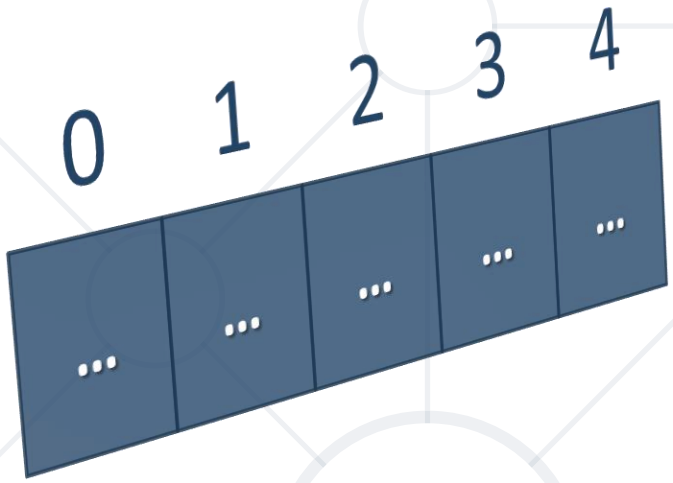
Lists

Processing Variable-Length Sequences of Elements



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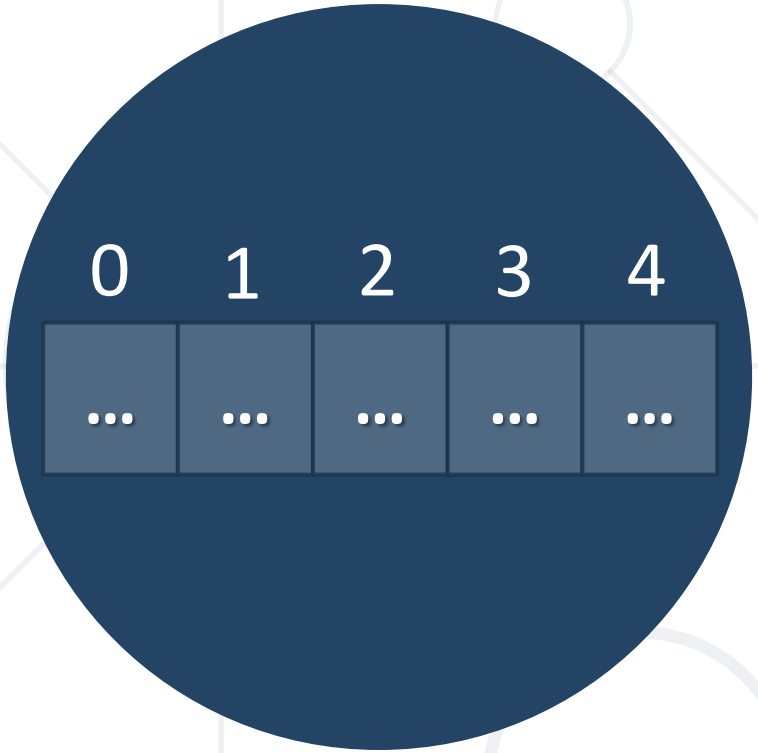


Lists

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

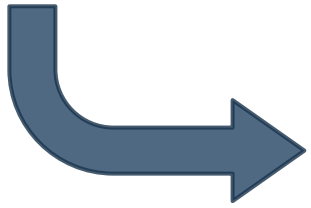
```
List<Integer> nums = new ArrayList<>(
            Arrays.asList(10, 20, 30, 40, 50, 60));
nums.remove(2);
nums.remove(Integer.valueOf(40));
nums.add(100);
nums.add(0, -100);
for (int i = 0; i < nums.size(); i++)
  System.out.print(nums.get(i) + " ");
```

Remove by index

Remove by value

Inserts an element to index

Items count

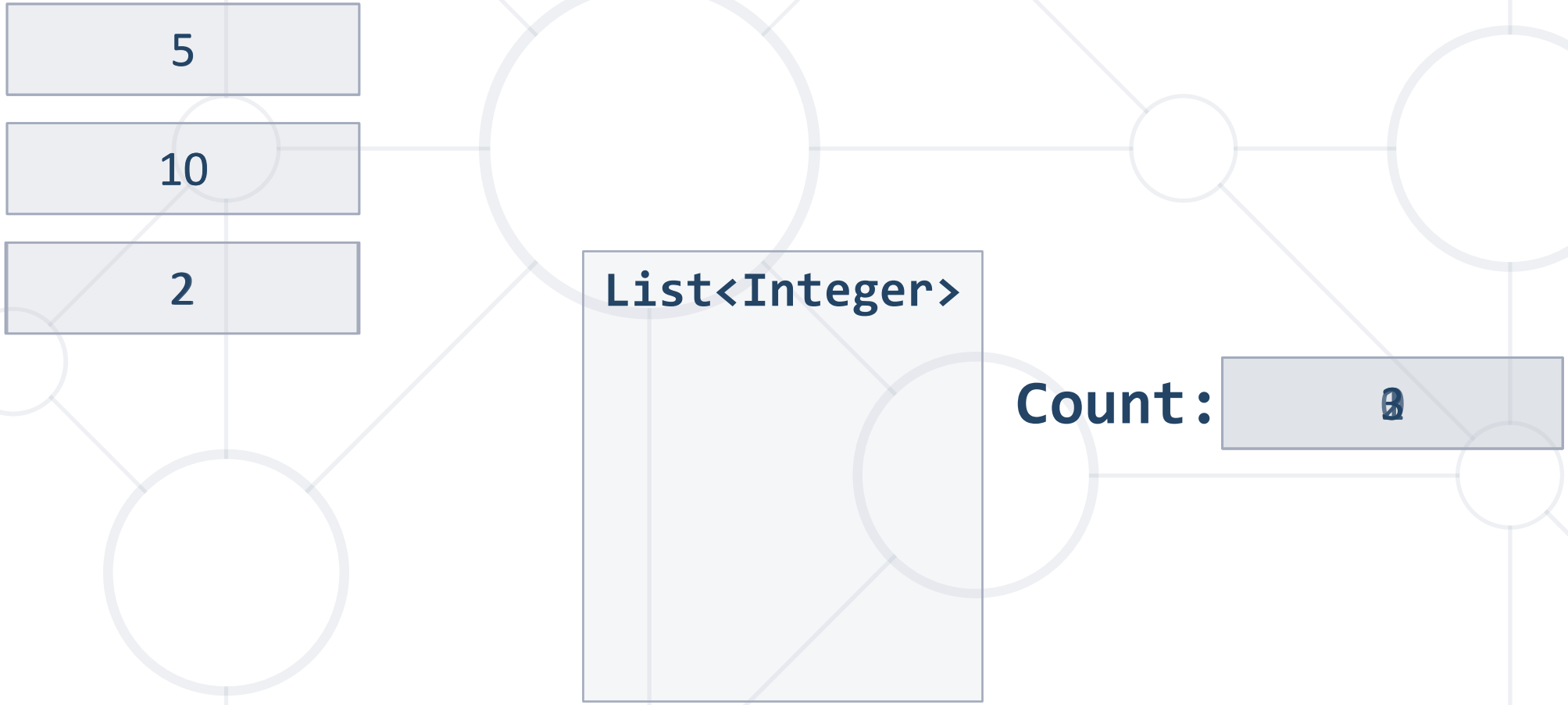


```
-100 10 20 50 60 100
```

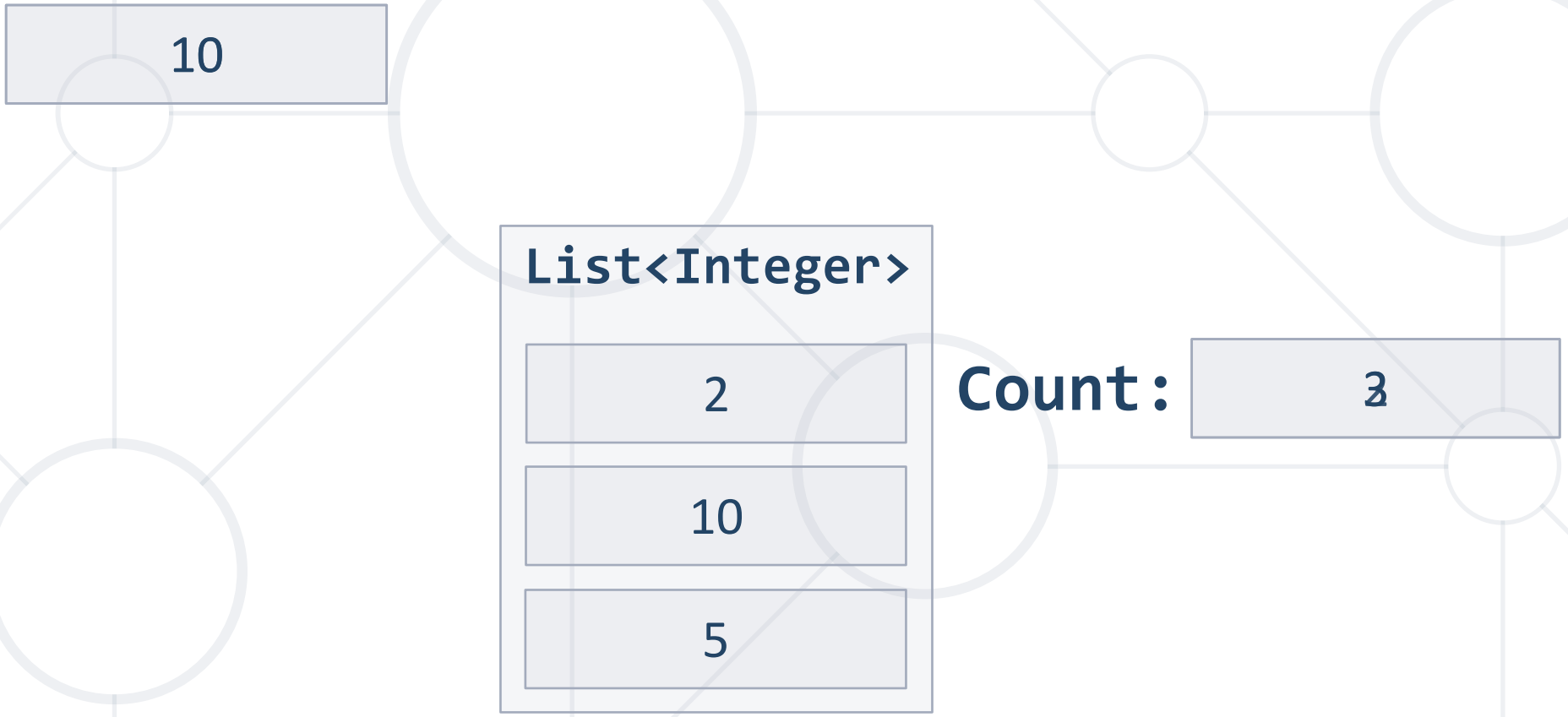
List<E> – Data Structure

- `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

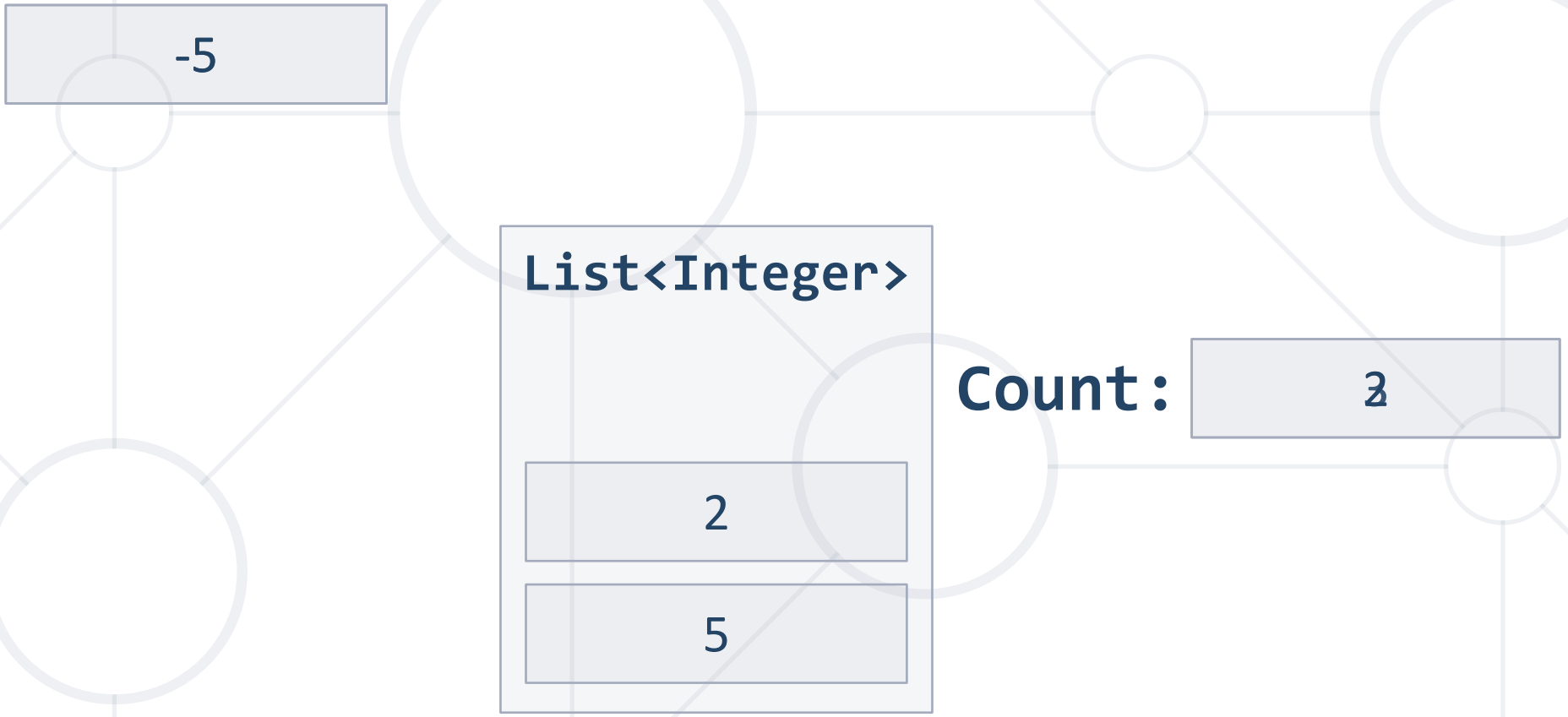
Add – Appends an Element



Remove – Deletes an Element



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



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 Lists On the Console

- 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));
```

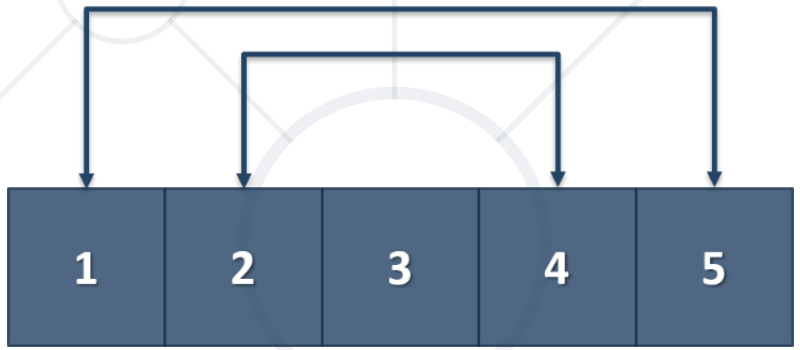
- Printing a list using a **String.join()**:

Gets an element at given index

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

Problem: Gauss' Trick

- Write a program that sum all numbers in a list in the following order:
  - first + last, first + 1 + last - 1, first + 2 + last - 2, … first + n, last – n
- Examples:



1 2 3 4 5	6 6 3
1 2 3 4	5 5

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

Solution: Gauss' Trick

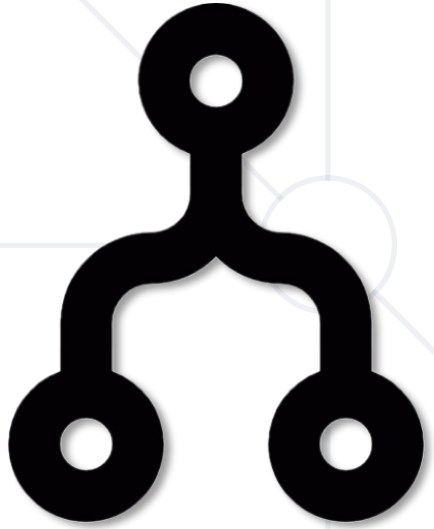
```
Scanner sc = new Scanner(System.in);
List<Integer> numbers = Arrays.stream(sc.nextLine().split(" "))
        .map(Integer::parseInt).collect(Collectors.toList());
int size = numbers.size();
for (int i = 0; i < size / 2; i++) {
  numbers.set(i, numbers.get(i) + numbers.get(numbers.size() - 1));
 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

```
1 2 3 4 5
6 7 8
```

```
1 6 2 7 3 8 4 5
```



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Solution: Merging Lists

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```
//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("[\\[\\],]", ""));
```

Solution: Merging Lists

```
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;
}
```

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

Sorting Lists and Arrays

Sorting Lists

- 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:

```
4
Potatoes
Tomatoes
Onions
Apples
```

```
1.Apples
2.Onions
3.Potatoes
4.Tomatoes
```

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

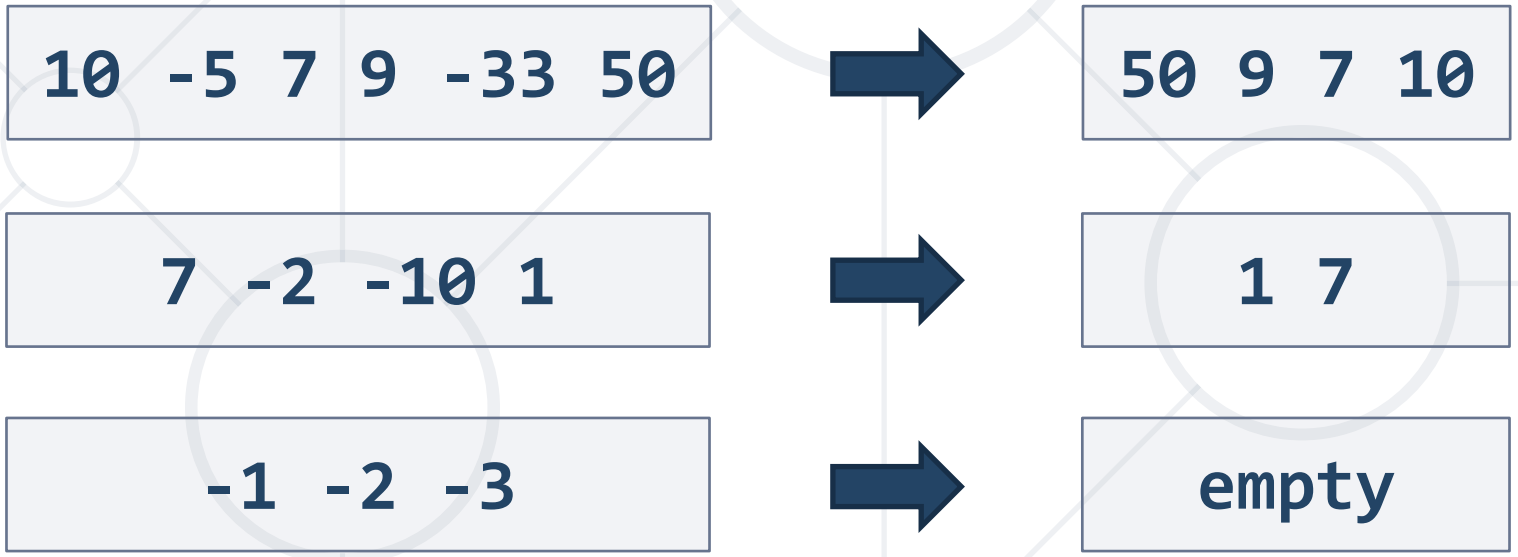
Solution: List of Products

```
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"



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

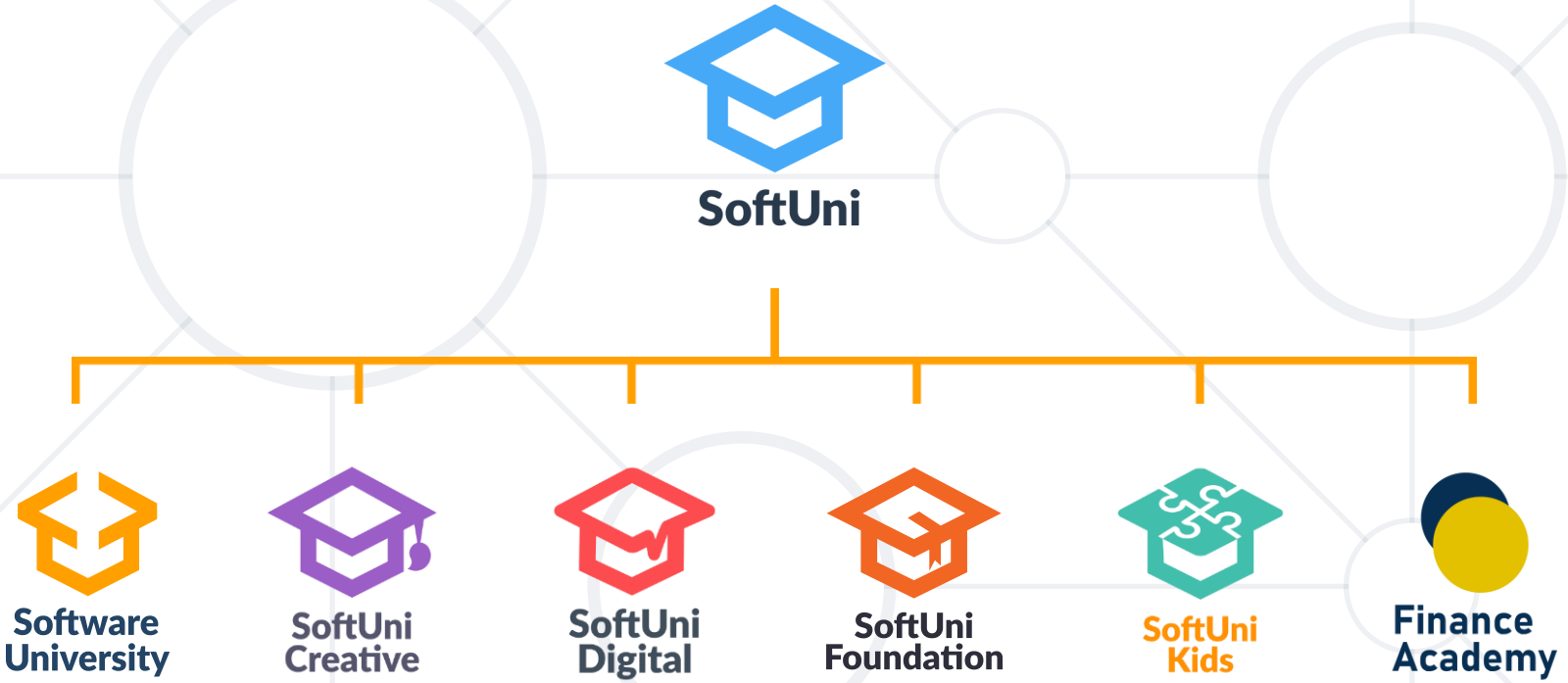
Solution: Remove Negatives and Reverse

```
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("[\\[\\],]",
""));
```

Summary

- 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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