Consider the following list of integers: [1,2,3,4,5,6,7,8,9,10]. Show how this list is sorted by the following algorithms:

- bubble sort
- · selection sort
- · insertion sort

## **Bubble Sort**

| 1           | <      | 2  |  |  |  |  |  |
|-------------|--------|----|--|--|--|--|--|
| no swapping |        |    |  |  |  |  |  |
| 2           | <      | 3  |  |  |  |  |  |
| no          | swappi | ng |  |  |  |  |  |
| 3           | <      | 4  |  |  |  |  |  |
| no          | swappi | ng |  |  |  |  |  |
| 4           | <      | 5  |  |  |  |  |  |
| no          | swappi | ng |  |  |  |  |  |
| 5           | <      | 6  |  |  |  |  |  |
| no swapping |        |    |  |  |  |  |  |
| 6           | <      | 7  |  |  |  |  |  |
| no          | swappi | ng |  |  |  |  |  |
| 7           | <      | 8  |  |  |  |  |  |
| no swapping |        |    |  |  |  |  |  |
| 8           | <      | 9  |  |  |  |  |  |
| no swapping |        |    |  |  |  |  |  |
| 9           | <      | 10 |  |  |  |  |  |
| no swapping |        |    |  |  |  |  |  |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|----|
|   |   |   |   |   |   |   |   |   |    |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|   |   |   |   |   |   |   |   |   |    |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|   |   |   |   |   |   |   |   |   |    |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|   |   |   |   |   |   |   |   |   |    |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|   |   |   |   |   |   |   |   |   |    |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|   |   |   |   |   |   |   |   |   |    |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|   |   |   |   |   |   |   |   |   |    |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|   |   |   |   |   |   |   |   |   |    |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

## Selection Sort Sorted List Current Element Exchange

Total comparisons = n(n-1)/2

 $\sim O(n^2)$ 

|   | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 1st smallest    |
|---|---|---|---|---|---|---|---|----|----|-----------------|
|   |   |   |   |   |   |   |   |    | 10 | 13t Smallest    |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 2nd smallest    |
|   | 2 | 3 | 4 | 5 | 0 | / | 0 | 9  | 10 | Ziid siiiallest |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 3rd smallest    |
| · | _ | J |   |   |   |   |   |    |    |                 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 4th smallest    |
|   |   |   |   |   |   |   |   |    |    |                 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 5th smallest    |
|   |   |   |   |   |   | r |   | 1  | ı  |                 |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 6th smallest    |
|   |   |   |   |   |   |   | Ī | 1  | I  | 1               |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 7th smallest    |
|   |   |   |   |   |   | _ |   | Γ. |    | ]               |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 8th smallest    |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | 9th smallest    |
|   | _ | J | 7 | J | J | , | U | J  |    | Julianianest    |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9  | 10 | sorted list     |
|   |   |   |   |   |   |   |   |    |    | l               |

## **Insertion Sort**

To sort an array of size n in ascending order:

- Iterate from arr[1] to arr[n] over the array.
- Compare the current element(key) to its predecessor.
- 3. If the key element is smaller than its predecessor, compare it to the elements before. Move the greater element one position up to make space for the swapped element.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|----|
|   |   |   |   |   |   |   |   |   |    |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|   |   |   |   |   |   |   |   |   |    |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|   |   |   |   |   |   |   |   |   |    |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|   |   |   |   |   |   |   |   |   |    |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|   |   |   |   |   |   |   |   |   |    |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|   |   |   |   |   |   |   |   |   |    |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|   |   |   |   |   |   |   |   |   |    |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|   |   |   |   |   |   |   |   |   |    |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |