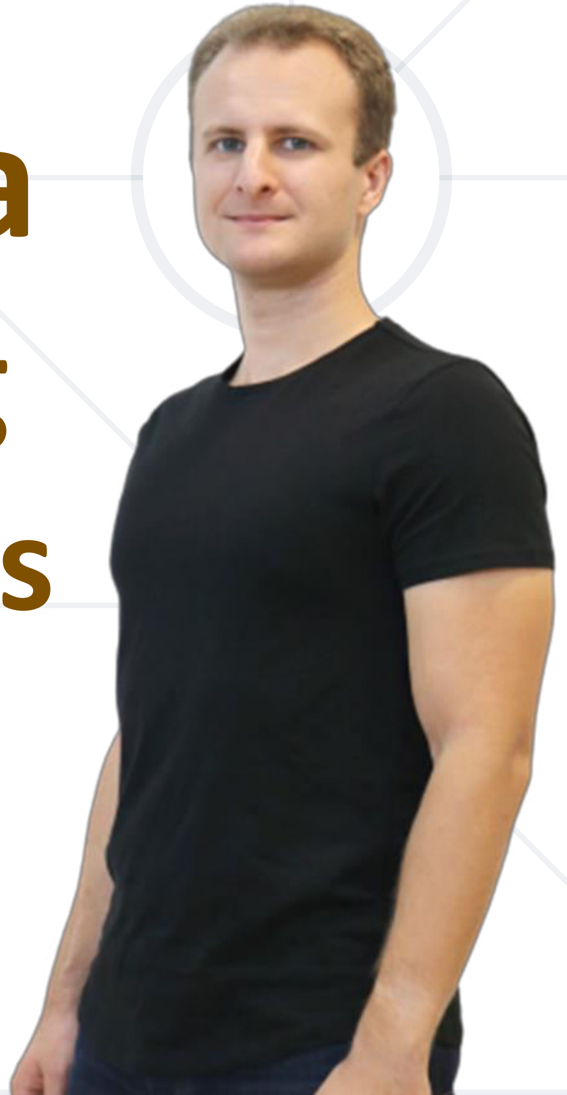
Java Foundations

Methods in Java

Defining and Using Methods. Overloads



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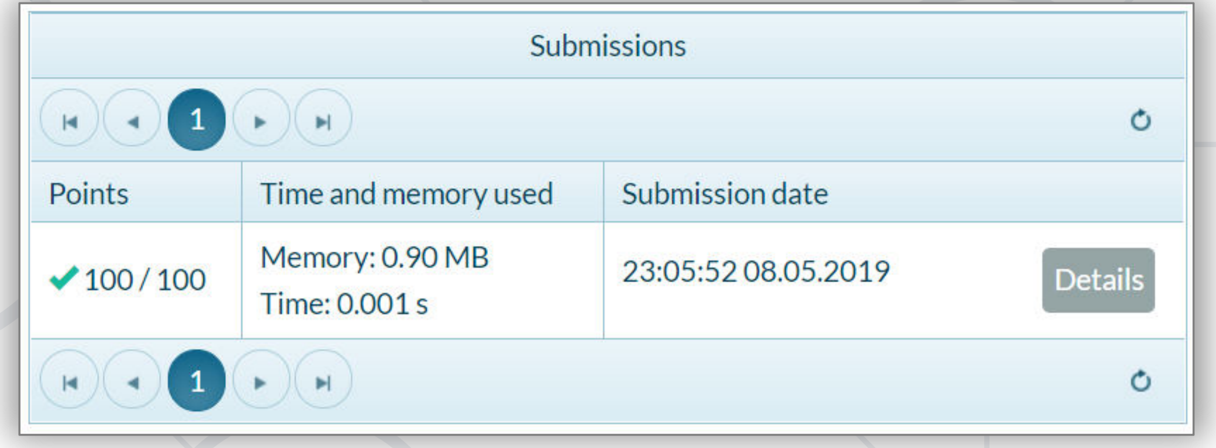
The Judge System

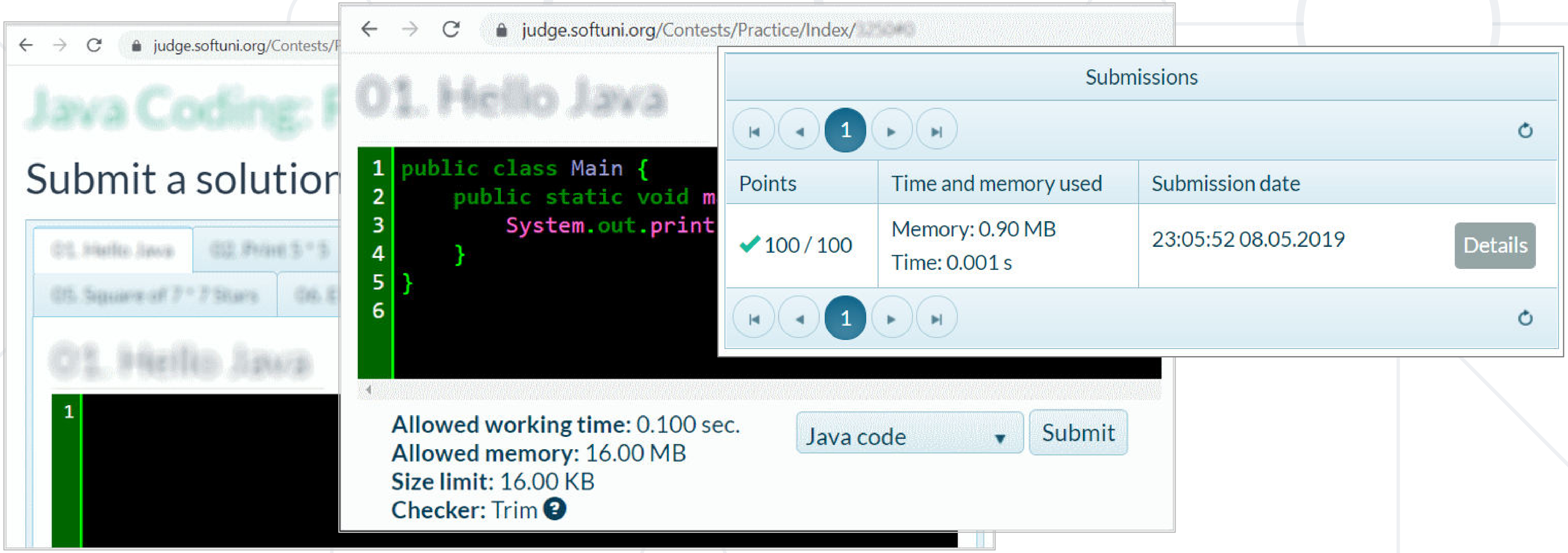

Submissions

Points	Time and memory used	Submission date	
✓ 100 / 100	Memory: 0.90 MB Time: 0.001 s	23:05:52 08.05.2019	Details

Sending your Solutions for Automated Evaluation

Testing Your Code in the Judge System

- Test your code online in the SoftUni **Judge system**: https://judge.softuni.org/Contests/3294



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Submit a solution

```java
public class Main {
    public static void main
        System.out.print
    }
}
```

Allowed working time: 0.100 sec.
Allowed memory: 16.00 MB
Size limit: 16.00 KB
Checker: Trim

Submissions

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Methods

Defining and Using Methods, Overloads

Table of Contents

What Is a Method

Void Methods

Simple Methods

- **Named block of code**, that can be invoked later
- Sample method **definition**:

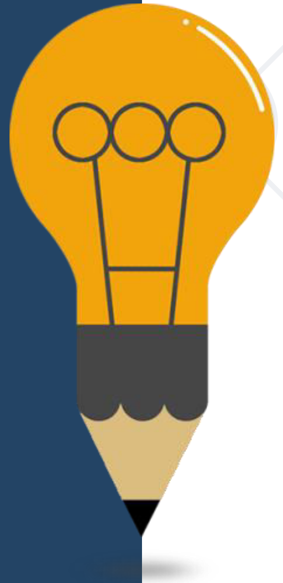
```
public static void printHello() {
  System.out.println("Hello!");
}
```

Method named printHello

Method **body** always surrounded by { }

- **Invoking** (calling) the method several times:

```
printHello();
printHello();
```



Why Use Methods?

- More **manageable programming**
  - Splits large problems into small pieces
  - Better organization of the program
  - Improves code readability
  - Improves code understandability
- Avoiding **repeating code**
  - Improves code maintainability
- Code **reusability**
  - Using existing methods several times

Void Type Method

- Executes the code between the brackets
- Does **not** return result

```java
public static void printHello() {
  System.out.println("Hello");
}
```

Prints "Hello" on the console

```java
public static void main(String[] args) {
  System.out.println("Hello");
}
```

`main()` is also a method

Naming and Best Practices

Naming Methods

- Methods naming guidelines
  - Use **meaningful** method names
  - Method names should answer the question:
    - **What does this method do**?

✓
```
findStudent, loadReport, sine
```

  - If you cannot find a good name for a method, think about whether it has a **clear intent**

🚫
```
Method1, DoSomething, HandleStuff, SampleMethod
```

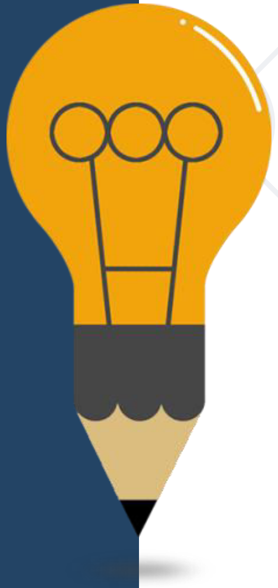
Naming Method Parameters

- Method parameters names
  - Preferred form: [Noun] or [Adjective] + [Noun]
  - Should be in `camelCase`
  - Should be meaningful

```
firstName, report, speedKmH,
usersList, fontSizeInPixels, font
```

  - Unit of measure should be obvious

```
p, p1, p2, populate, LastName, last_name, convertImage
```



Methods – Best Practices

- Each method should perform a **single**, well-defined task
  - A Method's name should **describe that task** in a clear and non-ambiguous way
- **Avoid** methods **longer than one screen**
  - **Split them** to several shorter methods

```
private static void printReceipt() {
    printHeader();
    printBody();
    printFooter();
}
```

Self documenting and easy to test

Code Structure and Code Formatting

- Make sure to use correct **indentation**

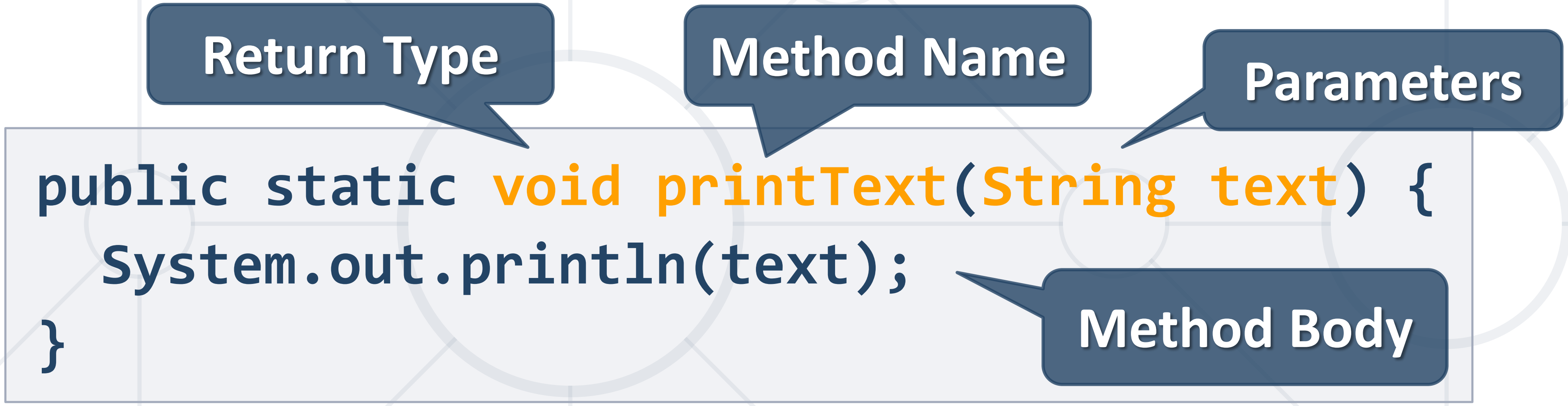
```
static void main(args) {
    // some code…
    // some more code…
}
```

```
static void main(args)
    {
        // some code…
// some more code…
}
```

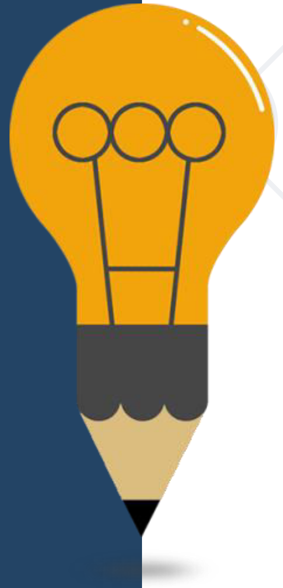
- Leave a **blank line** between **methods**, after **loops** and after **if** statements
- Always use **curly brackets** for loops and `if` statements bodies
- **Avoid long lines** and **complex expressions**

Declaring and Invoking Methods

Declaring Methods



```
public static void printText(String text) {
  System.out.println(text);
}
```



- Methods are declared **inside a class**
- `main()` is also a method
- Variables inside a method are **local**

Invoking a Method

- Methods are first **declared**, then **invoked** (many times)

```
public static void printHeader() {
  System.out.println("----------");
}
```

Method Declaration

- **Methods** can be **invoked (called)** by their name + **( )**:

```
public static void main(String[] args) {
  printHeader();
}
```

Method Invocation

Invoking a Method (2)

- A method can be invoked from:
  - The main method – **main()**

```
public static void main(String[] args) {
  printHeader();
}
```

  - Its own body – **recursion**

```
static void crash() {
  crash();
}
```

  - Some **other method**

```
public static void printHeader() {
  printHeaderTop();
  printHeaderBottom();
}
```

double
String
long

Methods with Parameters

Method Parameters

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- Method **parameters** can be of **any data type**

```
static void printNumbers(int start, int end) {
  for (int i = start; i <= end; i++) {
    System.out.printf("%d ", i);
  }
}
```

Multiple parameters separated by comma

- Call the method with certain values (**arguments**)

```
public static void main(String[] args) {
  printNumbers(5, 10);
}
```

Passing arguments at invocation

Method Parameters (2)

- You can pass **zero** or **several** parameters
- You can pass parameters of **different types**
- Each parameter has **name** and **type**

Multiple parameters of different types

Parameter type

Parameter name

```java
public static void printStudent(String name, int age, double grade) {
    System.out.printf("Student: %s; Age: %d, Grade: %.2f\n",
        name, age, grade);
}
```

Problem: Sign of Integer Number

- Create a method that prints the **sign** of an integer number **n**:

Input	Output
`2`	`The number 2 is positive.`
`-5`	`The number -5 is negative.`
`0`	`The number 0 is zero.`

Solution: Sign of Integer Number

```java
public static void main(String[] args) {
  printSign(Integer.parseInt(sc.nextLine()));
}

public static void printSign(int number) {
  if (number > 0)
    System.out.printf("The number %d is positive.", number);
  else if (number < 0)
    System.out.printf("The number %d is negative.", number);
  else
    System.out.printf("The number %d is zero.", number);
}
```

Problem: Grades

- Write a method that receives a grade between 2.00 and 6.00 and prints the corresponding grade in words
  - 2.00 - 2.99 - "Fail"
  - 3.00 - 3.49 - "Poor"
  - 3.50 - 4.49 - "Good"
  - 4.50 - 5.49 - "Very good"
  - 5.50 - 6.00 - "Excellent"

`3.33`	→	`Poor`
`4.50`	→	`Very good`
`2.99`	→	`Fail`

Solution: Grades

```
public static void main(String[] args) {
  printInWords(Double.parseDouble(sc.nextLine()));
}
public static void printInWords(double grade) {
  String gradeInWords = "";
  if (grade >= 2 && grade <= 2.99)
    gradeInWords = "Fail";
  //TODO: make the rest
  System.out.println(gradeInWords);
}
```

Problem: Printing Triangle

- Create a method for printing triangles as shown below:

```
3
```

```
1
1 2
1 2 3
1 2
1
```

```
4
```

```
1
1 2
1 2 3
1 2 3 4
1 2 3
1 2
1
```

Solution: Printing Triangle (1)

- Create a method that **prints a single line**, consisting of numbers from a **given start** to a **given end**:

```
public static void printLine(int start, int end) {
  for (int i = start; i <= end; i++) {
    System.out.print(i + " ");
  }
  System.out.println();
}
```

Solution: Printing Triangle (2)

- Create a method that prints the **first half (1..n)** and then the **second half (n-1…1)** of the triangle:

```
public static void printTriangle(int n) {
  for (int line = 1; line <= n; line++)
    printLine(1, line);

  for (int line = n - 1; line >= 1; line--)
    printLine(1, line);
}
```

Method with **parameter n**

Lines 1…n

Lines n-1…1

Live Exercises

Returning Values From Methods

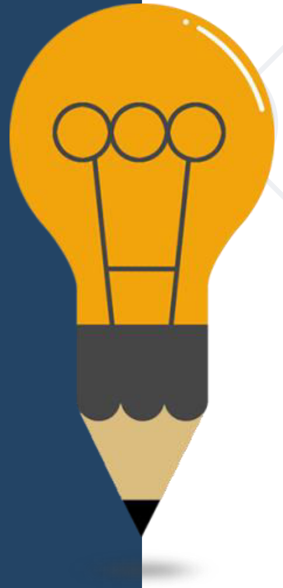
The Return Statement

- The **return** keyword immediately stops the method's execution
- Returns the specified value

```java
public static String readFullName(Scanner sc) {
  String firstName = sc.nextLine();
  String lastName = sc.nextLine();
  return firstName + " " + lastName;
}
```

Returns a `String`

- Void methods can be **terminated** by just using **return**



Using the Return Values

- Return value can be:
  - **Assigned** to a variable

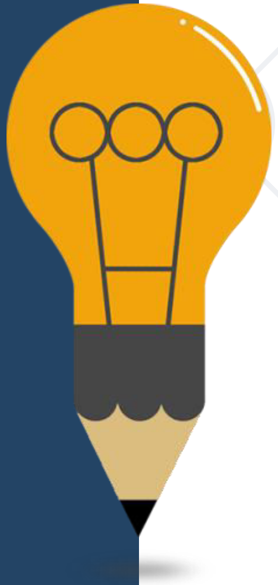
```java
int max = getMax(5, 10);
```

  - **Used** in expression

```java
double total = getPrice() * quantity * 1.20;
```

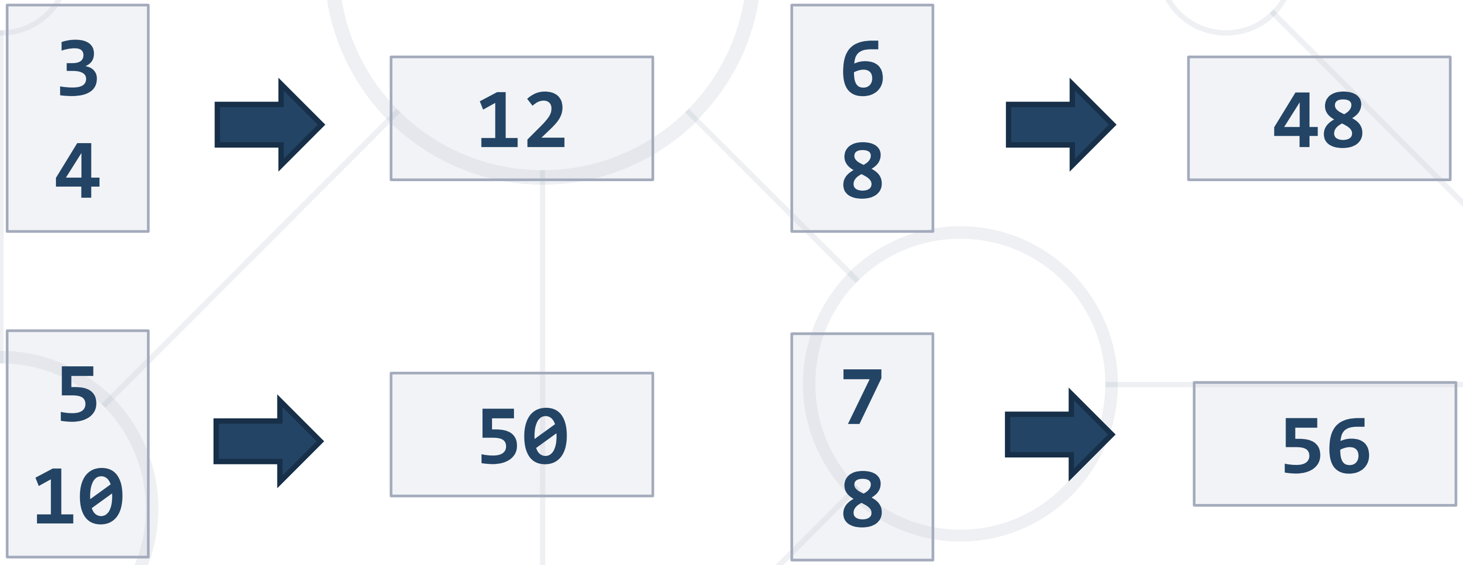
  - **Passed** to another method

```java
int age = Integer.parseInt(sc.nextLine());
```



Problem: Calculate Rectangle Area

- Create a method which returns **rectangle area** with given **width** and **height**



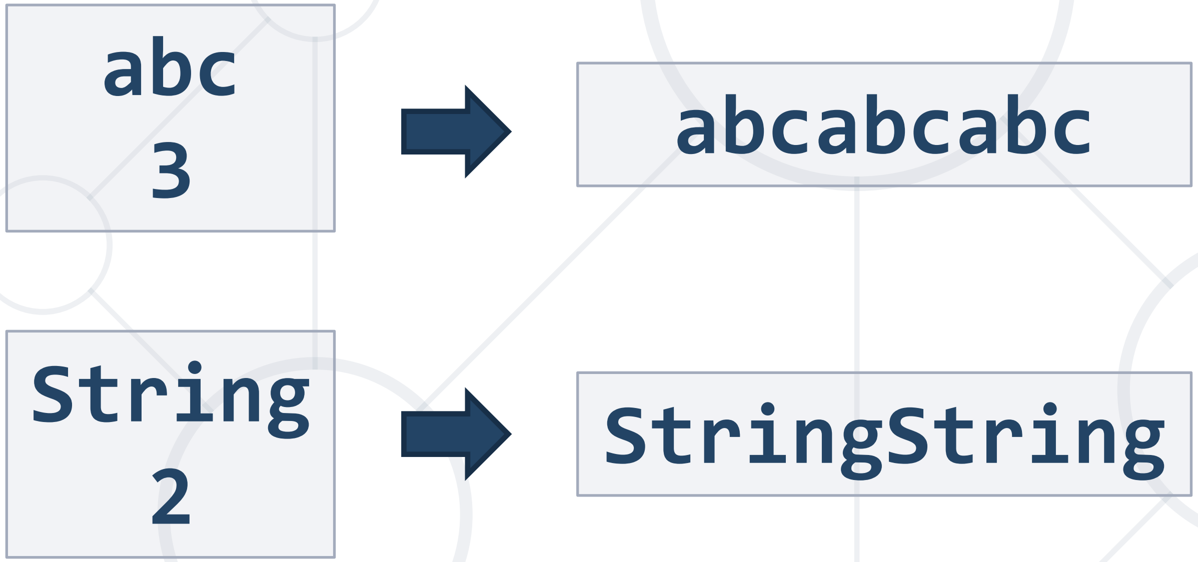
Solution: Calculate Rectangle Area

```java
public static void main(String[] args) {
  double width = Double.parseDouble(sc.nextLine());
  double height = Double.parseDouble(sc.nextLine());
  double area = calcRectangleArea(width, height);
  System.out.printf("%.0f%n",area);
}
```

```java
public static double calcRectangleArea(
    double width, double height) {
  return width * height;
}
```

Problem: Repeat String

- Write a method that receives a string and a repeat count n
- The method should return a new string



Solution: Repeat String

```
public static void main(String[] args) {
  String inputStr = sc.nextLine();
  int count = Integer.parseInt(sc.nextLine());
  System.out.println(repeatString(inputStr, count));
}
private static String repeatString(String str, int count) {
  String result = "";
  for (int i = 0; i < count; i++) result += str;
  return result;
}
```

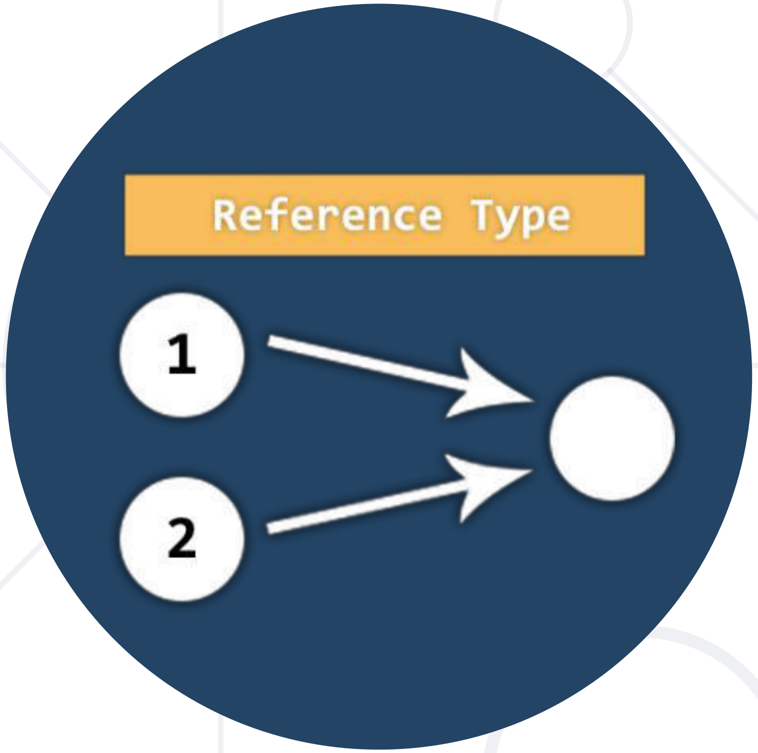
Problem: Math Power

- Create a method that calculates and returns the value of a **number raised to a given power**

2^8 → 256 5.5^3 → 166.375

```
public static double mathPower(double number, int power) {
  double result = 1;
  for (int i = 0; i < power; i++)
    result *= number;
  return result;
}
```

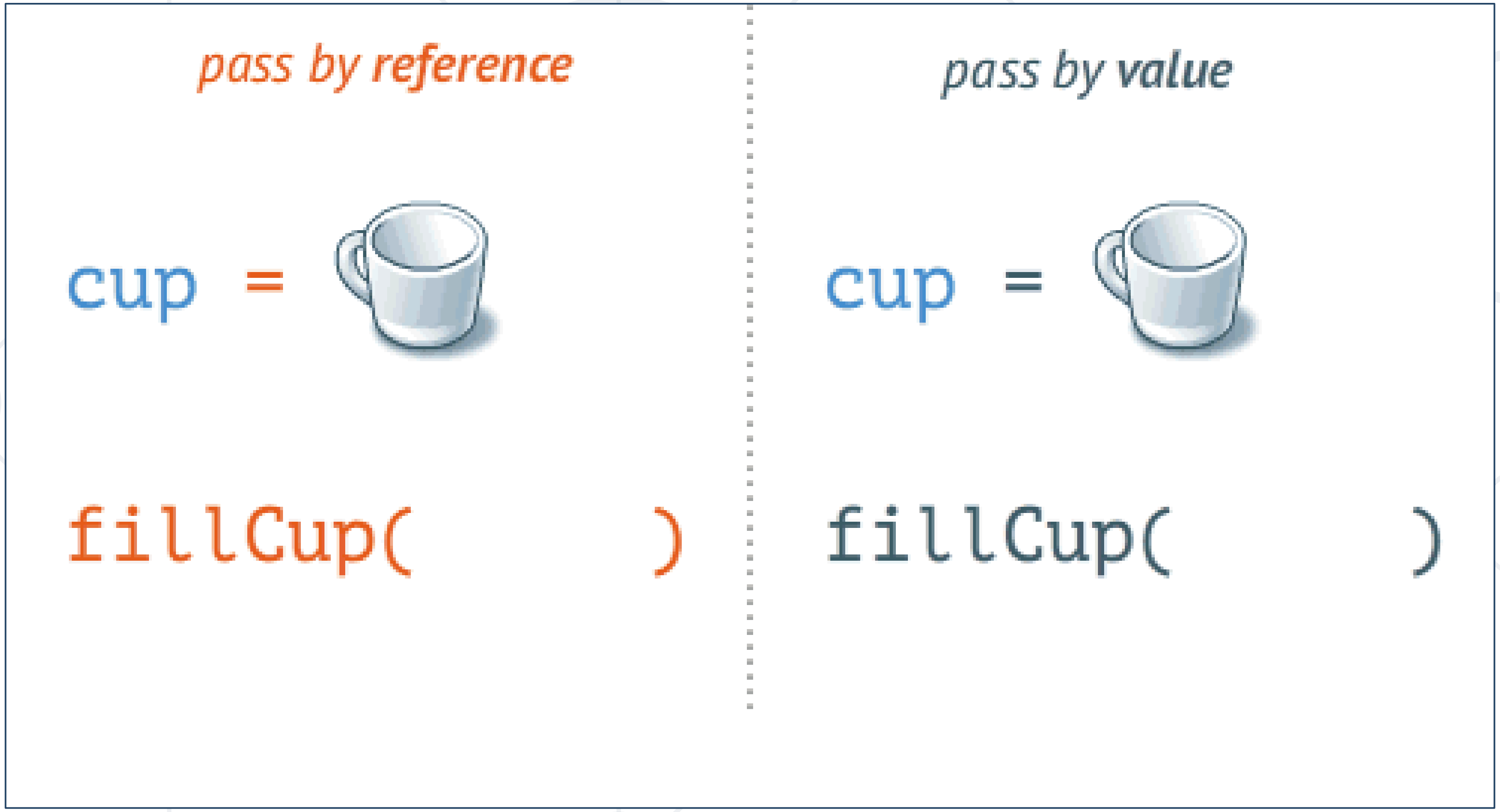
Live Exercises



Value vs. Reference Types

Memory Stack and Heap

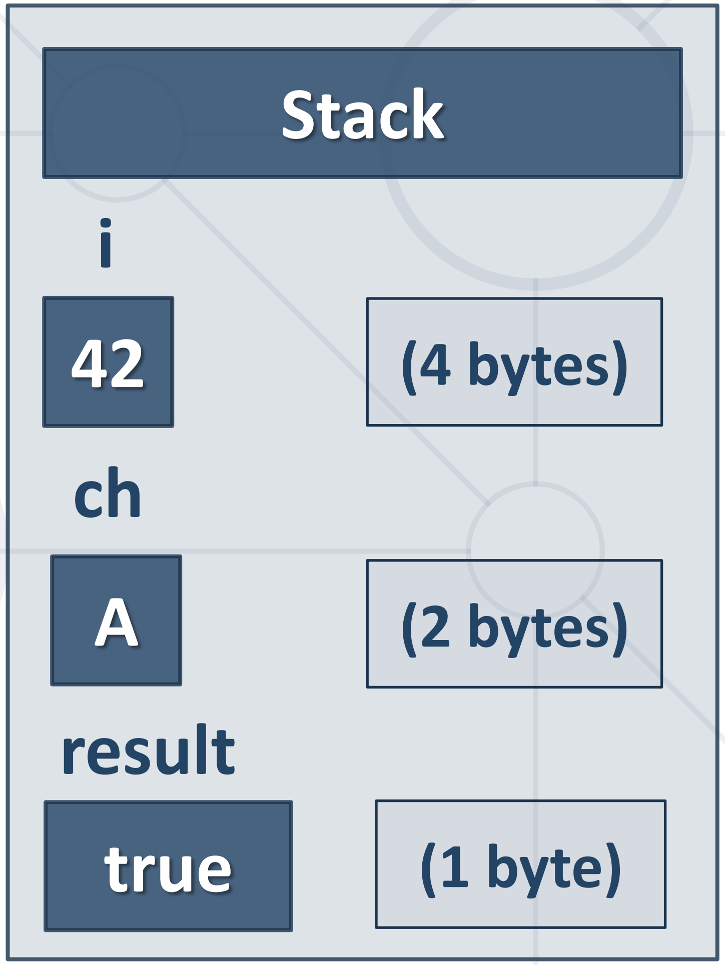
Value vs. Reference Types



Value Types

- **Value type** variables hold directly their value
  - **`int`**, **`float`**, **`double`**, **`boolean`**, **`char`**, …
- Each variable has its own **copy** of the **value**

```
int i = 42;
char ch = 'A';
boolean result = true;
```

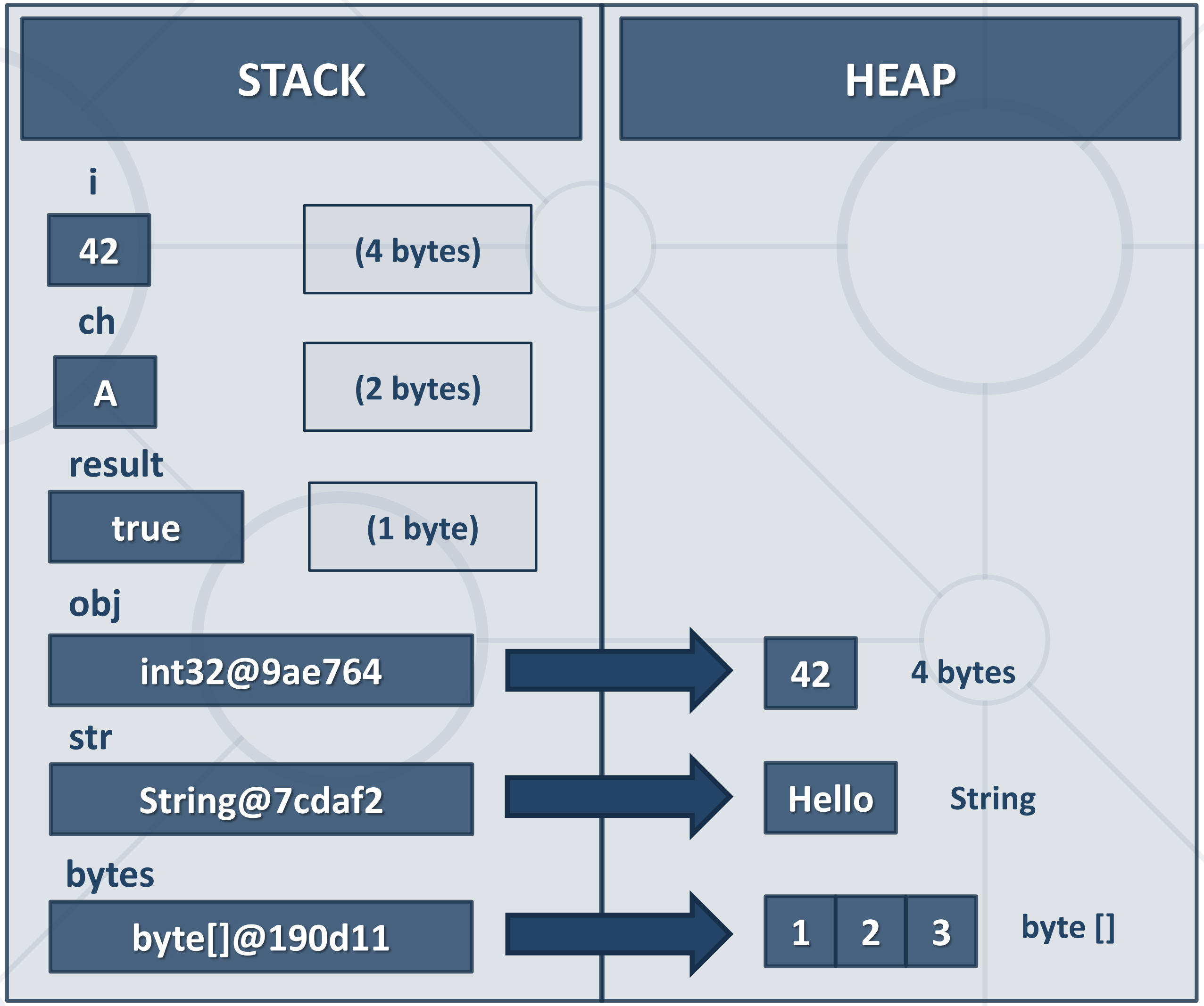


Reference Types

- **Reference type** variables hold a reference (pointer / memory address) of the value itself
  - **String**, **int[]**, **char[]**, **String[]**
- Two reference type variables can **reference** the **same object**
  - Operations on both variables access / modify **the same data**

Value Types vs. Reference Types

```
int i = 42;
char ch = 'A';
boolean result = true;
Object obj = 42;
String str = "Hello";
byte[] bytes ={ 1, 2, 3 };
```



Example: Value Types

```java
public static void main(String[] args) {
    int num = 5;
    increment(num, 15);
    System.out.println(num);
}

public static void increment(int num, int value) {
    num += value;
}
```

num == 5

num == 20

Example: Reference Types

```java
public static void main(String[] args) {
  int[] nums = { 5 };
  increment(nums, 15);
  System.out.println(nums[0]);
}

public static void increment(int[] nums, int value) {
  nums[0] += value;
}
```

nums[0] == 20

nums[0] == 20

Live Exercises

Overloading Methods

Method Signature

- The combination of method's **name** and **parameters** is called **signature**

```
public static void print(String text) {
  System.out.println(text);
}
```

Method's **signature**

- Signature **differentiates** between methods with same names
- When methods with the **same name** have **different signature**, this is called method "**overloading**"

Overloading Methods

- Using the same name for multiple methods with different **signatures** (method **name** and **parameters**)

```java
static void print(int number) {
  System.out.println(number);
}
```

```java
static void print(String text) {
  System.out.println(text);
}
```

```java
static void print(String text, int number) {
  System.out.println(text + ' ' + number);
}
```

Different method **signatures**

Signature and Return Type

- Method's return type **is not part** of its signature

```
public static void print(String text) {
  System.out.println(text);
}

public static String print(String text) {
  return text;
}
```

Compile-time error!

- How would the compiler know **which method to call**?

Problem: Greater of Two Values

- Create a method **`getMax()`** that **returns the greater** of two values (the values can be of type **`int`**, **`char`** or **`String`**)

```
int
2
16
```
→
```
16
```

```
char
a
z
```
→
```
z
```

```
String
aaa
bbb
```
→
```
bbb
```

Live Exercises

Program Execution Flow

Program Execution

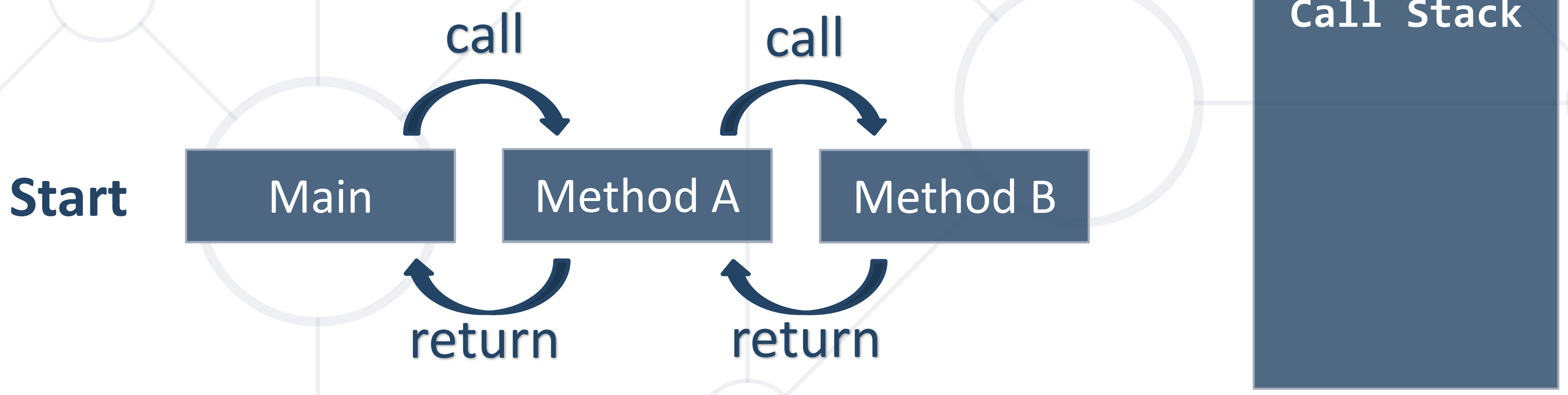
- The program continues, after a method execution completes:

```
public static void main(String[] args) {
  System.out.println("before method executes");
  printLogo();
  System.out.println("after method executes");
}
```

```
public static void printLogo() {
  System.out.println("Company Logo");
  System.out.println("http://www.companywebsite.com");
}
```

Program Execution – Call Stack

- "The stack" **stores information** about the **active subroutines** (methods) of a computer program
- Keeps track of **the point** to which each active subroutine should **return control** when it **finishes executing**



Problem: Multiply Evens by Odds

- Create a program that **multiplies the sum** of **all even digits** of a number **by the sum of all odd digits** of the same number:
  - Create a method called `getMultipleOfEvensAndOdds()`
  - Create a method `getSumOfEvenDigits()`
  - Create `getSumOfOddDigits()`
  - You may need to use `Math.abs()` for negative numbers

```
-12345  →  Evens: 2 4      →  Even sum: 6  →  54
           Odds:  1 3 5       Odd sum:  9
```

Live Exercises

Summary

- Break large programs into simple **methods** that solve small sub-problems
- Methods consist of **declaration** and **body**
- Methods are invoked by their **name** + **()**
- Methods can accept **parameters**
- Methods can **`return`** a value or nothing (**`void`**)

Next Steps

- Join the SoftUni "Learn To Code" Community

https://softuni.org

- Access the Free Coding Lessons
- Get Help from the Mentors
- Meet the Other Learners