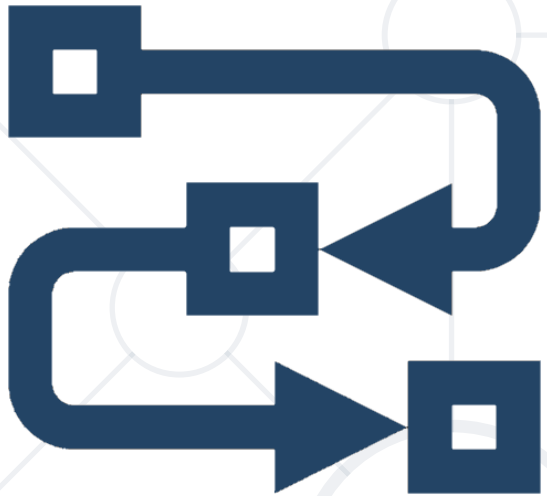


Methods

Defining and Using Methods, Overloads



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Technical Trainers



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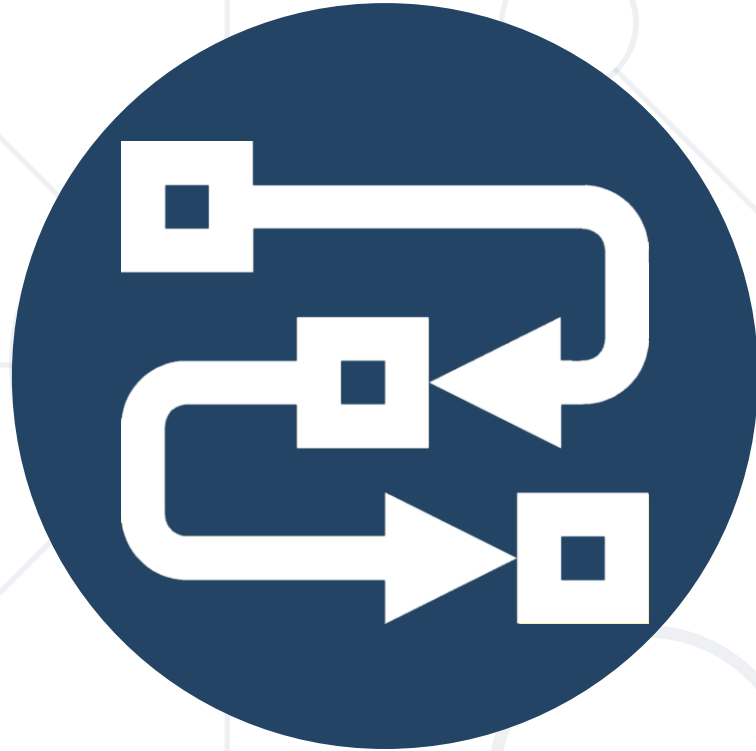
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#fund-java

1. What Is a Method?
2. Naming and Best Practices
3. Declaring and Invoking Methods
 - Void and Return Type Methods
4. Methods with Parameters
5. Value vs. Reference Types
6. Overloading Methods
7. Program Execution Flow





What is a Method?

Void Method

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

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

Prints
"Hello" on
the console

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



findStudent, loadReport, sine



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
```

- 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**

- 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


Type

Method Name

Parameters

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

Method
Body

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

- 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();  
}
```


Invoking a Method (3)

- Some **other method**

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



**double
String
long**

Methods with Parameters

- 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

```
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**:

2 ➡ The number 2 is positive.

-5 ➡ The number -5 is negative.

0 ➡ The number 0 is zero.

Check your solution here: <https://judge.softuni.org/Contests/1260/>

Solution: Sign of Integer Number

```
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);  
}
```

Check your solution here: <https://judge.softuni.org/Contests/1260/>

- 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



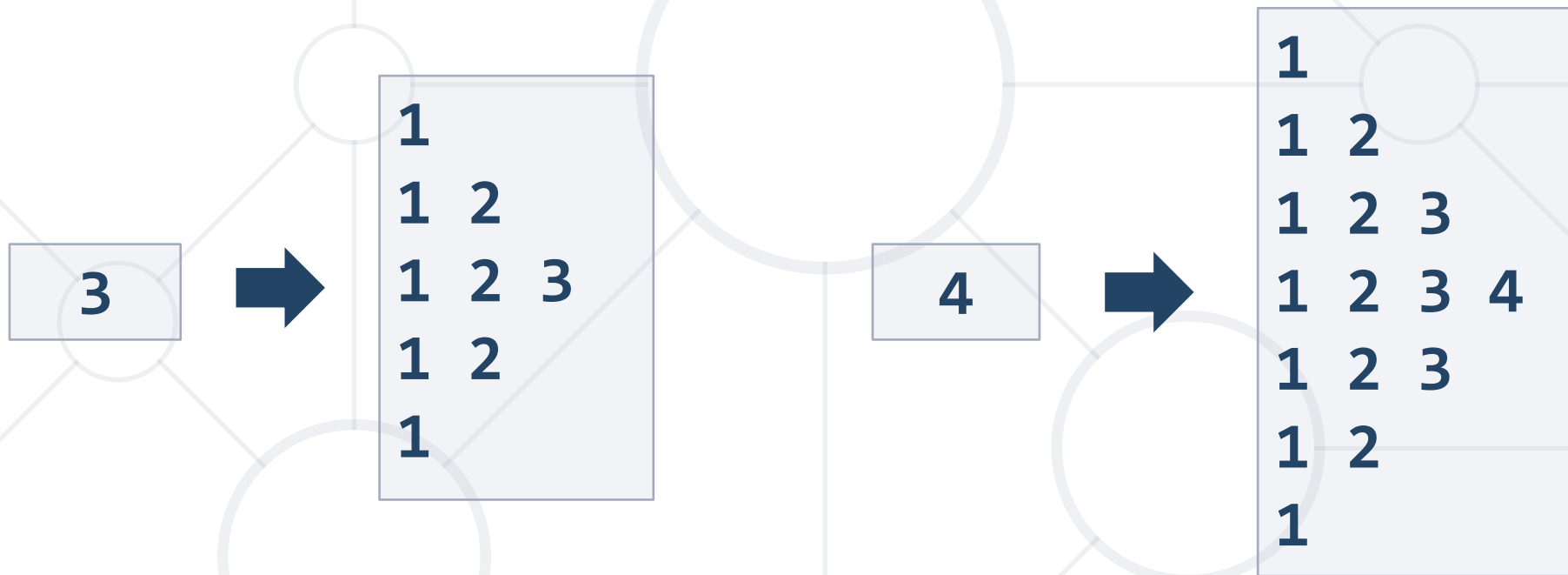
Fail

Check your solution here: <https://judge.softuni.org/Contests/1260/>

```
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:



Check your solution here: <https://judge.softuni.org/Contests/1260/>

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();  
}
```

Check your solution here: <https://judge.softuni.org/Contests/1260/>

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

```
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

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

- Used** in expression

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

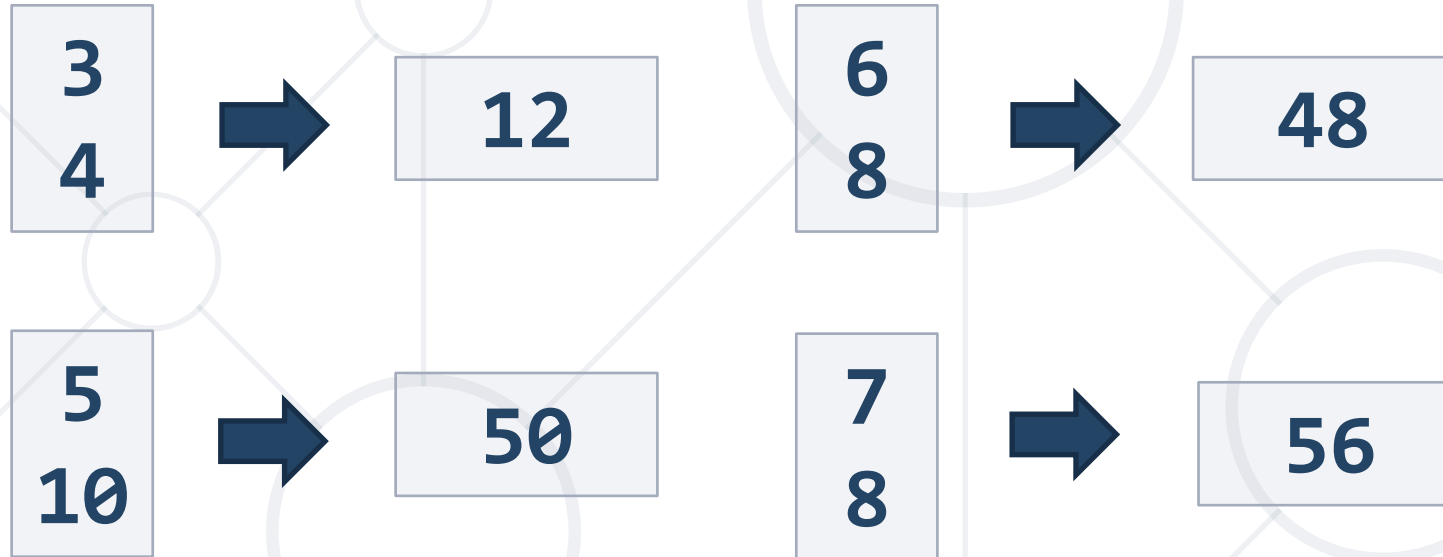
- Passed** to another method

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



Problem: Calculate Rectangle Area

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



Check your solution here: <https://judge.softuni.org/Contests/1260/>

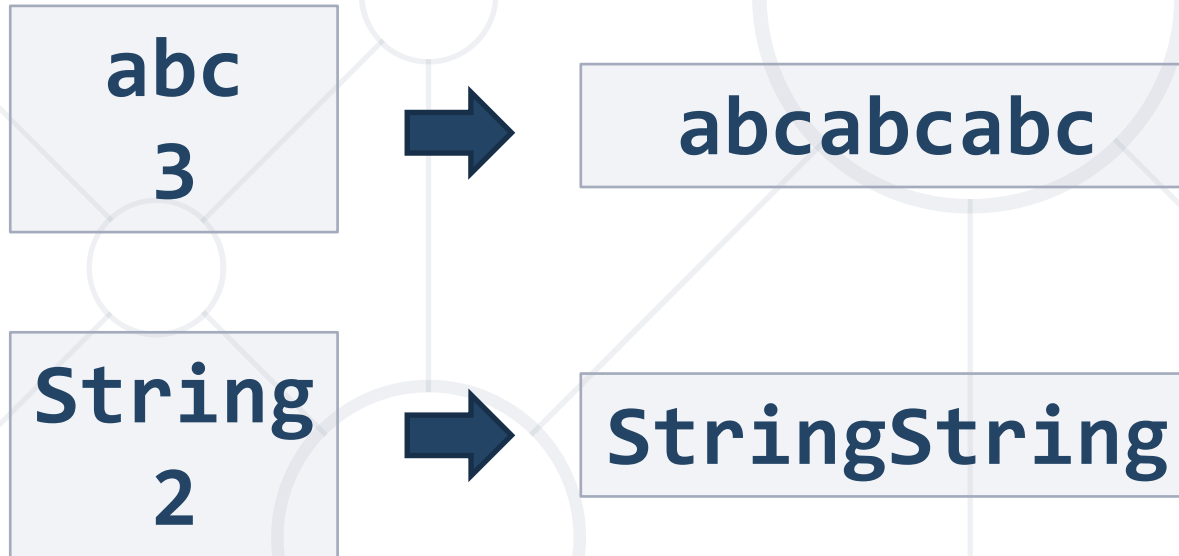
Solution: Calculate Rectangle Area

```
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);  
}
```

```
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



Check your solution here: <https://judge.softuni.org/Contests/1260/>

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**

$$2^8 \Rightarrow 256$$

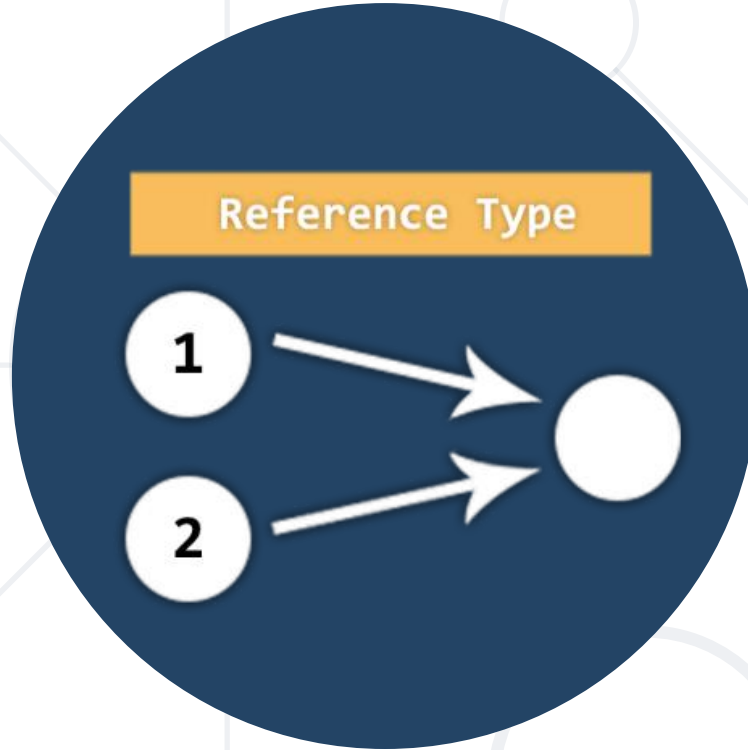
$$5.5^3 \Rightarrow 166.375$$

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

Check your solution here: <https://judge.softuni.org/Contests/1260/>



Live Exercises




Value vs. Reference Types

Memory Stack and Heap


Value vs. Reference Types

pass by reference

cup = 

fillCup()

pass by value

cup = 

fillCup()

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;
```



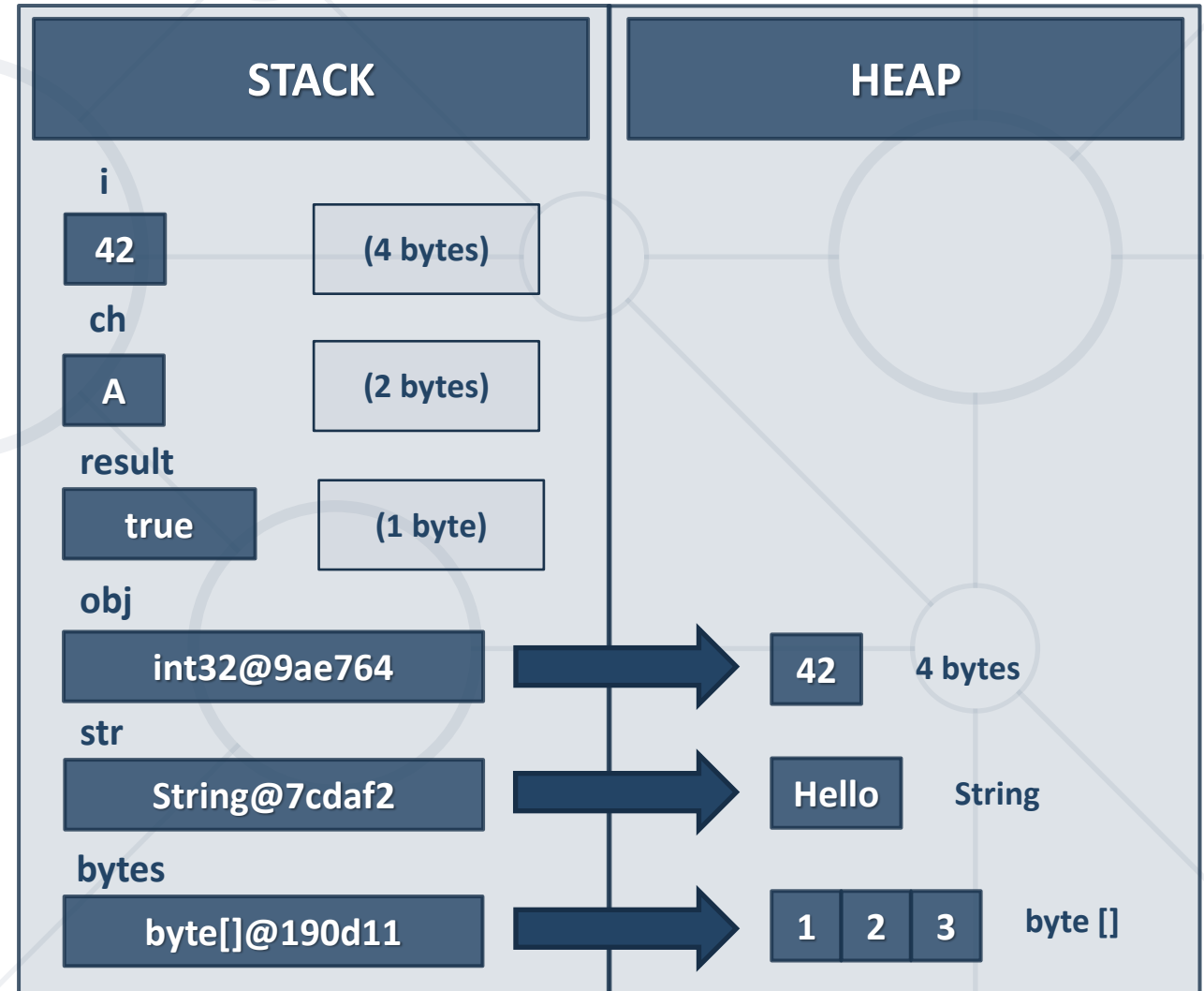
Reference Types

- **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

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

num == 5

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

num == 20

Example: Reference Types

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

nums[0] == 20

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

nums[0] == 20



Live Exercises



Overloading Methods

- 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**"

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

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

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

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

Different
method
signatures

- 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

String
aaa
bbb



bbb

char
a
z

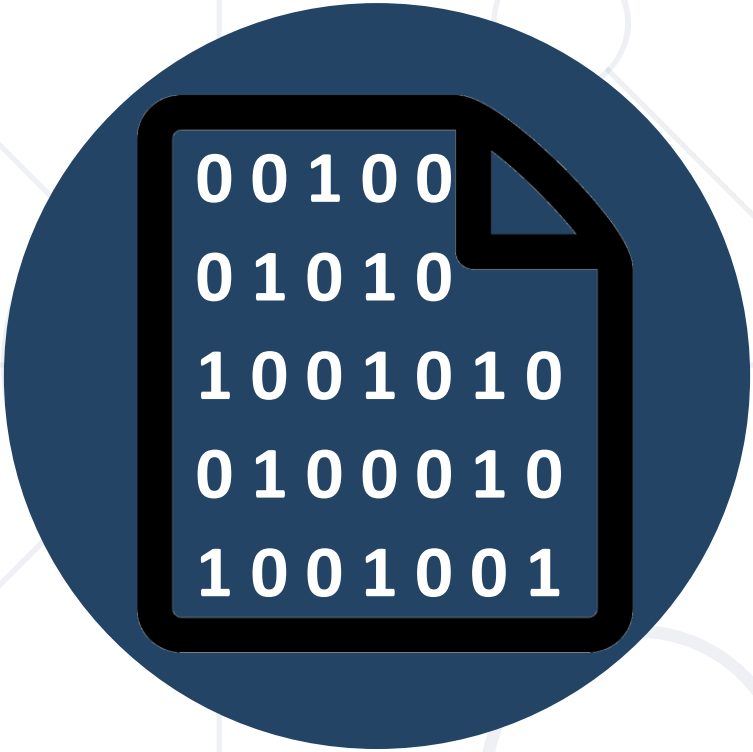


z

Check your solution here: <https://judge.softuni.org/Contests/1260/>



Live Exercises



00100
01010
1001010
0100010
1001001

Program Execution Flow

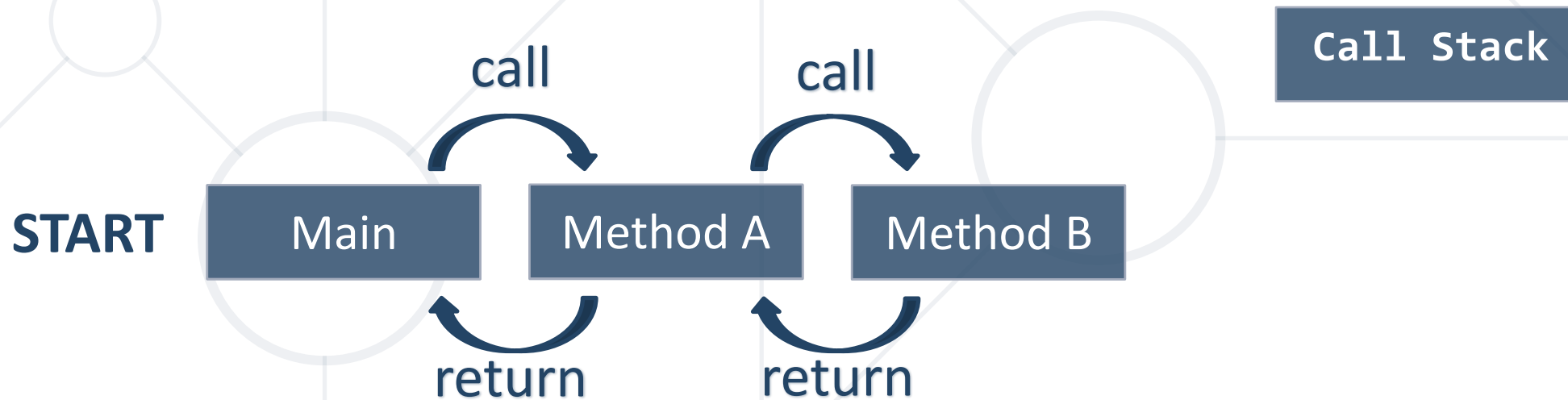
- The program continues, after a method execution completes:

```
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



Check your solution here: <https://judge.softuni.org/Contests/1260/>

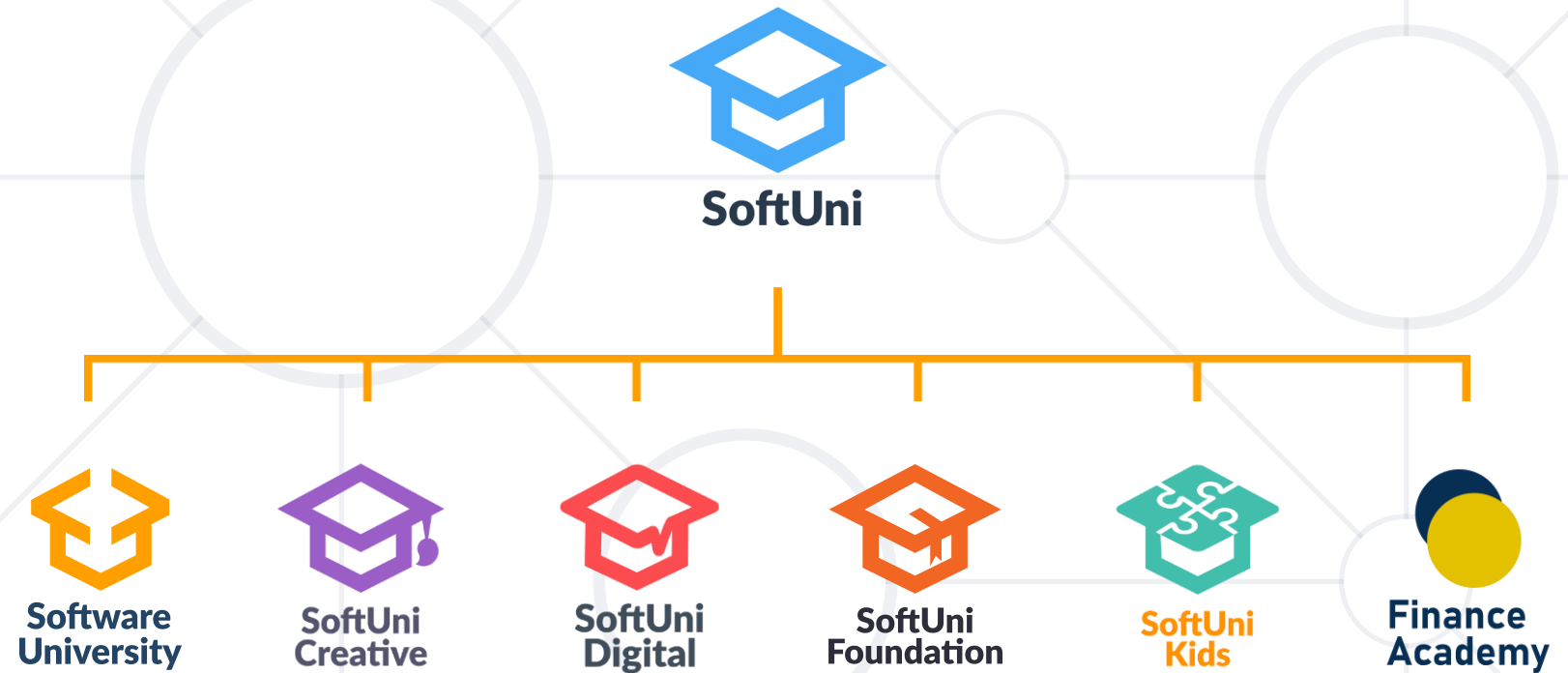


Live Exercises

- 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**)



Questions?



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