

Algorithms + Data Structures = Programs

Algorithms in Java

- This week, we focus on algorithms, i.e. how to manipulate the data structures.

Sorting an Array

- A simple algorithm to sort a fixed length array
 - Find smallest element
 - move it to the front
 - repeat until all the array has been scanned
 - simple but not the most efficient method

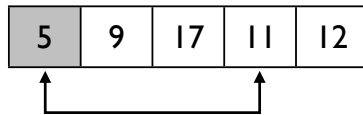
Selection Sort

- Find the smallest element
- Swap it with the first element

| | | | | |
|----|---|----|---|----|
| 11 | 9 | 17 | 5 | 12 |
|----|---|----|---|----|

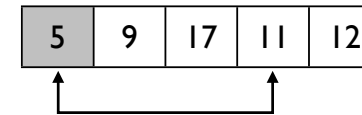
Selection Sort

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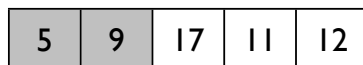
Selection Sort

- Find minimum of remaining elements
- Swap it with the next element



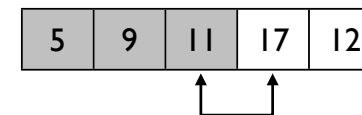
Selection Sort

- Find minimum of remaining elements
- Swap it with the next element



Selection Sort

- Repeat



Selection Sort

- Repeat



Sort Demo

Main Method

```
public static void main()
{
    int[] a = randomIntArray(20, 100);

    print(a);           // print the unsorted array
    sort(a);            // sort the array
    print(a);           // print the sorted array
}
```

Create a random array

```
public static int[] randomIntArray(int length, int n)
{
    int a[] = new int[length];
    Random generator = new Random();

    for (int i = 0; i < a.length; i++)
    {
        a[i] = generator.nextInt(n);
    }
    return a;
}
```

Print an array

```
public static void print(int[] a)
{
    for (int n: a)
    {
        System.out.print(n + " ");
    }
    System.out.println();
}
```

Sort an array

```
public static void sort(int[] a)
{
    for (int n = 0; n < a.length - 1; n++)
    {
        int minPos = minimumPosition(a, n);

        if (minPos != n)
        {
            swap(a, minPos, n);
        }
    }
}
```

Find the position of the smallest element

```
public static int minimumPosition(int[] a, int from)
{
    int minPos = from;

    for (int i = from + 1; i < a.length; i++)
    {
        if (a[i] < a[minPos])
        {
            minPos = i;
        }
    }
    return minPos;
}
```

Swap two elements in an array

```
public static void swap(int[] a, int i, int j)
{
    int temp = a[i];
    a[i] = a[j];
    a[j] = temp;
}
```