【DS】Day6(2)

Tags	
Date	@May 28, 2022
Summary	Selection Sort and Insertion Sort

【Week2】Sort

2.4 Selection Sort

- In iteration i, find index min of smallest remaining entry
- Swap `a[i]` and `a[min]`

```
public class Selection {
  public static void sort(Comparable[] a) {
    int N = a.length;
    for (int i = 0; i < N; ++i) {
      int min = i;
      for (int j = i + 1; i < N; ++j) {
        if (less(a[j], a[min])
          min = j;
      }
      exch(a, i, min);
    }
  }

  private statc boolean less(Comparable v, Comparable w) {
    return v.compareTo(w) < 0;
  }

  private static void exch(Comparable[] a, int i, int j) {
    Comparable swap = a[i];
    a[i] = a[j];
    a[j] = swap;
  }
}
```

Proposition: Selection sort uses $(N-1)+(N-2)+...+1+0=N^2/2$ compares and N exchanges

Running time insensitive to input: Quadratic time, even if input is sorted

Data movement is minimal: Linear number of exchanges.

2.5 Insertion Sort

Code:

```
public class Insertion {
  public static void sort(Comparable[] a) {
    int N = a.length;
    for (int i = 0; i < N; ++i) {
      for (int j = i; j > 0; --j) {
        if (less(a[j], a[j - 1]))
          exch(a, j, j - 1);
        else
          break;
      }
    }
  }

  private static boolean less(Comparable v, Comparable w) { ... }

  private static void exch(Comparable[] a, int i, int j) { ... }
}
```

Proposition: To sort a randomly-ordered array with distinct keys, insertion sort uses $\frac{1}{4}N^2$ compares and $\frac{1}{4}N^2$ exchanges on average.

Best Case: If the array is in ascending order, insertion sort makes N-1 compares and 0 exchanges.

Worst Case: If the array is in descending order, insertion sort makes $\frac{1}{2}N^2$ compares and $\frac{1}{2}N^2$ exchanges.

For partially-sorted array(The first couple items are in order), insertion sort runs in linear time.