

## Sorting

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Texas A&M University

Acknowledgement: Lecture slides based on those created by  
J. Michael Moore

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## Sorting Algorithms

- There are lots of ways to sort
  - you will implement several in CSCE 221
- C++ STL has built in sorting
  - So do many other languages
- Still very useful to know how to implement
  - Good first algorithm to code
  - Even a small amount of code can be tricky

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## Selection Sort

- Start with an 'empty' list.
- While we still have values to insert,
  - Find smallest value and put at end of list.

Outer Loop

Inner Loop

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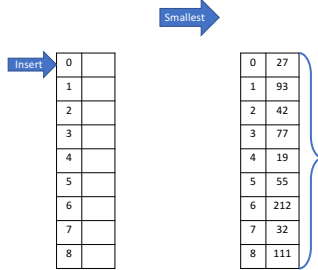
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## Selection Sort

- Start with an 'empty' list.
- While we still have values to insert,
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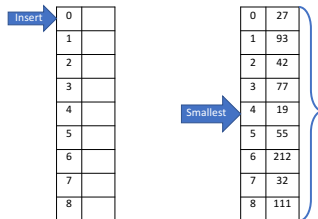
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## Selection Sort

- Start with an 'empty' list.
- While we still have values to insert,
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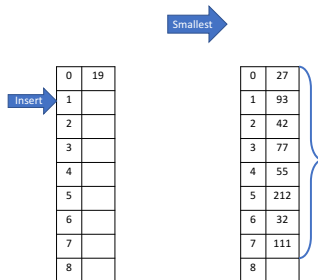
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## Selection Sort

- Start with an 'empty' list.
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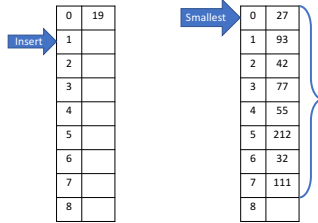
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## Selection Sort

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- While we still have values to insert,
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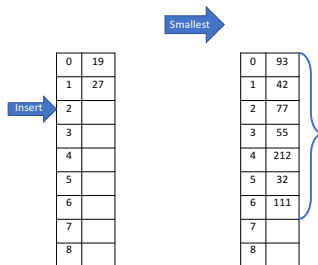
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## Selection Sort

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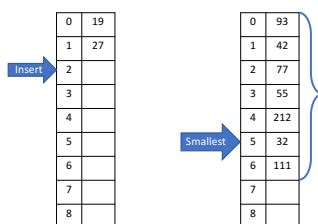
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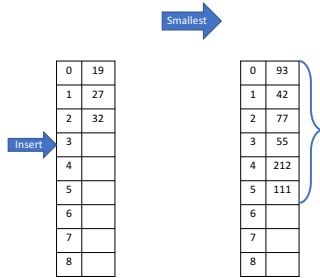
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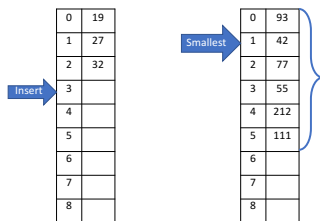
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## Selection Sort

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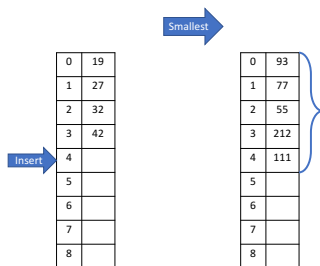
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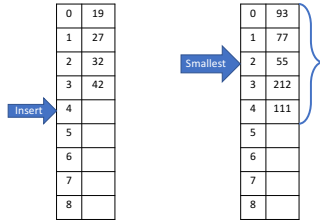
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### Selection Sort

- Start with an 'empty' list.
- While we still have values to insert,
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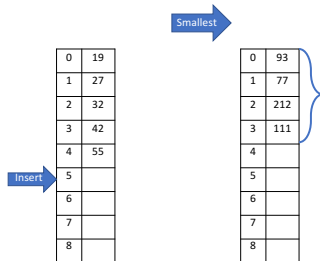
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### Selection Sort

- Start with an 'empty' list.
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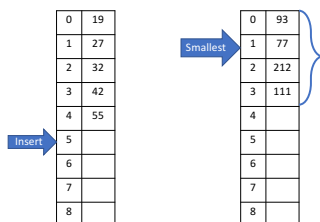
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### Selection Sort

- Start with an 'empty' list.
- While we still have values to insert,
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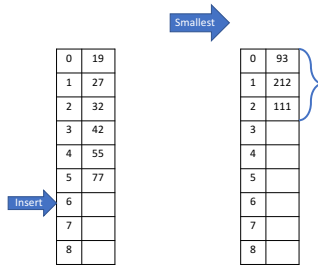
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## Selection Sort

- Start with an 'empty' list.
- While we still have values to insert,
  - Find smallest value and put at end of list.




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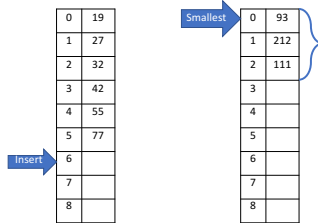
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## Selection Sort

- Start with an 'empty' list.
- While we still have values to insert,
  - Find smallest value and put at end of list.




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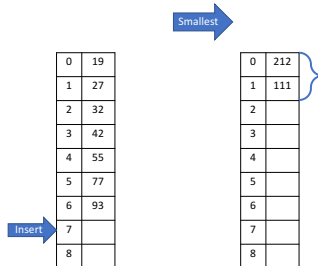
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## Selection Sort

- Start with an 'empty' list.
- While we still have values to insert,
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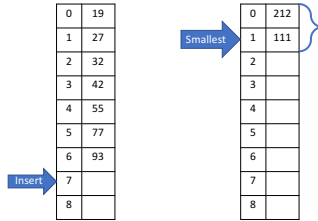
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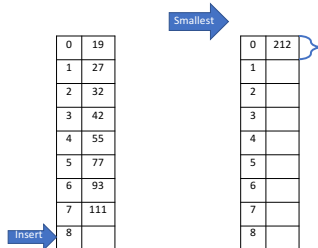
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## Selection Sort

- Start with an 'empty' list.
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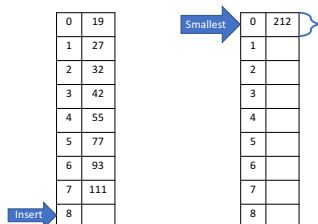
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## Selection Sort

- Start with an 'empty' list.
- While we still have values to insert,
  - Find smallest value and put at end of list.




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## Selection Sort

- Start with an 'empty' list.
- While we still have values to insert,
  - Find smallest value and put at end of list.

	0	19		0	
	1	27		1	
	2	32		2	
	3	42		3	
	4	55		4	
	5	77		5	
	6	93		6	
	7	111		7	
Insert	8	212		8	

Smallest

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## Selection Sort

- Start with an 'empty' list.
- While we still have values to insert,
  - Find smallest value and put at end of list.

	0	19		0	
	1	27		1	
	2	32		2	
	3	42		3	
	4	55		4	
	5	77		5	
	6	93		6	
	7	111		7	
	8	212		8	

Sorted!

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## Improve?

- Created a second vector.
  - Do we have to?
    - NO!
- Keep sorted list and remaining items to place in the same vector.
- When we start
  - the sorted list has size 0 (zero)
  - the number of items to place is the size of the list
- Start with the place to insert at zero
  - Find smallest starting from the place to insert
  - Swap smallest with item in the place to insert
  - Increment place to insert

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### Selection Sort (Second Version)

- Set place to insert to first location in list
- While we still have values to insert,
  - Find smallest value and swap with location to insert.
  - Increment place to insert

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### Selection Sort

- Set place to insert to first location in list
- While we still have values to insert,
  - Find smallest value and swap with location to insert
  - Increment place to insert

Insert	0	27
	1	93
	2	42
	3	77
Smallest	4	19
	5	55
	6	212
	7	32
	8	111

Items to search

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### Selection Sort

- Set place to insert to first location in list
- While we still have values to insert,
  - Find smallest value and swap with location to insert
  - Increment place to insert

Insert	0	19
	1	93
	2	42
	3	77
Smallest	4	27
	5	55
	6	212
	7	32
	8	111

Items to search

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## Selection Sort

- Set place to insert to first location in list
- While we still have values to insert,
  - Find smallest value and swap with location to insert
  - Increment place to insert

	0	19
Insert	1	93
	2	42
	3	77
Smallest	4	27
	5	55
	6	212
	7	32
	8	111

Items to search

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## Selection Sort

- Set place to insert to first location in list
- While we still have values to insert,
  - Find smallest value and swap with location to insert
  - Increment place to insert

	0	19
Insert	1	27
	2	42
	3	77
Smallest	4	93
	5	55
	6	212
	7	32
	8	111

Items to search

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## Selection Sort

- Set place to insert to first location in list
- While we still have values to insert,
  - Find smallest value and swap with location to insert
  - Increment place to insert

	0	19
	1	27
Insert	2	42
	3	77
	4	93
	5	55
	6	212
Smallest	7	32
	8	111

Items to search

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## Selection Sort

- Set place to insert to first location in list
- While we still have values to insert,
  - Find smallest value and swap with location to insert.

	0	19
	1	27
Insert →	2	32
	3	77
	4	93
	5	55
	6	212
Smallest →	7	42
	8	111

Items to search

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## Selection Sort

- Set place to insert to first location in list
- While we still have values to insert,
  - Find smallest value and swap with location to insert.

	0	19
	1	27
	2	32
Insert →	3	77
	4	93
	5	55
	6	212
Smallest →	7	42
	8	111

Items to search

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## Selection Sort

- Set place to insert to first location in list
- While we still have values to insert,
  - Find smallest value and swap with location to insert.

	0	19
	1	27
	2	32
Insert →	3	42
	4	93
	5	55
	6	212
Smallest →	7	77
	8	111

Items to search

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## Selection Sort

- Set place to insert to first location in list
- While we still have values to insert,
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  - Increment place to insert

	0	19
	1	27
	2	32
	3	42
Insert	4	93
Smallest	5	55
	6	212
	7	77
	8	111

Items to search

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## Selection Sort

- Set place to insert to first location in list
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	0	19
	1	27
	2	32
	3	42
Insert	4	55
Smallest	5	93
	6	212
	7	77
	8	111

Items to search

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## Selection Sort

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	0	19
	1	27
	2	32
	3	42
	4	55
Insert	5	93
Smallest	6	212
	7	77
	8	111

Items to search

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## Selection Sort

- Set place to insert to first location in list
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	0	19
	1	27
	2	32
	3	42
	4	55
Insert	5	77
	6	212
Smallest	7	93
	8	111

Items to search

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## Selection Sort

- Set place to insert to first location in list
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	0	19
	1	27
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Insert	6	212
Smallest	7	93
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Items to search

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Smallest	7	212
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Items to search

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## Selection Sort

- Set place to insert to first location in list
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0	19
1	27
2	32
3	42
4	55
5	77
6	93
7	212
8	111

Insert  
Smallest  
Items to search

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## Selection Sort

- Set place to insert to first location in list
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0	19
1	27
2	32
3	42
4	55
5	77
6	93
7	111
8	212

Insert  
Smallest  
Items to search

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## Selection Sort

Since last item has to be in the right place, we actually stop before inserting into last location.

- Set place to insert to first location in list
- While we still have values to insert,
  - Find smallest value and swap with location to insert
  - Increment place to insert

0	19
1	27
2	32
3	42
4	55
5	77
6	93
7	111
8	212

Smallest  
Insert  
Items to search

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## Selection Sort

- Set place to insert to first location in list
- While we still have values to insert,
  - Find smallest value and swap with location to insert
  - Increment place to insert

Sorted!

0	19
1	27
2	32
3	42
4	55
5	77
6	93
7	111
8	212

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