15 Arrays (2) — Sorting and Searching

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Outline

Reading Homework

Textbook

- Section 7.10–7.12.

Internet

- Bubble Sort (`http://www.algolist.net/Algorithms/Sorting/Bubble_sort`).
- Binary Search (`https://www.hackerearth.com/practice/algorithms/searching/binary-search/tutorial/`).

Bubble Sort

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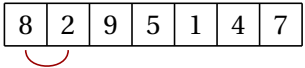

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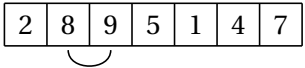

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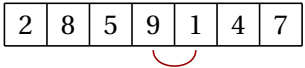

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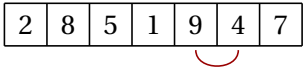

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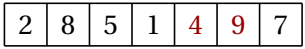

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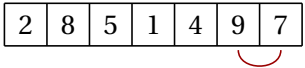

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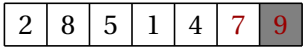

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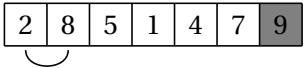

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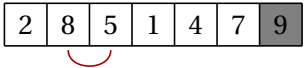

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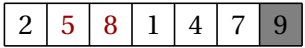

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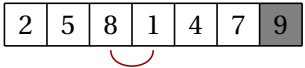

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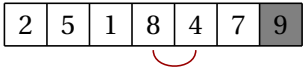

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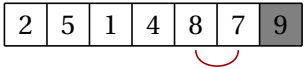

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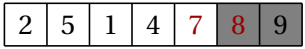

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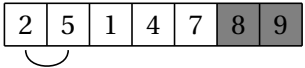

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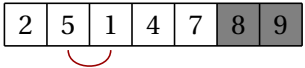

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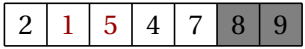

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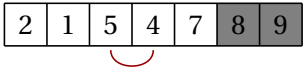

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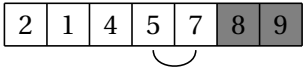

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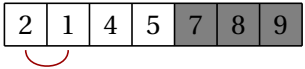

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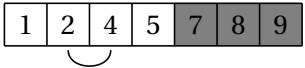

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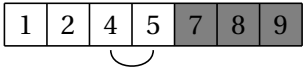

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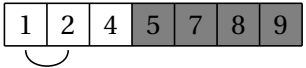

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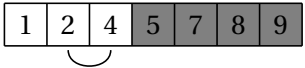

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Bubble Sort (Code)

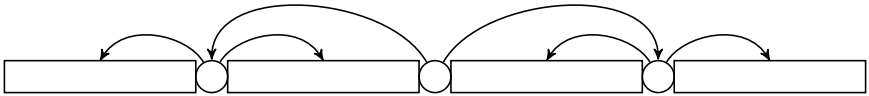
The *bubbleSort* method sorts an `int` array *in-place* by the Bubble Sort algorithm.

```
1  static void bubbleSort(int[] a) {
2      for ( int i = a.length-1; i > 0; --i ) {
3          boolean swapped = false;
4          for ( int j = 0; j < i; ++j )
5              if ( a[j] > a[j+1] ) {
6                  int t = a[j];
7                  a[j] = a[j+1];
8                  a[j+1] = t;
9                  swapped = true;
10             }
11         if ( !swapped )
12             break;
13     }
14 }
```

Binary Search

- If we have a sorted array, we may employ this useful clue — the ordering — to search for an element in the array.
- We may pickup any element in the array, and compare the given element k with it. We have two possible outcomes, if unequal:
  1. less than: k can only appear on the left;
  2. greater than: k can only appear on the right.

  In either case, we can recursively find the element in the smaller array, until the array becomes empty.



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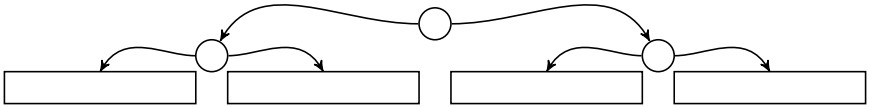

Binary Search (Code)

The following defines the method that searches for an element k in an `int` array a by the binary search algorithm. The method returns the index of k if it is found, otherwise -1.

```
1  int binarySearch(int[] a, int k) {
2      int l = 0, r = a.length;
3      while ( l < r ) {
4          int m = (l+r)/2;
5          if ( k == a[m] ) return m;
6          else if ( k < a[m] ) r = m;
7          else l = m+1;
8      }
9      return -1;
10 }
```