

COP 3502 10/17/23

- ⑥ Exams being graded. Done by Fri.
Get back in Recitation. (Exceptions =
If no LabNm filled in on WC + SAS)
Give formula to calc current etc.
Approx grade lines A = , B = , C =

① Sorting

Today: Bubble, Insertion, Selection $O(n^2)$

Thursday: Merge Sort, Quick Sort Avg case
 $O(n \lg n)$

- Rec This Week (Tracing)

- Rec Next Week (Notes) - Merge, Quick
Ints

- P4 (create structs soA)

Bubble Sort

10, 3, 2, 15, 18, 12, 20, 6

3 10 2 15 18 12 20 6

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3 2 10 15 18 12 20 6

3 2 10 15 12 18 20 6

3 2 10 15 12 18 20 6

3	2	10	15	12	18	6	20	1 st iter
2	3	10	12	15	6	18	20	2 nd iter
2	3	10	12	6	15	18	20	3 rd iter
2	3	10	6	12	15	18	20	4 th iter
2	3	6	10	12	15	18	20	5 th iter
2	3	6	10	12	15	18	20	6 th iter
2	3	6	10	12	15	18	20	7 th iter

Outer loop - counts down

Inner loop - count up

Run time $(n-1) + (n-2) + (n-3) + \dots + 1 = \frac{(n-1)n}{2}$

best, avg, worst = $O(n^2)$

Insertion Sort

10, 3, 2, 15, 18, 12, 20, 6

3, 10, 2, 15, 18, 12, 20, 6

1st iter

2, 3, 10, 15, 18, 12, 20, 6

2nd iter

2, 3, 10, 15, 18, 12, 20, 6

3rd iter

2, 3, 10, 15, 18, 12, 20, 6

4th iter

2, 3, 10, 12, 15, 18, 20, 6

5th iter

2, 3, 10, 12, 15, 18, 20, 6

6th iter

2, 3, 6, 10, 12, 15, 18, 20

7th iter

Runtime best case $O(n)$

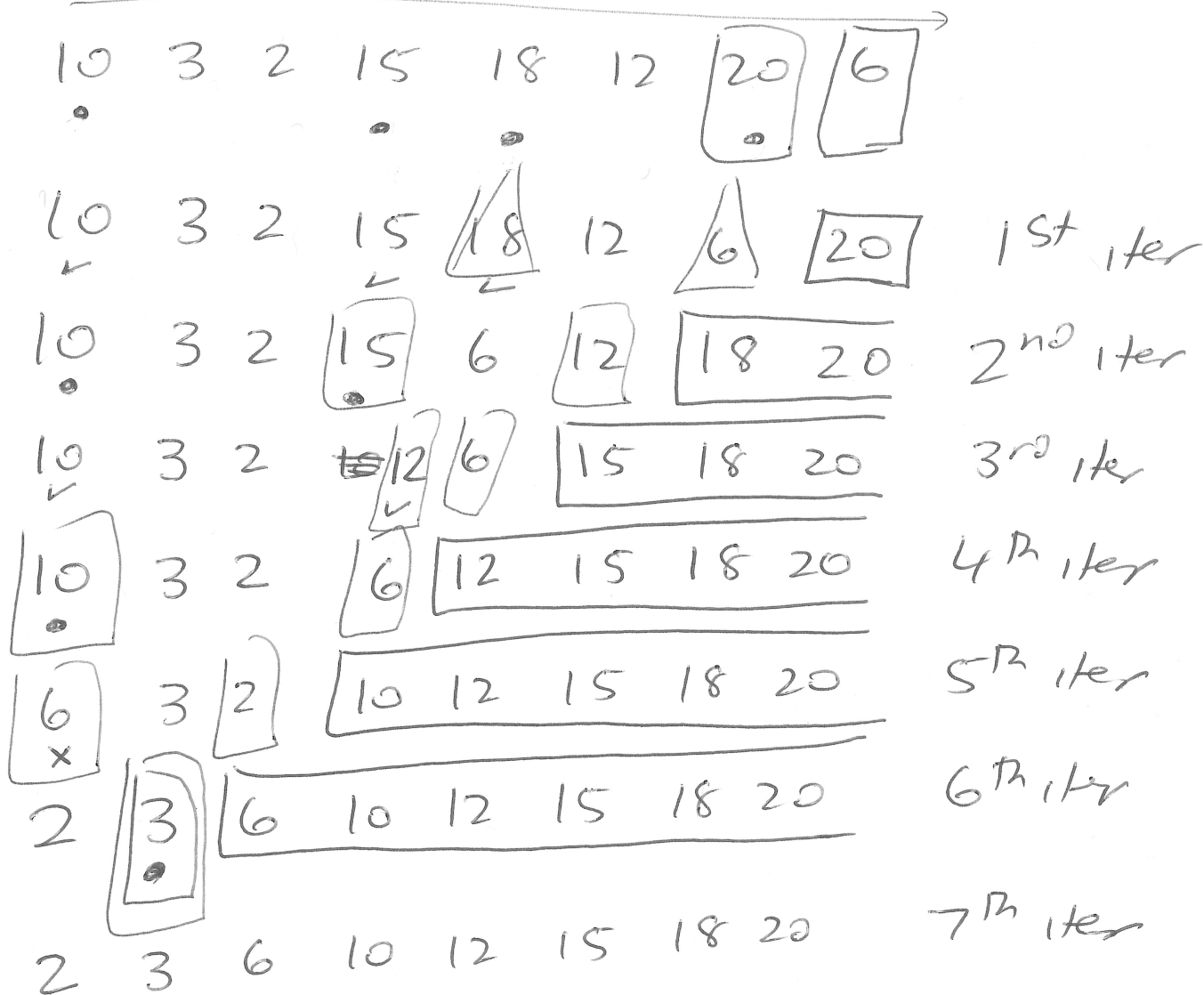
worst case $1+2+3+\dots+(n+1) = O(n^2)$

avg case $\sum_{i=1}^{n-1} \frac{i}{2} = \frac{(n-1)n}{2 \times 2} = O(n^2)$

Outer loop count up = 1 to $n-1$

Inner loop count down

Selection Sort



Outer loop count down

inner loop count up \rightarrow keeps track max index

swap happens AFTER inner loop completes

Run-time same (always "finish" loops)

$$(n-1) + (n-2) + (n-3) + \dots + 1 = \frac{(n-1)n}{2} = O(n^2)$$

best, avg, worst $O(n^2)$

Merge Algorithm

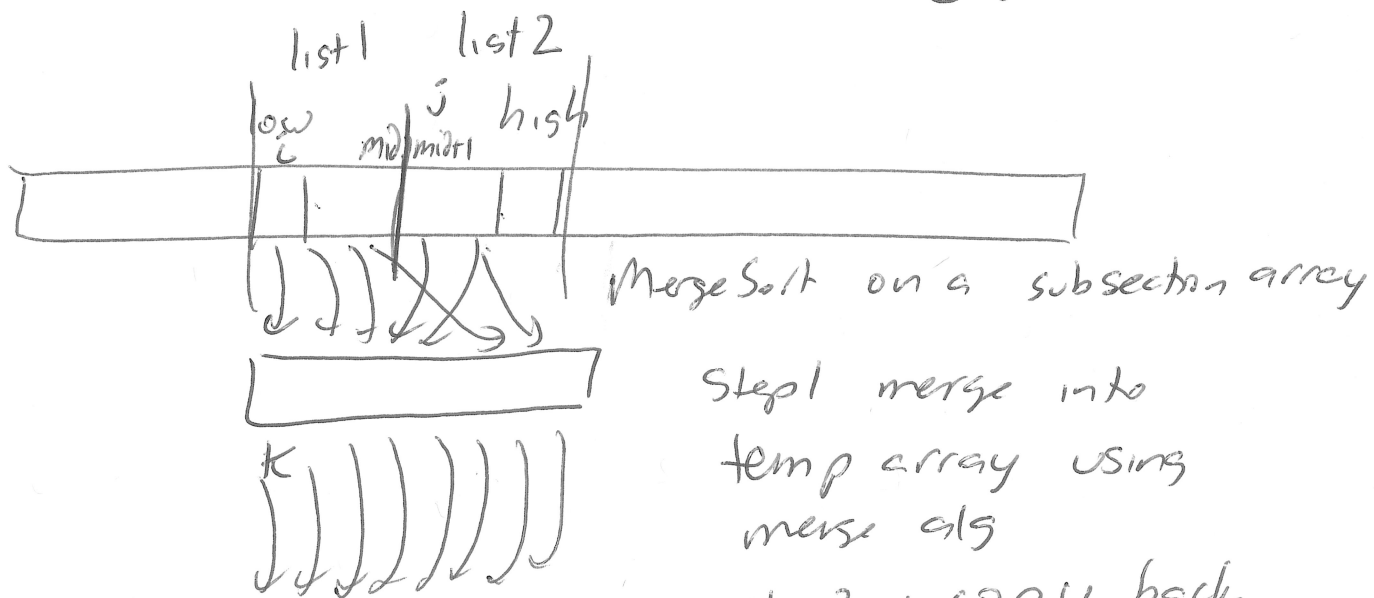
list 1 : 3, 6, 9, 10, 11, 20, 22, 26 n/2

list 2 : 1, 5, 7, 15, 18, 21, 29, 42 n/2

1 3 5 6 7 9 10 11 15 18 20
k=0

Run time if both lists size n/2 $O(n)$

more generally with lists sizes n, m
 $O(n+m)$



Step 1 merge into temp array using merge alg
Step 2 : copy back into original array