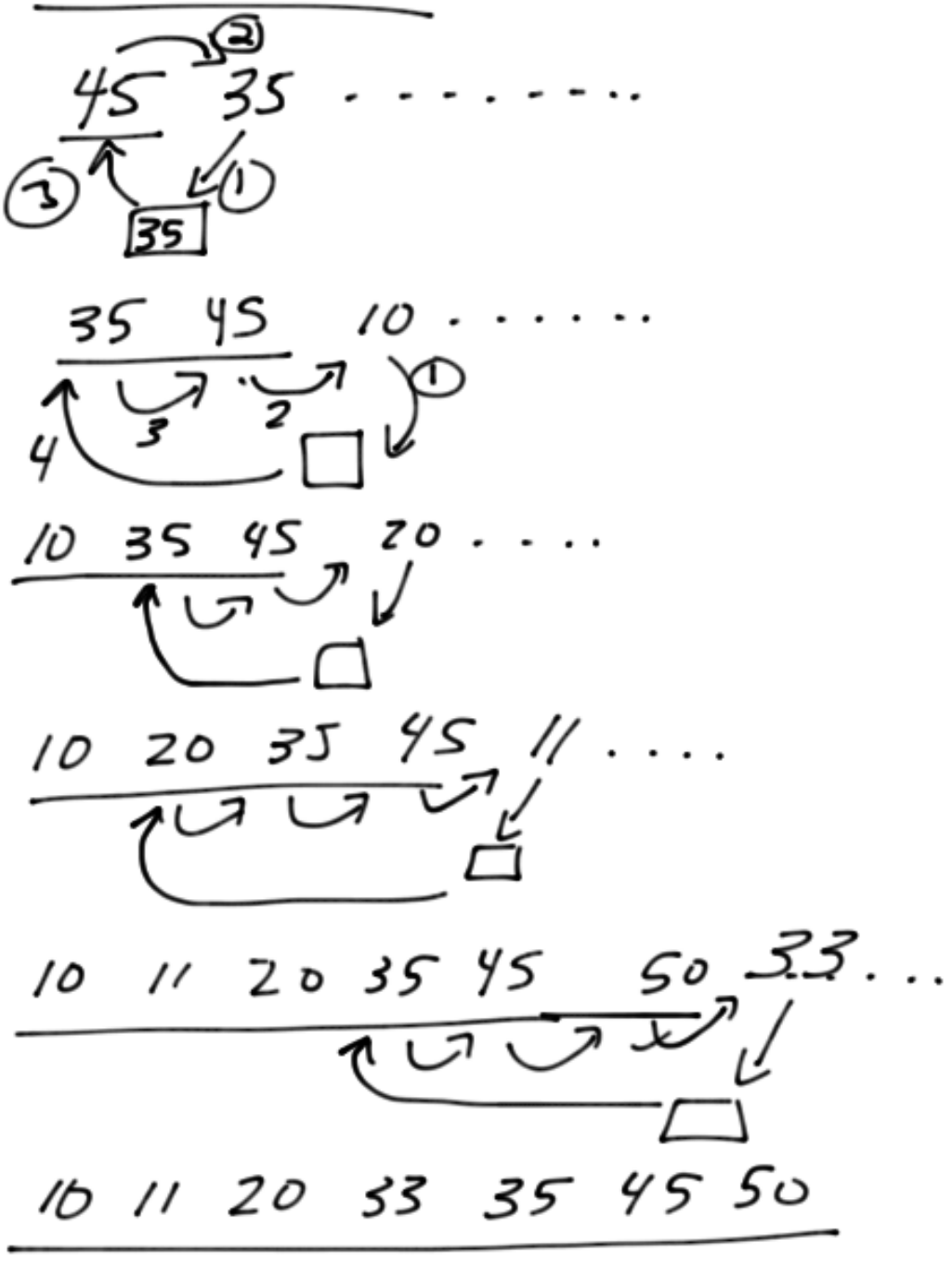
Today - Lecture 17 - cs163

1) Topic #7 - Measuring Efficiency
2) Topic #12 - Iterative Sorting Algs
   - Insertion Sort
   - selection sort
   - exchange sort
   - Shell sort
   - Radix sort
3) Next: Topic #13 - Recursive Sorting!

45 35 10 20 11 50 33

"Insertion sort"



10 11 20 33 35 45 50

10 20 30 40 50

←

#Move	#Compares
∅	O(N)

Best Case - Already sorted

Worst Case - Reverse order

50 40 30 20

40 50 30 20

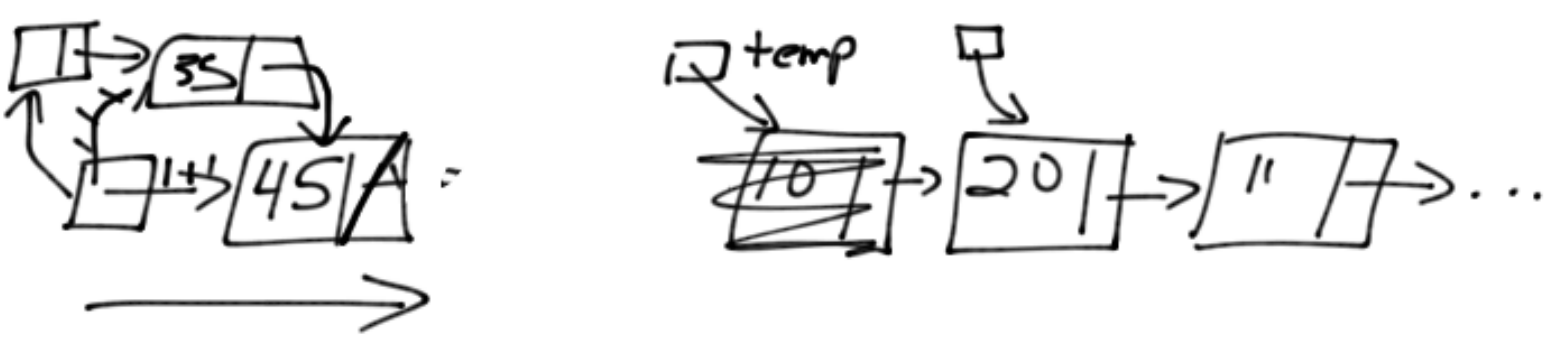
30 40 50 20

20 30 40 50

∅	∅
3	1
4	2
5	3
N+1	N-1
$\alpha(N^2)$	$\alpha(N^2)$

N

What if a LLL was used??



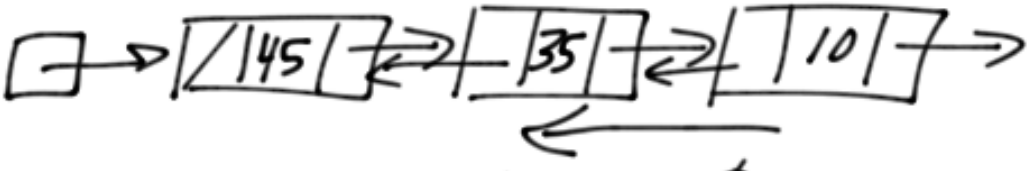
45 35 10 20 11 50 33 25 5 30

"Insertion sort"

	moves	compares
"Best" case - "sorted" —	$\emptyset$	$O(N^2)$
~ Worst Case	$O(1)$	$O(N)$

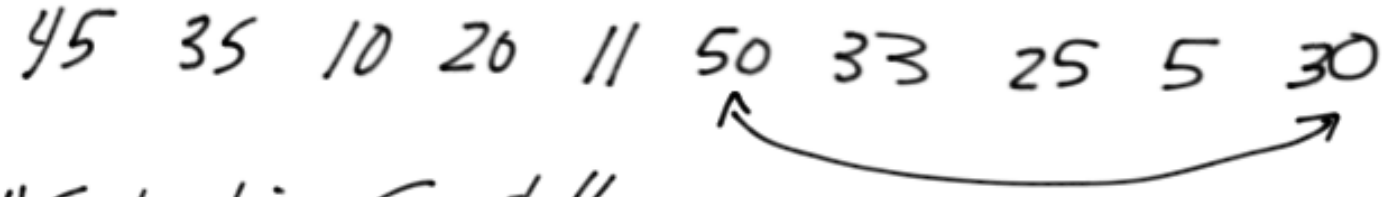
45 35 10 20 11 50 33 25 5 30

"Insertion sort"

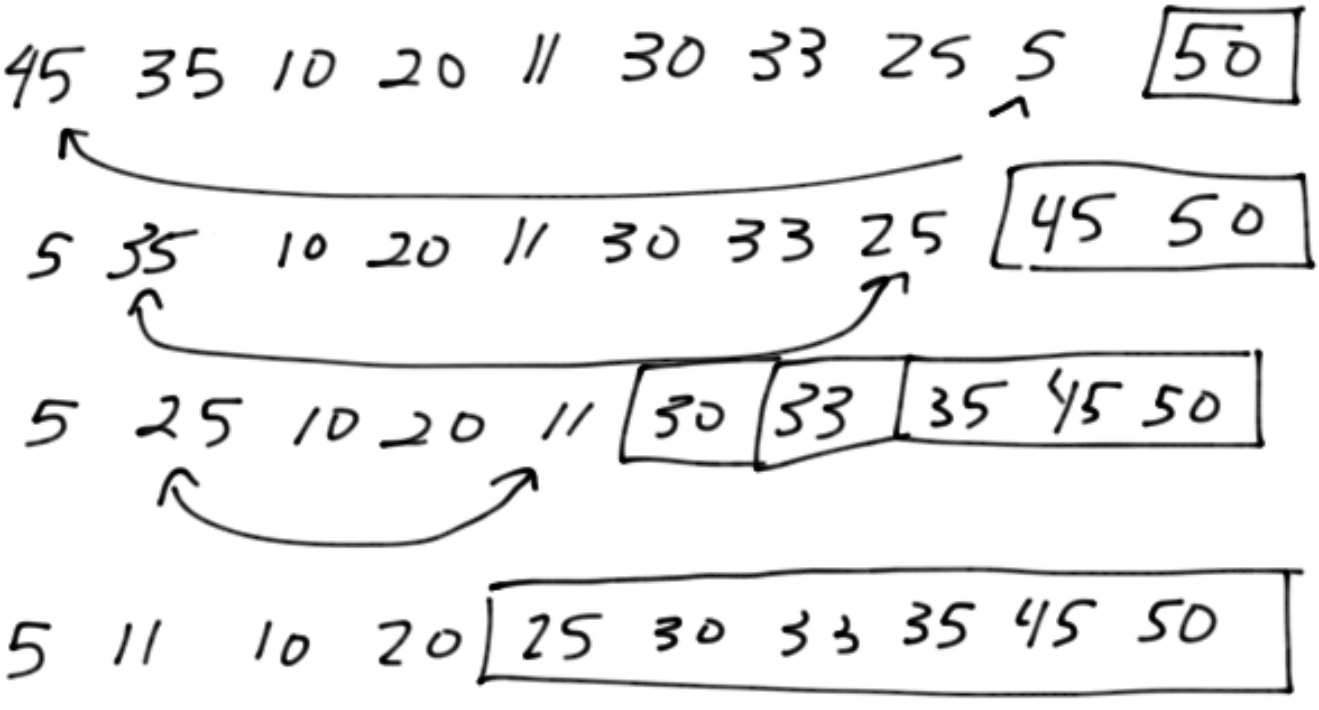


Best case - sorted ϕ moves $O(N)$ compares

Worst case $O(N)$ $O(N^2)$ compares



"Selection Sort"



All cases

#compares $O(N^2)$

#moves $\emptyset \rightarrow O(N)$

45 35 10 20 11 50 33 25 5 30

"Exchange Sort – Bubble sort"

35 ~~45~~ ~~45~~ ~~45~~ 45 ~~50~~ ~~50~~ ~~50~~ 50 **50**
10 20 11 33 25 5 30

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10 ~~35~~ ~~35~~ 35 ~~45~~ ~~45~~ ~~45~~ 45 **45 50**
20 11 33 25 5 30

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10 20 20 ~~35~~ ~~35~~ ~~35~~ ~~35~~ **35 45 50**
11 33 25 5 30

Best case - Sorted - O(N) compares Ø moves
"trivial rejected"

Worst case - $O(N^2)$ compares, $O(N^2)$ moves

15 33 10 5 11 45 35 25 20 30 50

10 15 33

5 10 15 33

11 15 33 45

35 45

25 33 35 45

20 25 33 35 45

30 33 35 45 50

LAX PDX SFO SEA JFK KTN MST CDG

Compares ∅

A	G	K	N	O	T	X
SEA	CDG	JFK	KTN	SFO	MST	LAX, PDX

A	D	E	F	S	T
CDG, LAX, PDX	SEA	JFK, SFO		MST	KTN

C	JK	L	M	P	S
CDG	JFK, KTN	LAX	MST	PDX	SEA, SFO

Moves ~~O(##N)~~

O(N) → O(Klength * N)

** Memory **