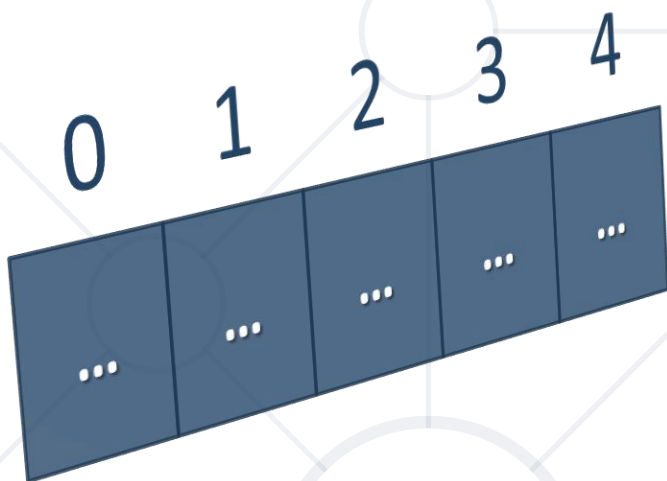


# Lists

## Processing Variable-Length Sequences of Elements



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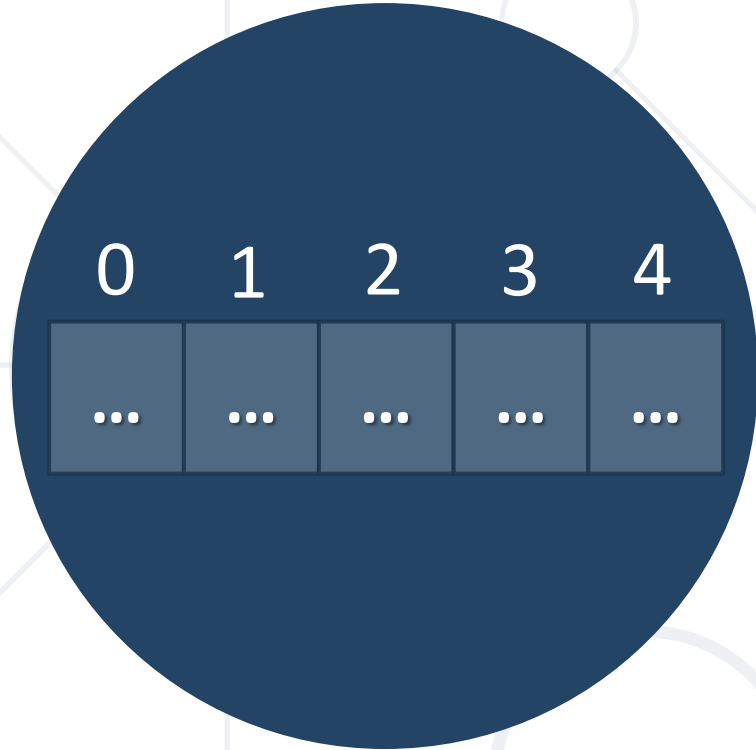
sli.do

**#fund-java**

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**Lists**

# List<E> – Overview

- **List<E>** holds a list of elements of any type

```
List<String> names = new ArrayList<>();  
//Create a list of strings  
names.add("Peter");  
names.add("Maria");  
names.add("George");  
names.remove("Maria");  
for (String name : names)  
    System.out.println(name);  
//Peter, George
```



# List<E> – Overview (2)

```
List<Integer> nums = new ArrayList<>(
    Arrays.asList(10, 20, 30, 40, 50, 60));
nums.remove(2);
nums.remove(Integer.valueOf(40));
nums.add(100);
nums.add(0, -100);
for (int i = 0; i < nums.size(); i++)
    System.out.print(nums.get(i) + " ");
```

Remove by index

Remove by value

Inserts an element to index

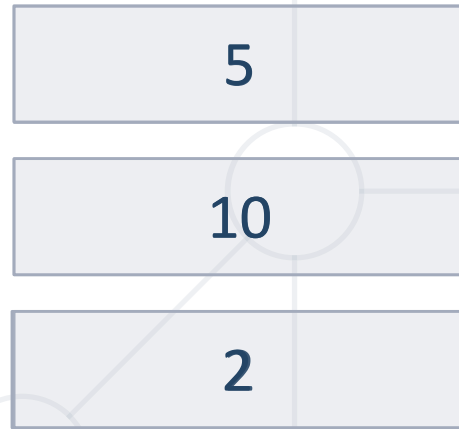
Items count



-100 10 20 50 60 100

- **List<E>** holds a list of elements (like array, but extendable)
- Provides operations to **add** / **insert** / **remove** / **find** elements:
  - **size()** – number of elements in the List<E>
  - **add(element)** – adds an element to the List<E>
  - **add(index, element)** – inserts an element to given position
  - **remove(element)** – removes an element (returns true / false)
  - **remove(index)** – removes element at index
  - **contains(element)** – determines whether an element is in the list
  - **set(index, item)** – replaces the element at the given index

# Add – Appends an Element



**List<Integer>**

**Count:**

**0**



# Remove – Deletes an Element

10

**List<Integer>**

2

10

5

**Count:**

3

# Add (Index, El) – Inserts an Element at Position

-5

**List<Integer>**

2

5

**Count:**

2



# Reading Lists from the Console

Using for Loop or String.split()

# Reading Lists from the Console

- First, read from the console the array **length**:

```
Scanner sc = new Scanner(System.in);  
int n = Integer.parseInt(sc.nextLine());
```

- Next, create a list of given size **n** and read its **elements**:

```
List<Integer> list = new ArrayList<>();  
for (int i = 0; i < n; i++) {  
    int number = Integer.parseInt(sc.nextLine());  
    list.add(number);  
}
```

# Reading List Values from a Single Line

- Lists can be read from a **single line** of **space separated values**:

```
2 8 30 25 40 72 -2 44 56
```

```
String values = sc.nextLine();  
List<String> items = Arrays.stream(values.split(" "))  
    .collect(Collectors.toList());  
List<Integer> nums = new ArrayList<>();  
for (int i = 0; i < items.size(); i++)  
    nums.add(Integer.parseInt(items.get(i)));
```

Convert a collection  
into **List**

```
List<Integer> items = Arrays.stream(values.split(" "))  
    .map(Integer::parseInt).collect(Collectors.toList());
```

- Printing a list using a **for**-loop:

```
List<String> list = new ArrayList<>(Arrays.asList(
    "one", "two", "three", "four", "five", "six"));
for (int index = 0; index < list.size(); index++)
    System.out.printf
        ("arr[%d] = %s%n", index, list.get(index));
```

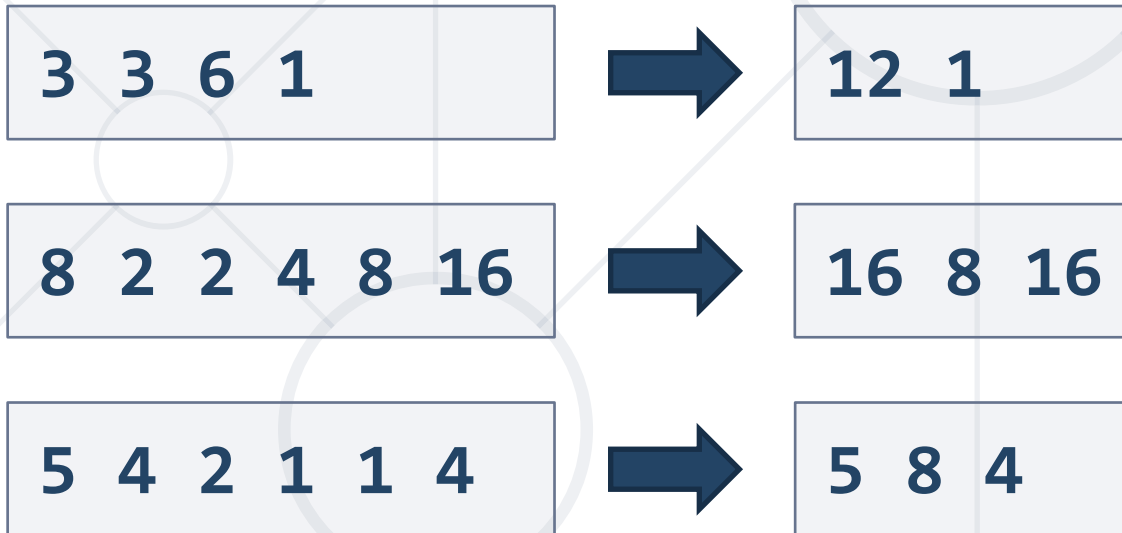
- Printing a list using a **String.join()**:

```
List<String> list = new ArrayList<>(Arrays.asList(
    "one", "two", "three", "four", "five", "six"));
System.out.println(String.join("; ", list));
```

Gets an element  
at given index

# Problem: Sum Adjacent Equal Numbers

- Write a program to sum all adjacent equal numbers in a list of decimal numbers, starting from left to right
- Examples:



Check your solution here: <https://judge.softuni.bg/Contests/1295/>

# Solution: Sum Adjacent Equal Numbers (1)

```
Scanner sc = new Scanner(System.in);
List<Double> numbers = Arrays.stream(sc.nextLine().split(" "))
    .map(Double::parseDouble).collect(Collectors.toList());
for (int i = 0; i < numbers.size() - 1; i++)
    if (numbers.get(i).equals(numbers.get(i + 1))) {
        numbers.set(i, numbers.get(i) + numbers.get(i + 1));
        numbers.remove(i + 1);
        i = -1;
    }
//Continue on the next slide
```



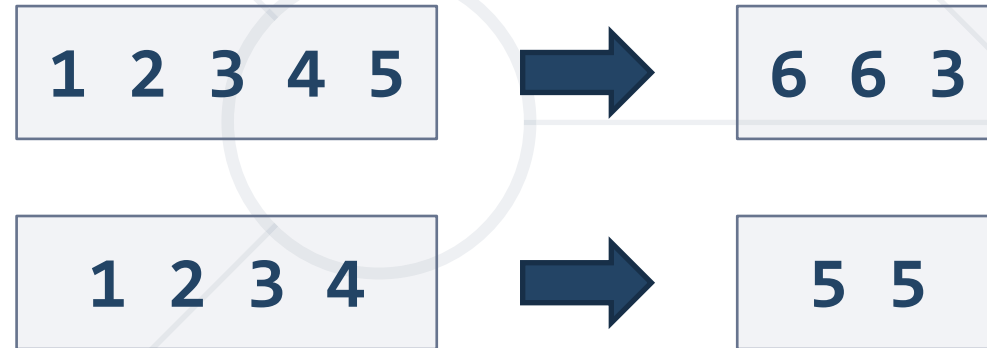
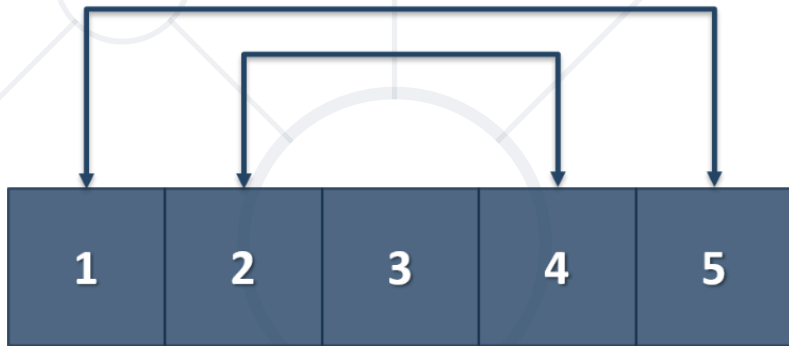
# Solution: Sum Adjacent Equal Numbers (2)

```
String output = joinElementsByDelimiter(numbers, " ");  
System.out.println(output);
```

```
static String joinElementsByDelimiter  
    (List<Double> items, String delimiter) {  
    String output = "";  
    for (Double item : items)  
        output += (new DecimalFormat("0.#").format(item) + delimiter);  
    return output;  
}
```

# Problem: Gauss' Trick

- Write a program that sum all numbers in a list in the following order:
  - $\text{first} + \text{last}$ ,  $\text{first} + 1 + \text{last} - 1$ ,  $\text{first} + 2 + \text{last} - 2$ , ...  $\text{first} + n$ ,  $\text{last} - n$
- Examples:



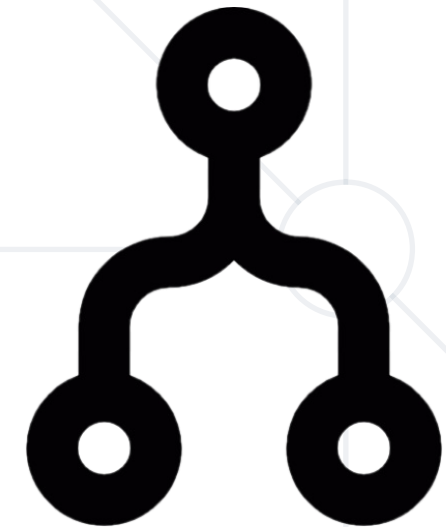
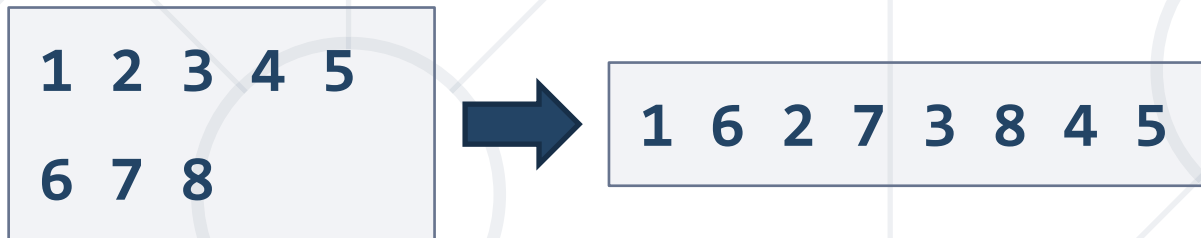
Check your solution here: <https://judge.softuni.org/Contests/1295/>

# Solution: Gauss' Trick

```
Scanner sc = new Scanner(System.in);
List<Integer> numbers = Arrays.stream(sc.nextLine().split(" "))
    .map(Integer::parseInt).collect(Collectors.toList());
int size = numbers.size();
for (int i = 0; i < size / 2; i++) {
    numbers.set(i, numbers.get(i) + numbers.get(numbers.size() - 1));
    numbers.remove(numbers.size() - 1);
}
System.out.println(numbers.toString().replaceAll("[\\[\\],]", ""));
```

# Problem: Merging Lists

- You receive two lists with numbers. Print a result list which contains the numbers from both of the lists
  - If the length of the two lists is not equal, just add the remaining elements at the end of the list
  - `list1[0]`, `list2[0]`, `list1[1]`, `list2[1]`, ...



Check your solution here: <https://judge.softuni.org/Contests/1295/>

# Solution: Merging Lists (1)

*//TODO: Read the input*

```
List<Integer> resultNums = new ArrayList<>();
```

```
for (int i = 0; i < Math.min(nums1.size(), nums2.size()); i++) {
```

*//TODO: Add numbers in resultNums*

```
}
```

```
if (nums1.size() > nums2.size())
```

```
    resultNums.addAll(getRemainingElements(nums1, nums2));
```

```
else if (nums2.size() > nums1.size())
```

```
    resultNums.addAll(getRemainingElements(nums2, nums1));
```

```
System.out.println(resultNums.toString().replaceAll("[\\s\\t,]", ""));
```

# Solution: Merging Lists (2)

```
public static List<Integer> getRemainingElements  
    (List<Integer> longerList, List<Integer> shorterList) {  
    List<Integer> nums = new ArrayList<>();  
    for (int i = shorterList.size(); i < longerList.size(); i++)  
        nums.add(longerList.get(i));  
    return nums;  
}
```



# Reading and Manipulating Lists

Live Exercises



# Sorting Lists and Arrays



- Sorting a list == reorder its elements incrementally: **Sort()**
  - List items should be **comparable**, e.g. numbers, strings, dates, ...

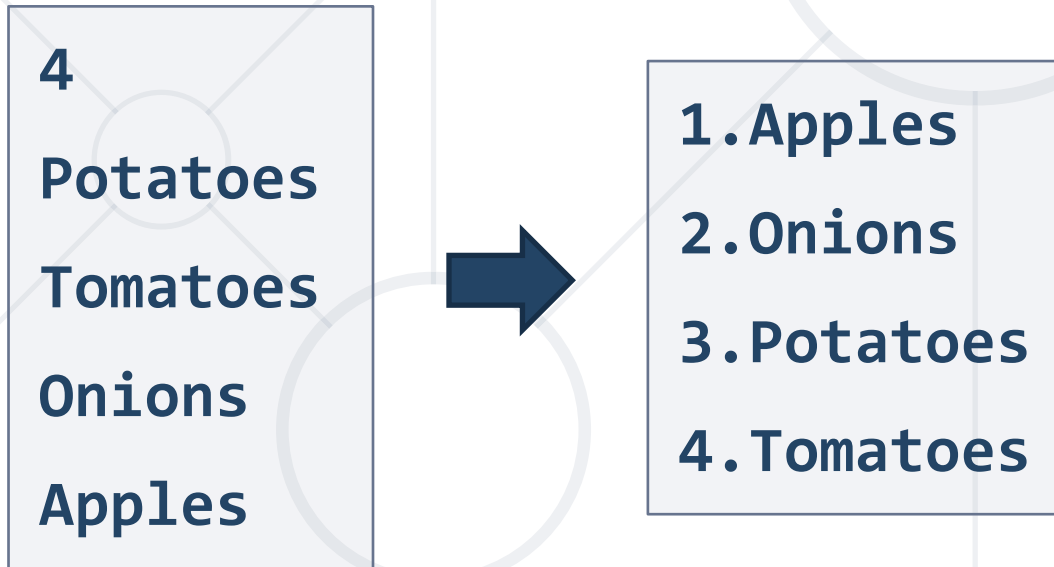
```
List<String> names = new ArrayList<>(Arrays.asList(
    "Peter", "Michael", "George", "Victor", "John"));
Collections.sort(names);
System.out.println(String.join(", ", names));
// George, John, Michael, Peter, Victor
Collections.sort(names);
Collections.reverse(names);
System.out.println(String.join(", ", names));
// Victor, Peter, Michael, John, George
```

Sort in natural  
(ascending) order

Reverse the sorted result

# Problem: List of Products

- Read a number **n** and **n** lines of products. Print a numbered list of all the products ordered by name
- Examples:



Check your solution here: <https://judge.softuni.org/Contests/1295/>

# Solution: List of Products

```
int n = Integer.parseInt(sc.nextLine());
List<String> products = new ArrayList<>();
for (int i = 0; i < n; i++) {
    String currentProduct = sc.nextLine();
    products.add(currentProduct);
}
Collections.sort(products);
for (int i = 0; i < products.size(); i++)
    System.out.printf("%d.%s\n", i + 1, products.get(i));
```

Check your solution here: <https://judge.softuni.org/Contests/1295/>

# Problem: Remove Negatives and Reverse

- Read a list of integers, remove all negative numbers from it
  - Print the remaining elements in reversed order
  - In case of no elements left in the list, print "empty"

10 -5 7 9 -33 50



50 9 7 10

7 -2 -10 1



1 7

-1 -2 -3



empty

Check your solution here: <https://judge.softuni.org/Contests/1295/>

# Solution: Remove Negatives and Reverse

```
List<Integer> nums = Arrays.stream(sc.nextLine().split(" "))
    .map(Integer::parseInt).collect(Collectors.toList());
for (int i = 0; i < nums.size(); i++)
    if (nums.get(i) < 0)
        nums.remove(i--);
Collections.reverse(nums);
if (nums.size() == 0)
    System.out.println("empty");
else
    System.out.println(nums.toString().replaceAll("[\\[\\]", "],",
    ""));
```



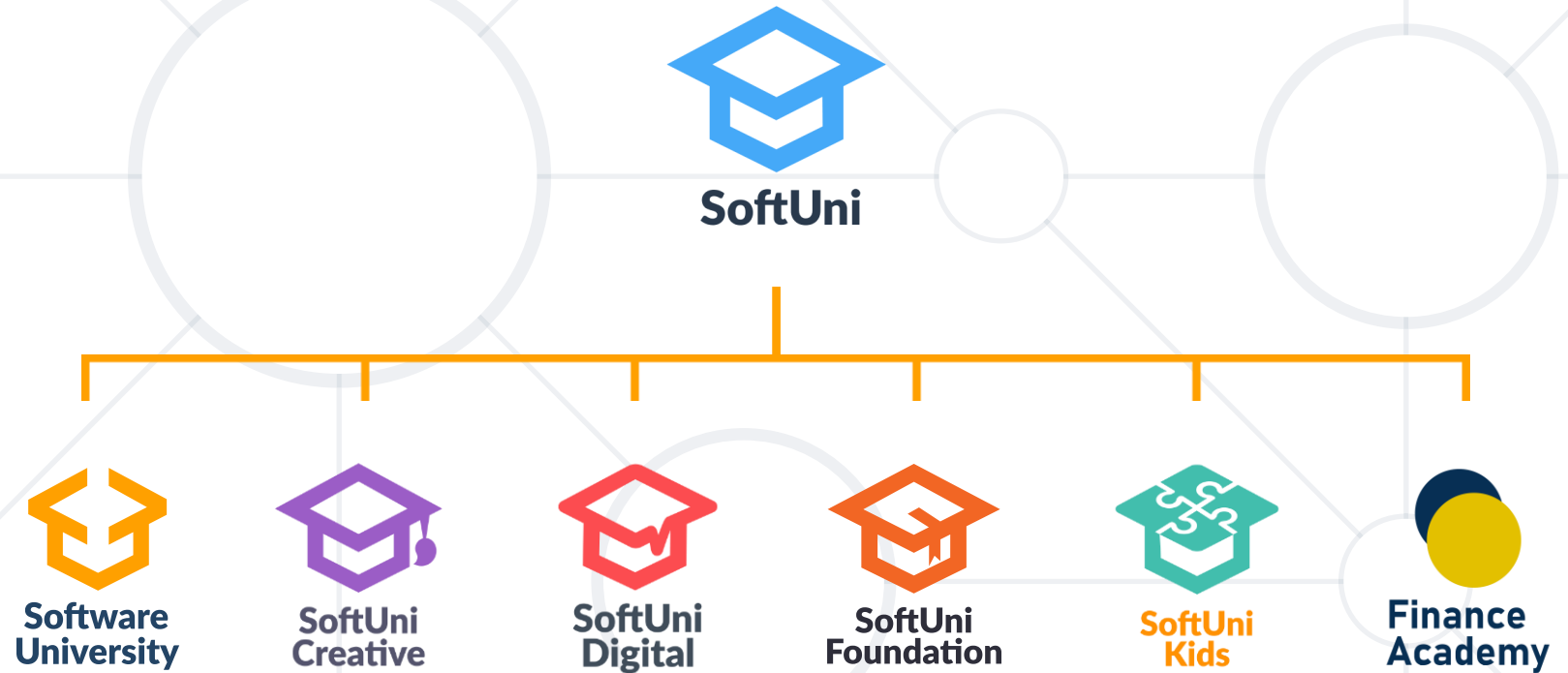
# Sorting Lists

Live Exercises

- Lists hold a sequence of elements (variable-length)
- Can **add** / **remove** / **insert** elements at runtime
- Creating (allocating) a list:  
**`new ArrayList<E>()`**
- Accessing list elements by index
- Printing list elements: **`String.join(...)`**



# Questions?





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