

Selection vs. Insertion Sort

Slides by **Sean Szumlanski**
for **CS106B**, Programming Abstractions

Summer 2025

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

0	1	2	3	4	5	6	7	8	9
10	18	2	14	3	12	1			

Selection Sort

(select the smallest element)

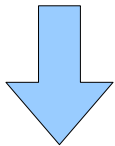
- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

MIN: 10



0	1	2	3	4	5	6	7	8	9
10	18	2	14	3	12	1			

Selection Sort

(select the smallest element)

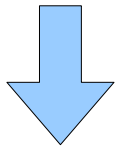
- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

MIN: 10



0	1	2	3	4	5	6	7	8	9
10	18	2	14	3	12	1			

Selection Sort

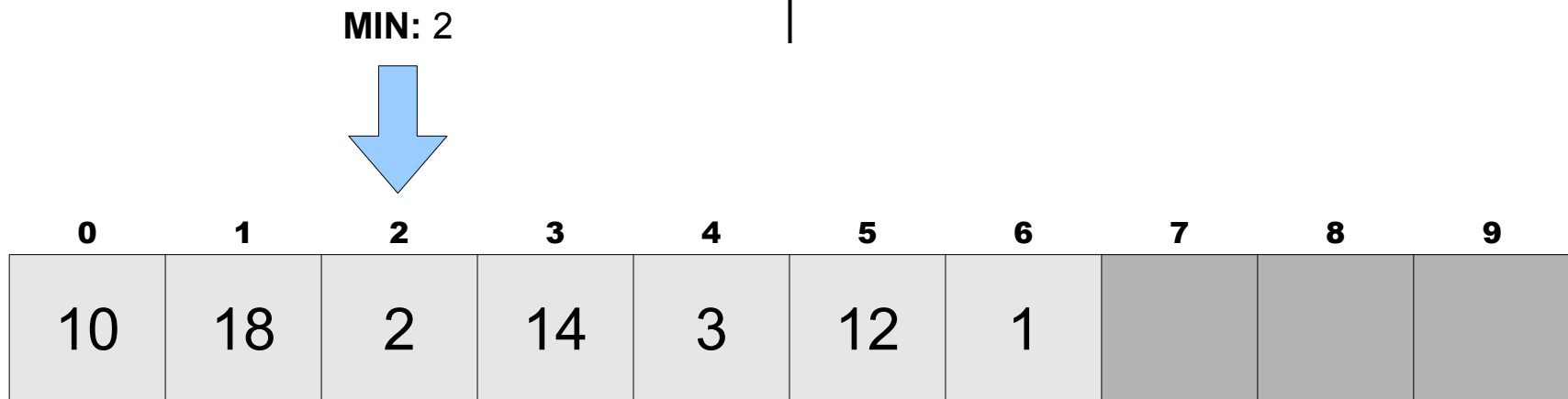
(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy



Selection Sort

(select the smallest element)

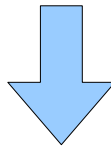
- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

MIN: 2



0	1	2	3	4	5	6	7	8	9
10	18	2	14	3	12	1			

Selection Sort

(select the smallest element)

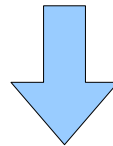
- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

MIN: 2



0	1	2	3	4	5	6	7	8	9
10	18	2	14	3	12	1			

Selection Sort

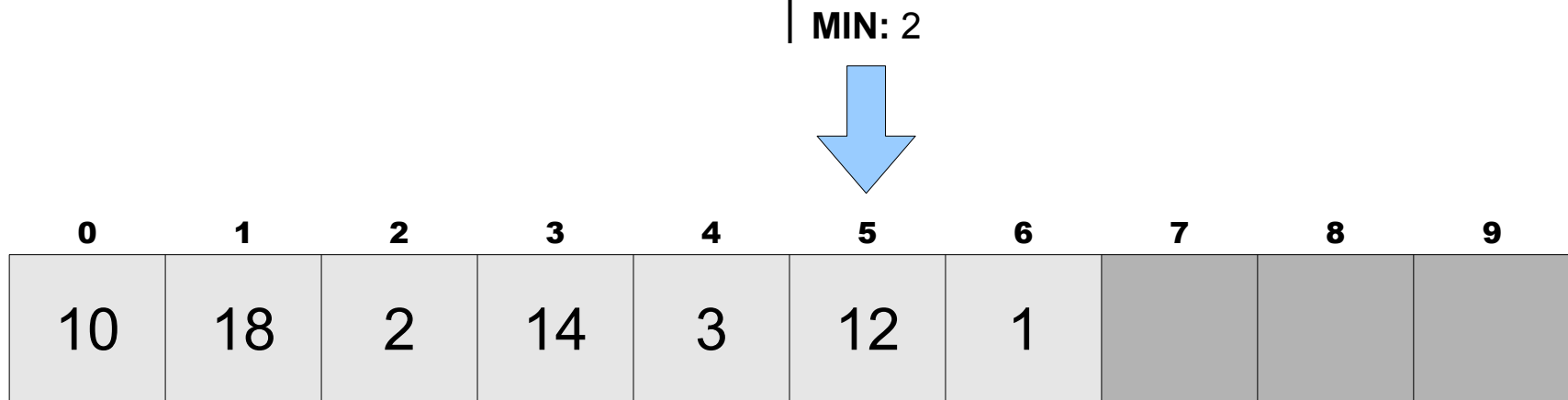
(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy



Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy



Selection Sort

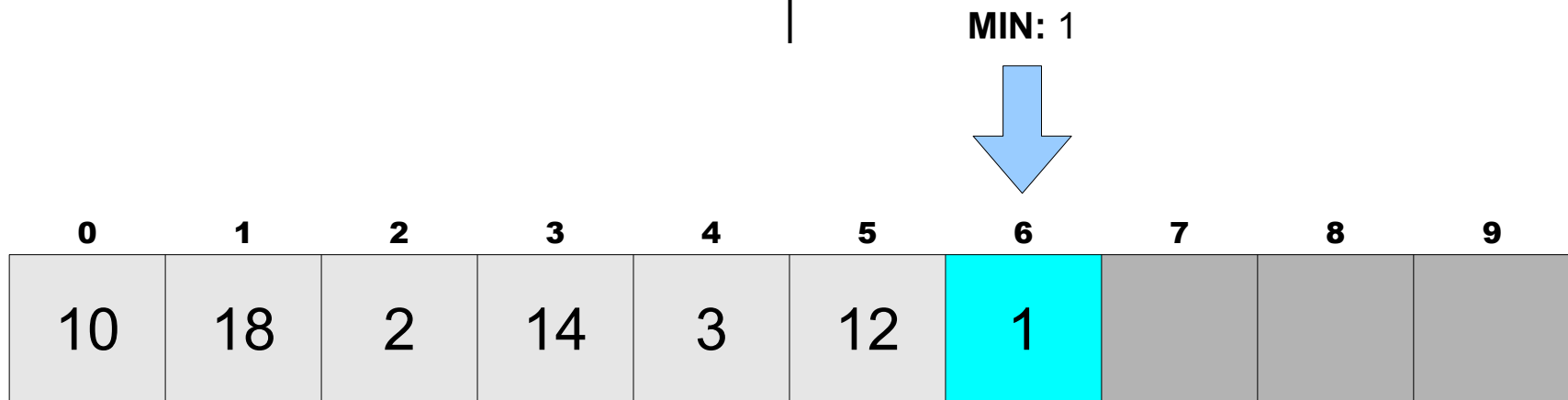
(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy



Selection Sort

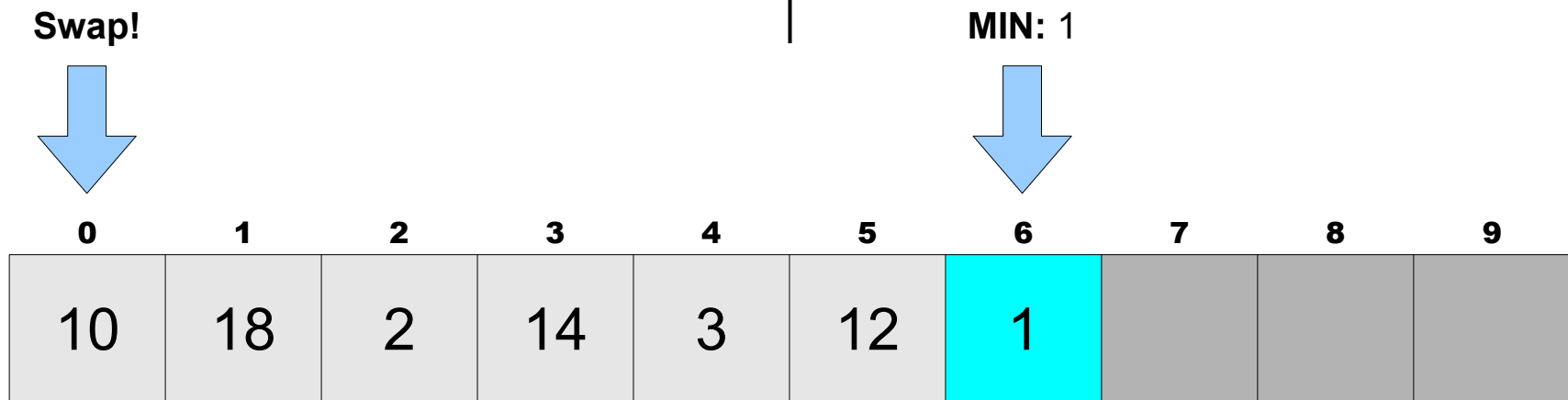
(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy



Selection Sort

(select the smallest element)

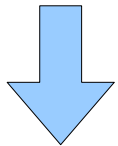
- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

MIN: 1



0	1	2	3	4	5	6	7	8	9
1	18	2	14	3	12	10			

Selection Sort

(select the smallest element)

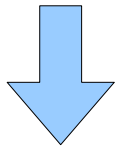
- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

MIN: 1



0	1	2	3	4	5	6	7	8	9
1	18	2	14	3	12	10			

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

0	1	2	3	4	5	6	7	8	9
1	18	2	14	3	12	10			

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

0	1	2	3	4	5	6	7	8	9
1	12	14	18	21	3	10			

Selection Sort

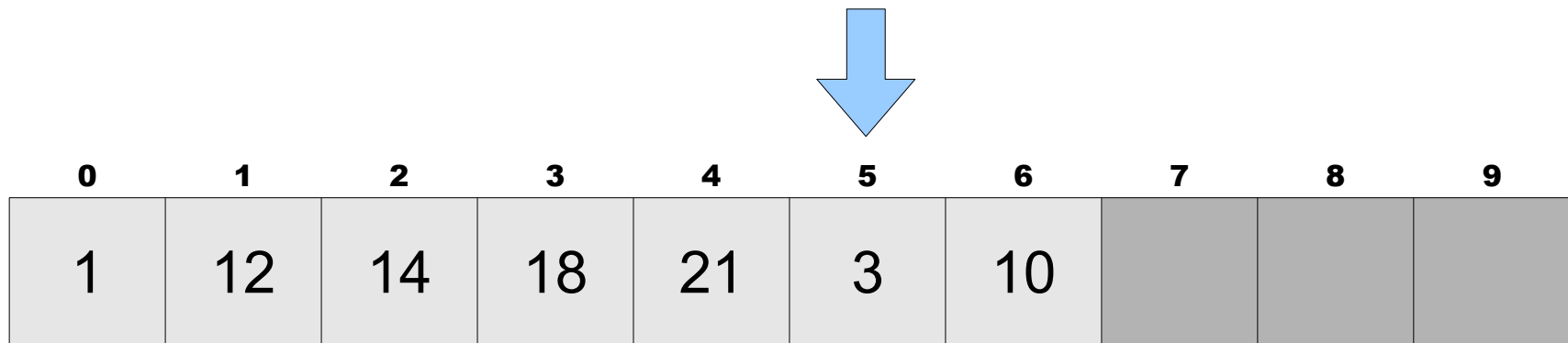
(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy



Selection Sort

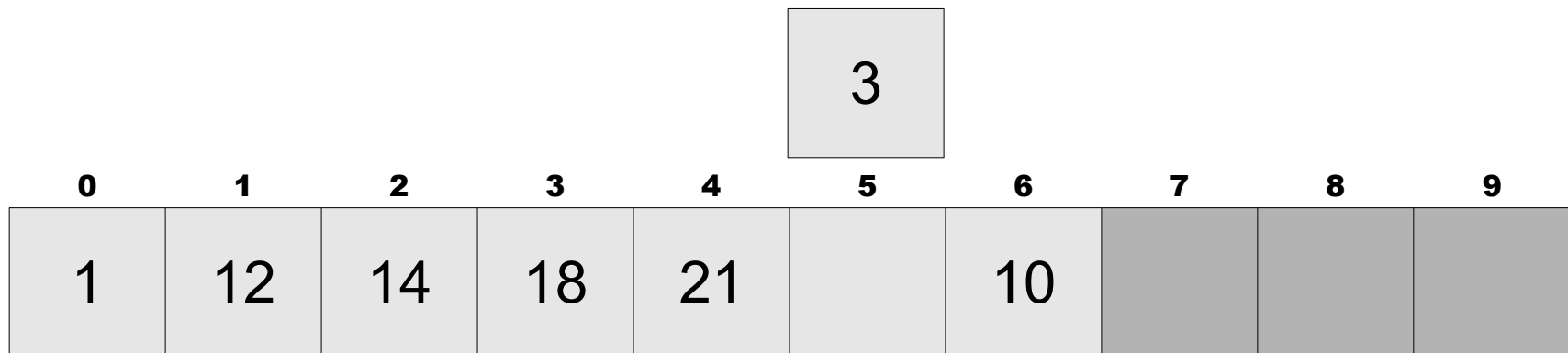
(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy



Selection Sort

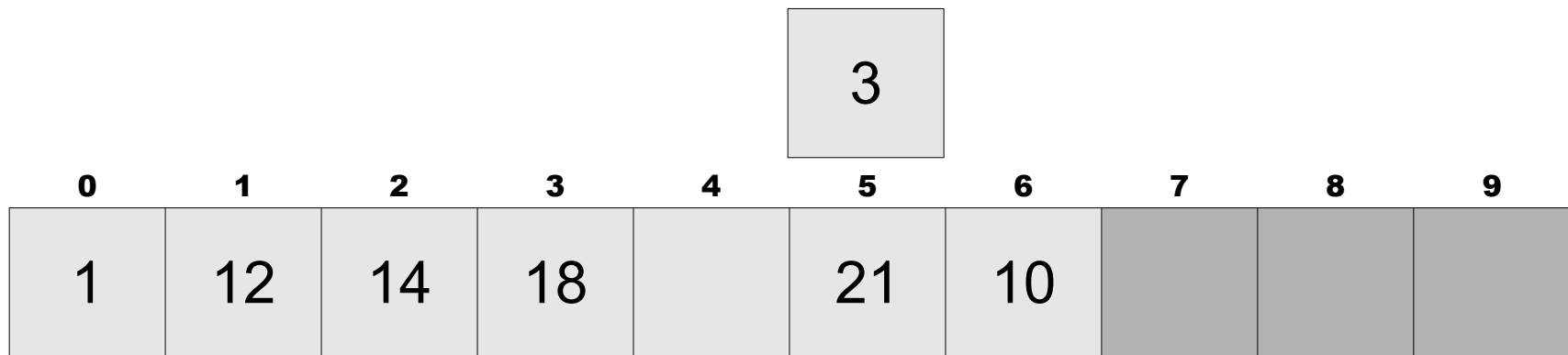
(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy



Swap!

Selection Sort

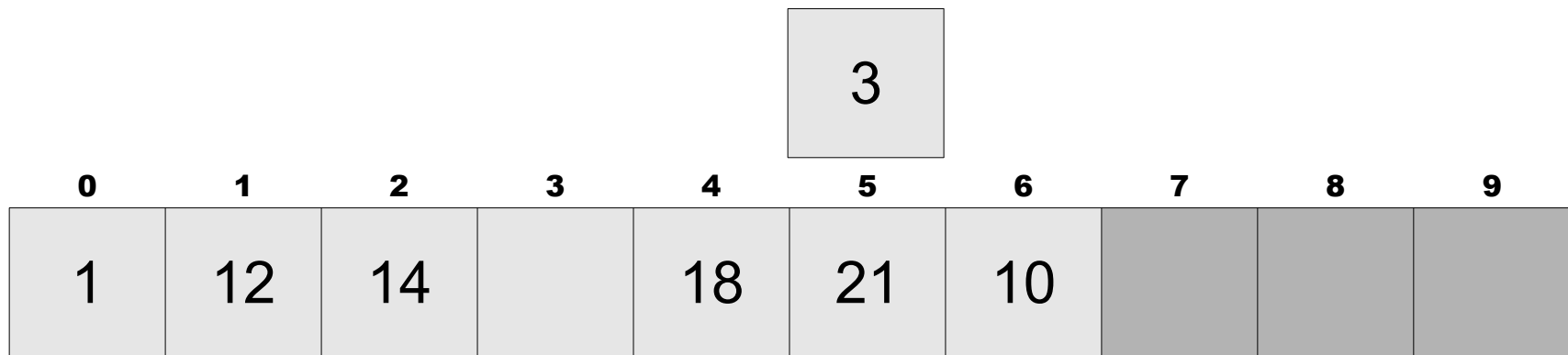
(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy



Swap!

Selection Sort

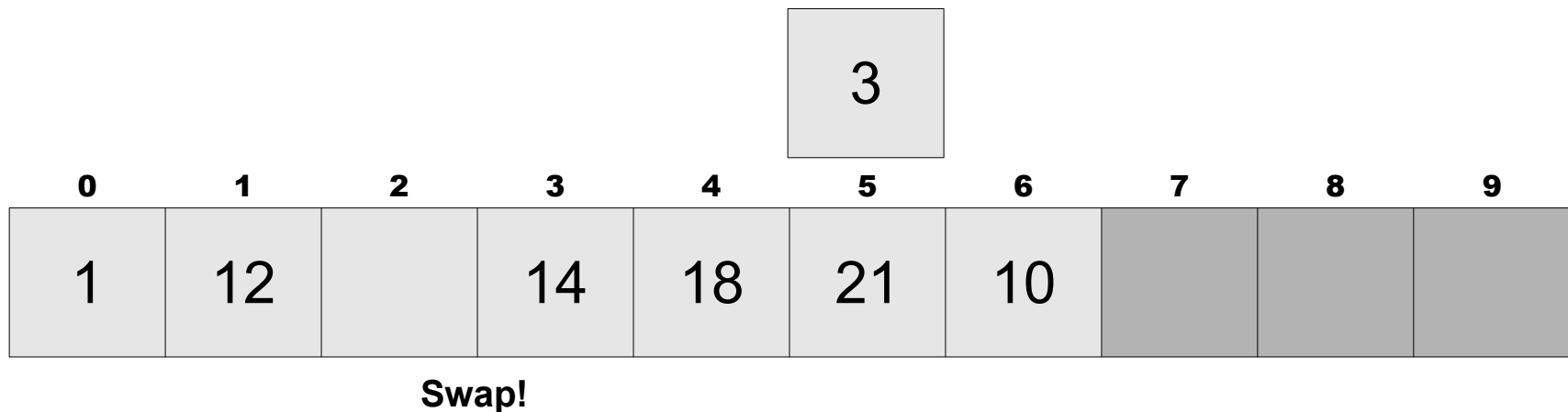
(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy



Selection Sort

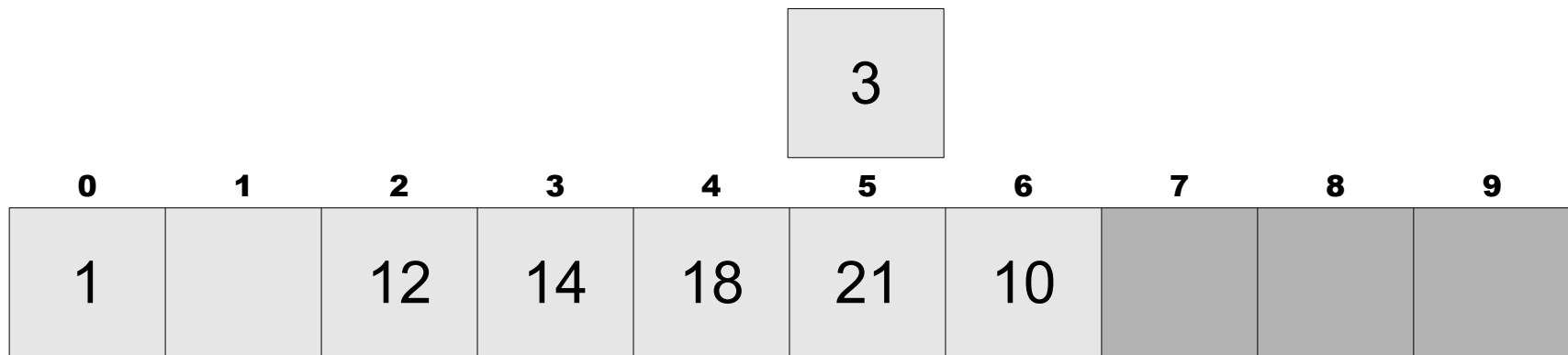
(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy



Swap!

Selection Sort

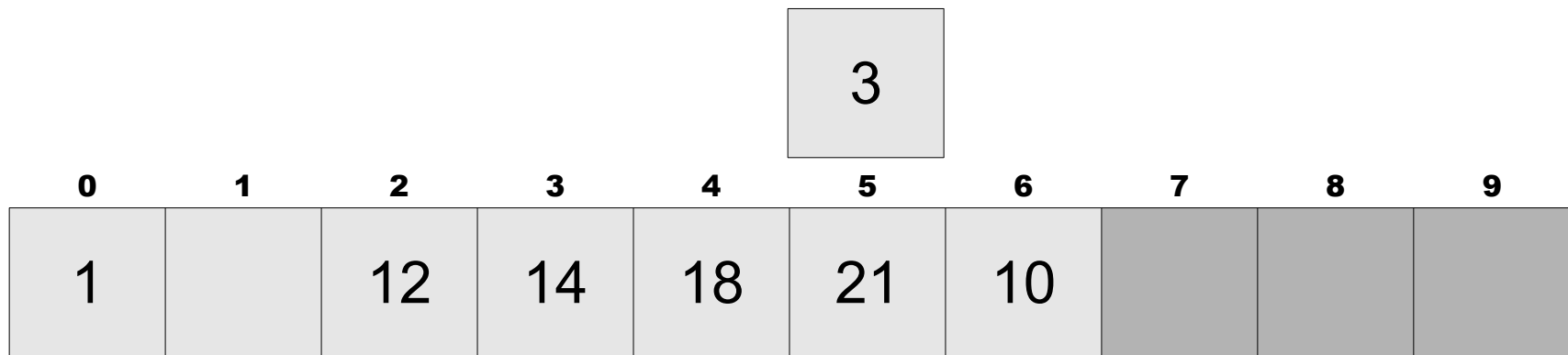
(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy



Stop!

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

0	1	2	3	4	5	6	7	8	9
1	3	12	14	18	21	10			

Stop!

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

0	1	2	3	4	5	6	7	8	9
1	3	12	14	18	21	10			

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

Example: Sorting fridges in a warehouse by price.

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

Example: Sorting fridges in a warehouse by price.

- Comparisons are easy.

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

Example: Sorting fridges in a warehouse by price.

- Comparisons are easy.
- Swapping is obnoxious.

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

Example: Sorting fridges in a warehouse by price.

**Selection
Sort!**

- Comparisons are easy.
- Swapping is obnoxious.

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

Example: Athletic competition with 1-on-1 comparison.

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

Example: Athletic competition with 1-on-1 comparison.

- Comparisons are taxing.

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

Example: Athletic competition with 1-on-1 comparison.

- Comparisons are taxing.
- Swapping is easy.

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

Example: Athletic competition with 1-on-1 comparison.

- Comparisons are taxing.
- Swapping is easy.

***Insertion
Sort!***

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

Example: Computational biology with simulations.

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

Example: Computational biology with simulations.

- Comparisons are expensive.

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

Example: Computational biology with simulations.

- Comparisons are expensive.
- Swapping is easy (unique IDs?).

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

Example: Computational biology with simulations.

- Comparisons are expensive.
- Swapping is easy (unique IDs?).

***Insertion
Sort!***

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

Example: Sorting data-heavy student records.

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

Example: Sorting data-heavy student records.

- Comparisons are easy.

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

Example: Sorting data-heavy student records.

- Comparisons are easy.
- Swapping is expensive.

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

Example: Sorting data-heavy student records.

**Selection
Sort!**

- Comparisons are easy.
- Swapping is expensive.

Selection Sort

(select the smallest element)

- Comparison Heavy

Insertion Sort

(insert into sorted partition)

- Swap heavy

Selection Sort

(select the smallest element)

- Comparison Heavy
 - Sorting refrigerators
 - Sorting data-heavy student records

Insertion Sort

(insert into sorted partition)

- Swap heavy
 - Athletic comparisons
 - Expensive simulations

Selection Sort

(select the smallest element)

- Comparison Heavy
 - Sorting refrigerators
 - Sorting data-heavy student records
- Runtime consistency

Insertion Sort

(insert into sorted partition)

- Swap heavy
 - Athletic comparisons
 - Expensive simulations

Selection Sort

(select the smallest element)

- Comparison Heavy
 - Sorting refrigerators
 - Sorting data-heavy student records
- Runtime consistency

Insertion Sort

(insert into sorted partition)

- Swap heavy
 - Athletic comparisons
 - Expensive simulations
- Faster in special cases

Selection Sort

(select the smallest element)

- Comparison Heavy
 - Sorting refrigerators
 - Sorting data-heavy student records
- Runtime consistency
- Ease of coding and debugging

Insertion Sort

(insert into sorted partition)

- Swap heavy
 - Athletic comparisons
 - Expensive simulations
- Faster in special cases

Selection Sort

(select the smallest element)

- Comparison Heavy
 - Sorting refrigerators
 - Sorting data-heavy student records
- Runtime consistency
- Ease of coding and debugging

Insertion Sort

(insert into sorted partition)

- Swap heavy
 - Athletic comparisons
 - Expensive simulations
- Faster in special cases
- Potential performance gains