1

In worst case, the big-O complexity of bubble sort is O(n^2) because it needs to compare the value of the current position and the value of the next position from the first item to the second last item. And it repeats this process until the array is sorted. In worst case, the round of repetition is equal to the size of the array.

In best case, the O complexity is O(n). We can add a flag to check whether swapping happened in each round. When the array is sorted, the flag can tell us there is no swapping after first round of sorting and the sorting can stop. So in this case bubble sort only runs the first round and the O complexity is O(n).

2

In worst case, the big-O complexity of selection sort is O(n^2). In each round it compares all the items in the unsorted part to find out the index of the minimum value. It will repeat until all items of the unsorted part move to the sorted part. In worst case, the repetition time is equal to the size of the array.

In best case, the big-O complexity of selection sort is also O(n^2). In each round it only finds the smallest one in the unsorted part. Even if the array is sorted, it still treats the array as unsorted and check all the items. Therefore, the round of repetition is equal to the size of the array. O complexity is O(n^2).

3

Selection sort does not need additional storage because it swaps two items in the same array and does not change the size.

4

The complexity would not change. When searching in a linked list or an array, we look through all items so the complexity is O(n). And when we want to swap two items in a linked list or an array, the complexity is O(1).

5

The big-O complexity of the sorting algorithm in C libraries is O(N log(N)).

When input size increases 10 times, the running time of the increases larger than 10 times but much smaller than 10^2. So I suppose O(N log(N)), whose complexity is between O(n) and O(n^2), is reasonable.

input size	csort
100	0.000039
1000	0.000905
10000	0.004348
100000	0.022888
1000000	0.203175
10000000	2.458893
100000000	27.530394