

# CSC108H Lecture 32

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# ConcepTest

For which of the following is a sort useful?

- ▶ A. Displaying the top fiction sales on Amazon
- ▶ B. Putting a list of words in alphabetical order
- ▶ C. Printing the average GPA of 100 students
- ▶ D. Two of the above
- ▶ E. All of the above

# Sorting Techniques

- ▶ So far, we have been using Python's `sort` method to sort lists
- ▶ We will cover three simple sorting algorithms: selection sort, insertion sort and bubble sort
- ▶ All three of these are quadratic ( $n^2$ ) algorithms
- ▶ We can do much better with faster sorting algorithms
  - ▶ Quicksort, merge sort, heapsort ... you'll see these in a later course!
- ▶ Once you understand the slow sorts, you'll be able to appreciate why the fast ones are so interesting

# Selection Sort

- ▶ In selection sort, our list consists of two parts: a sorted part, and an unsorted part
- ▶ Initially, our sorted part is empty, and our unsorted part is the whole list
- ▶ Then, while our sorted part is not the whole list
  1. Find the smallest remaining value **anywhere** in the unsorted part, and
  2. Swap this value with the leftmost value in the unsorted part
- ▶ These two steps constitute one **pass** of selection sort
- ▶ So, after each pass, the sorted part contains one more value, and the unsorted part contains one less

## Selection Sort: Example

- ▶ List: **8 10 3 5 1**
- ▶ After 1 pass: 1 **10 3 5 8**
- ▶ After 2 passes: 1 3 **10 5 8**
- ▶ After 3 passes: 1 3 5 **10 8**
- ▶ After 4 passes: 1 3 5 8 **10**
- ▶ Done: 1 3 5 8 10

# Insertion Sort

- ▶ Insertion sort also divides the list into a sorted part (initially empty) and an unsorted part (initially the whole list)
- ▶ Then, while our sorted part is not the whole list
  1. Obtain the leftmost value in the unsorted part, and
  2. Insert this value in its correct place in the sorted part (i.e. so that the sorted part remains sorted)
- ▶ These two steps constitute one pass of insertion sort

# Insertion Sort: Example

- ▶ List: **8 10 3 5 1**
- ▶ After 1 pass: 8 10 **3 5 1**
- ▶ After 2 passes: 3 8 10 **5 1**
- ▶ After 3 passes: 3 5 8 10 **1**
- ▶ After 4 passes: 1 3 5 8 10

# ConceptTest

Which of the following is true of **selection** sort?

- ▶ A. Once a value is placed in the sorted part, it will never move again
- ▶ B. All values in the sorted part are always less than or equal to all values in the unsorted part
- ▶ C. Both of the above are true
- ▶ D. None of the above is true