# Java Introduction

## Basic Syntax , I/O, Conditions, Loops and Debugging


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# Have a Question?

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# Introduction and Basic Syntax

# Java – Introduction

- **Java** is modern, flexible, general-purpose programming language
- **Object-oriented** by nature, statically-typed, compiled

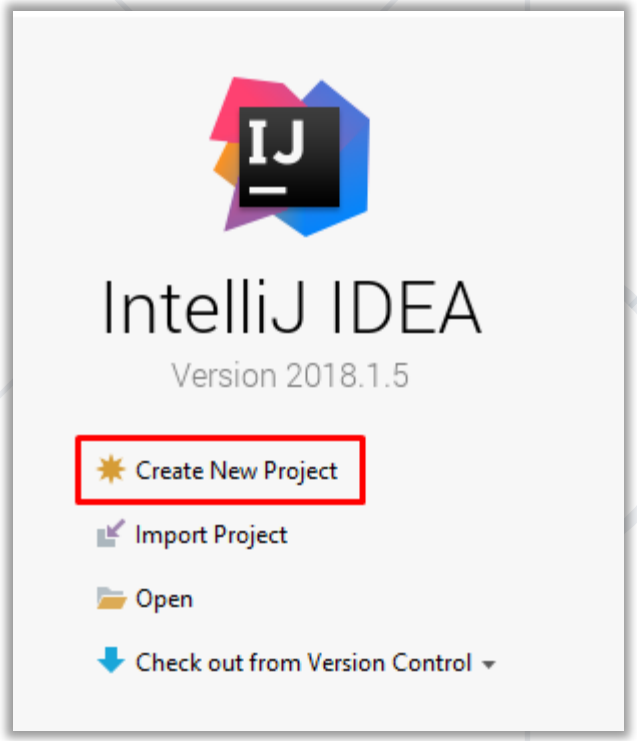
```
static void main(String[] args) {
    //Source Code
}
```

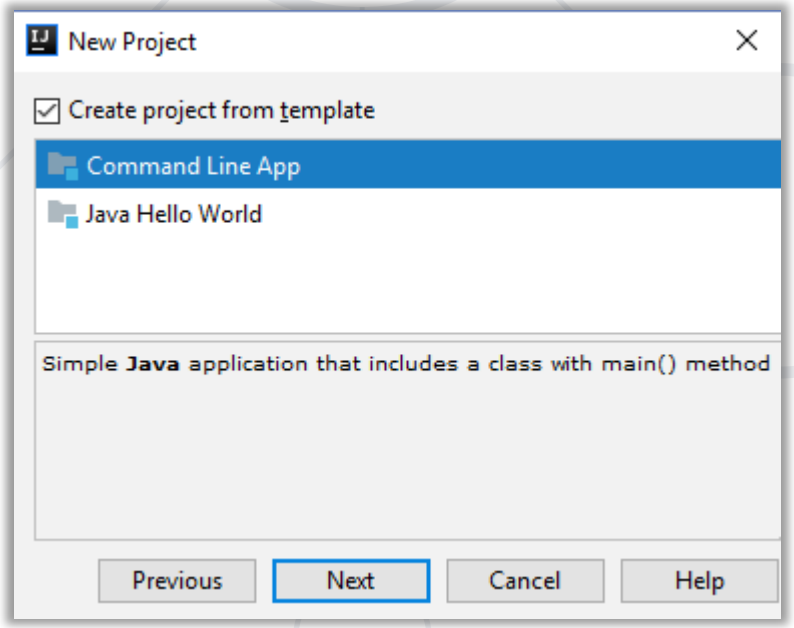
Program starting point

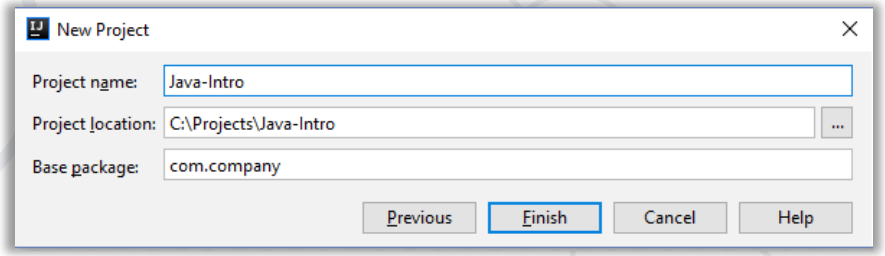
- In this course will use Java Development Kit (JDK) 13

# Using Intellij Idea

- **Intellij Idea** is powerful IDE for Java and other languages
- Create a project



# Declaring Variables

- Defining and Initializing variables

```
{data type / var} {variable name} = {value};
```

- Example:

```
int number = 5;
```

Variable name

Data type

Variable value

# Console I/O

Reading from and Writing to the Console

# Reading from the Console

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- We can **read/write** to the console, using the **Scanner** class
- Import the **java.util.Scanner** class

```
import java.util.Scanner;
…
Scanner sc = new Scanner(System.in);
```

- Reading input from the console using

```
String name = sc.nextLine();
```

Returns **string**

# Converting Input from the Console

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- `scanner.nextLine()` returns a `String`
- Convert the string to number by **parsing**:

```
import java.util.Scanner;
…
Scanner sc = new Scanner(System.in);
String name = sc.nextLine();
int age = Integer.parseInt(sc.nextLine());
double salary = Double.parseDouble(sc.nextLine());
```

# Printing to the Console

- We can **print** to the console, using the **System** class
- Writing output to the console:
  - **System.out.print()**
  - **System.out.println()**

```
System.out.print("Name: ");
String name = scanner.nextLine();
System.out.println("Hi, " + name);
// Name: George
// Hi, George
```

# Using Print Format

- Using **format** to print at the console
- Examples:

```
String name = "George";
int age = 5;
System.out.printf("Name: %s, Age: %d", name, age);
// Name: George, Age: 5
```

Placeholder %s stands for string and corresponds to name

Placeholder %d stands for integer number and corresponds to age

# Formatting Numbers in Placeholders

- **D** – format number to certain digits with leading zeros
- **F** – format floating point number with certain digits after the decimal point
- Examples:

```
int percentage = 55;
double grade = 5.5334;
System.out.printf("%03d", percentage);   // 055
System.out.printf("%.2f", grade);        // 5.53
```

# Using String.format

- Using `String.format` to create a string by pattern
- Examples:

```
String name = "George";
int age = 5;
String result = String.format("Name: %s,
                              Age: %d", name, age);
System.out.println(result);
//Name: George, Age 5
```

# Problem: Student Information

- You will be given 3 input lines:
  - Student Name, Age and Average Grade
- Print the input in the following format:
  - "Name: {name}, Age: {age}, Grade {grade}"
  - Format the grade to 2 decimal places

```
John
15
5.40
```

```
Name: John, Age: 15, Grade: 5.40
```

Check your solution here: https://judge.softuni.bg/Contests/1190/

# Solution: Student Information

```
import java.util.Scanner;

…
Scanner sc = new Scanner(System.in);
String name = sc.nextLine();
int age = Integer.parseInt(sc.nextLine());
double grade = Double.parseDouble(sc.nextLine());

System.out.printf("Name: %s, Age: %d, Grade: %.2f",
                                        name, age, grade);
```

# Comparison Operators

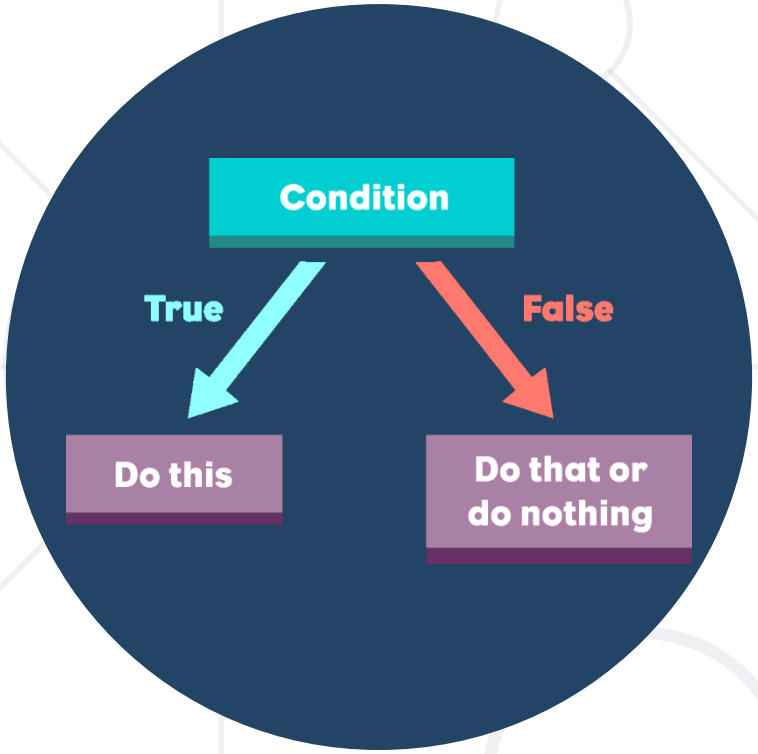
# Comparison Operators

| Operator | Notation in Java |
|---|---|
| Equals | == |
| Not Equals | != |
| Greater Than | > |
| Greater Than or Equals | >= |
| Less Than | < |
| Less Than or Equals | <= |

# Comparing Numbers

- Values can be compared:

```
int a = 5;
int b = 10;
System.out.println(a < b);          // true
System.out.println(a > 0);          // true
System.out.println(a > 100);        // false
System.out.println(a < a);          // false
System.out.println(a <= 5);         // true
System.out.println(b == 2 * a);     // true
```




# The If-else Statement

## Implementing Control-Flow Logic

# The If Statement

- The simplest conditional statement
  - Test for a condition
- Example: Take as an input a grade and check if the student has passed the exam (grade >= 3.00)

```
double grade = Double.parseDouble(sc.nextLine());
if (grade >= 3.00) {
   System.out.println("Passed!");
}
```

In Java the opening bracket stays on the same line

# The If-else Statement

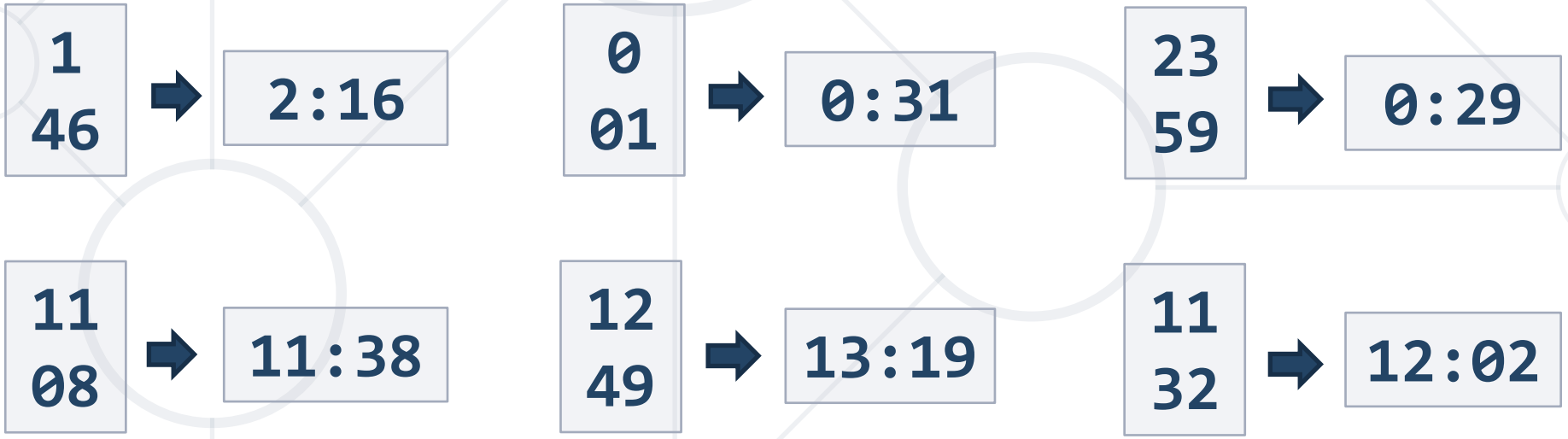
- Executes **one branch** if the condition is **true** and **another**, if it is **false**
- Example: **Upgrade** the last example, so it prints "**Failed**!", if the mark is lower than 3.00:

**The else keyword stays on a new line**

```
if (grade >= 3.00) {
    System.out.println("Passed!");
} else {
    // TODO: Print the message
}
```

# Problem: I Will Be Back in 30 Minutes

- Write a program that reads hours and minutes from the console and calculates the time after 30 minutes
  - The hours and the minutes come on separate lines
- Example:



# Solution: I Will Be Back in 30 Minutes (1)

```
int hours = Integer.parseInt(sc.nextLine());
int minutes = Integer.parseInt(sc.nextLine()) + 30;

if (minutes > 59) {
  hours += 1;
  minutes -= 60;
}
// Continue on the next slide
```

# Solution: I Will Be Back in 30 Minutes (2)

```
if (hours > 23) {
  hours = 0;
}
if (minutes < 10) {
  System.out.printf("%d:%02d%n", hours, minutes);
} else {
  System.out.printf("%d:%d", hours, minutes);
}
```

%n goes on the next line

# The Switch-Case Statement

Simplified If-else-if-else

# The Switch-case Statement

- Works as sequence of `if-else` statements
- Example: read input a number and print its corresponding month:

```
int month = Integer.parseInt(sc.nextLine());
switch (month) {
  case 1: System.out.println("January"); break;
  case 2: System.out.println("February"); break;
  // TODO: Add the other cases
  default: System.out.println("Error!"); break;
}
```

Check your solution here: https://judge.softuni.bg/Contests/1190/

# Problem: Foreign Languages

- By given country print its typical language:
  - English -> England, USA
  - Spanish -> Spain, Argentina, Mexico
  - other -> unknown

| | | |
|---|---|---|
| `England` | ➡ | `English` |
| `Spain` | ➡ | `Spanish` |

# Solution: Foreign Languages

```
//TODO: Read the input
switch (country) {
  case "USA":
  case "England": System.out.println("English"); break;
  case "Spain":
  case "Argentina":
  case "Mexico": System.out.println("Spanish"); break;
  default: System.out.println("unknown"); break;
}
```


# Logical Operators

## Writing More Complex Conditions

# Logical Operators

- Logical operators give us the ability to write multiple conditions in one `if` statement
- They return a boolean value and compare boolean values

| Operator | Notation in Java | Example |
|---|---|---|
| Logical NOT | ! | !false -> true |
| Logical AND | && | true && false -> false |
| Logical OR | \|\| | true \|\| false -> true |

# Problem: Theatre Promotions

- A theatre has the following ticket prices according to the age of the visitor and the type of day. If the age is < 0 or > 122, print "Error!":

| Day / Age | 0 <= age <= 18 | 18 < age <= 64 | 64 < age <= 122 |
|---|---|---|---|
| Weekday | 12$ | 18$ | 12$ |
| Weekend | 15$ | 20$ | 15$ |
| Holiday | 5$ | 12$ | 10$ |

```
Weekday
42
```
➡
```
18$
```

```
Holiday
-12
```
➡
```
Error!
```

# Solution: Theatre Promotions (1)

```
String day = sc.nextLine().toLowerCase();
int age = Integer.parseInt(sc.nextLine());
int price = 0;
if (day.equals("weekday")) {
  if ((age >= 0 && age <= 18) || (age > 64 && age <= 122)) {
    price = 12;
  }
  // TODO: Add else statement for the other group
}
// Continue…
```

# Solution: Theatre Promotions (2)

```
else if (day.equals("weekend")) {
  if ((age >= 0 && age <= 18) || (age > 64 && age <= 122)) {
    price = 15;
  } else if (age > 18 && age <= 64) {
    price = 20;
  }
} // Continue…
```

# Solution: Theatre Promotions (3)

```
else if (day.equals("holiday")){
  if (age >= 0 && age <= 18)
    price = 5;
  // TODO: Add the statements for the other cases
}
if (price != 0)
  System.out.println(price + "$");
else
  System.out.println("Error!");
```

# Loops

## Code Block Repetition

# Loop: Definition

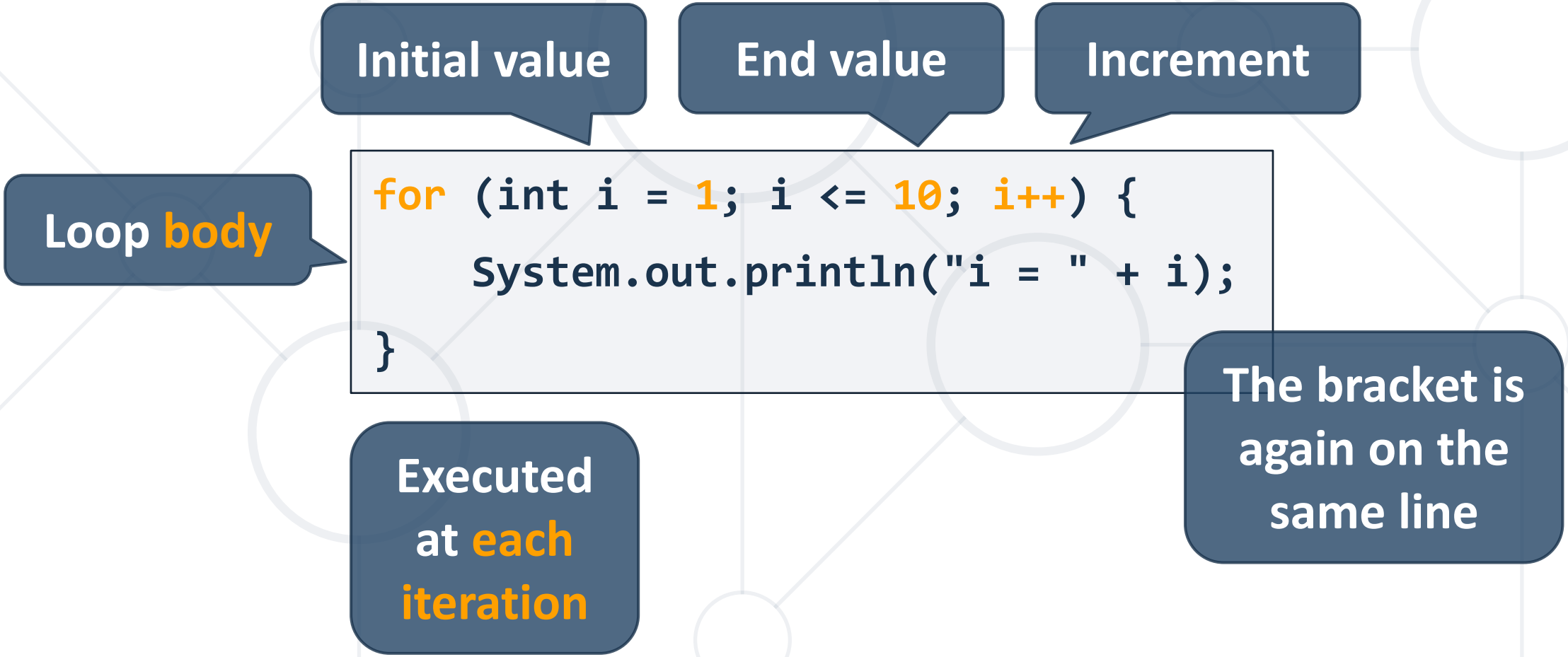
- A **loop** is a control statement that repeats the execution of a block of statements. The loop can:
  - `for` loop
    - Execute a code block a fixed number of times
  - `while` and `do…while`
    - Execute a code block while a given condition returns true


# For-Loops

## Managing the Count of the Iteration

# For-Loops

- The for loop executes statements a fixed number of times:



# Example: Divisible by 3

- Print the numbers from 1 to 100, that are divisible by 3

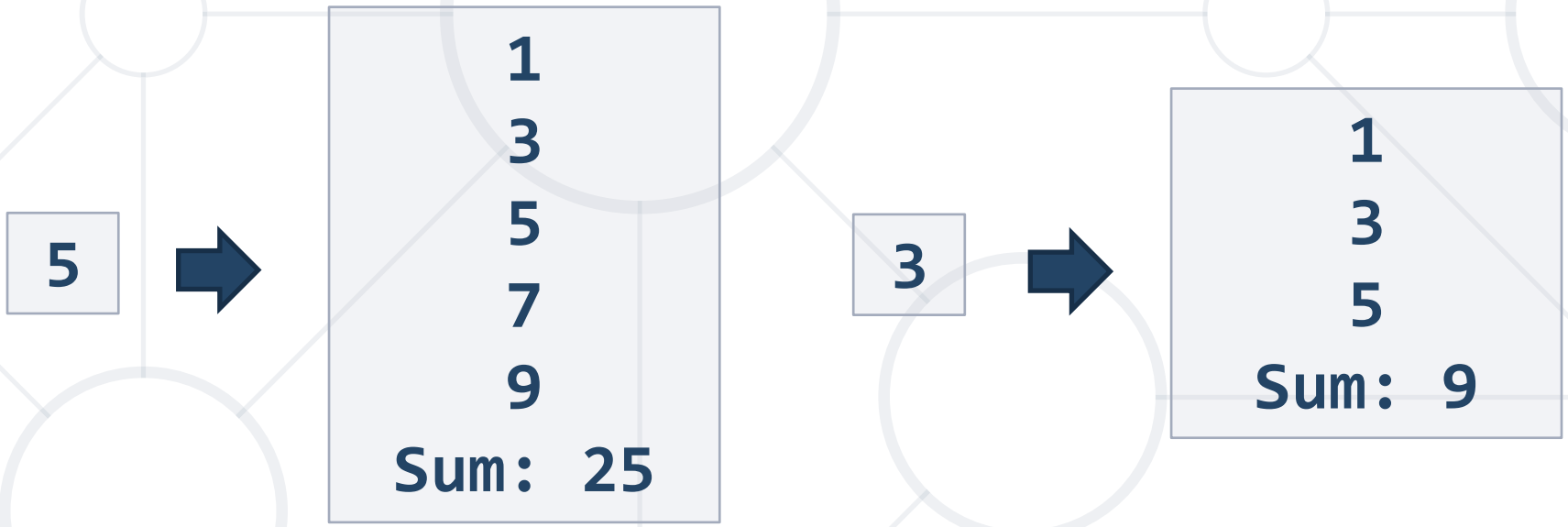
```
for (int i = 3; i <= 100; i += 3) {
  System.out.println(i);
}
```

- You can use "**fori**" live template in Intellij


```
for (int i = 0; i < ; i++) {

}
```

# Problem: Sum of Odd Numbers

- Write a program to print the first **n** odd numbers and their sum



# Solution: Sum of Odd Numbers

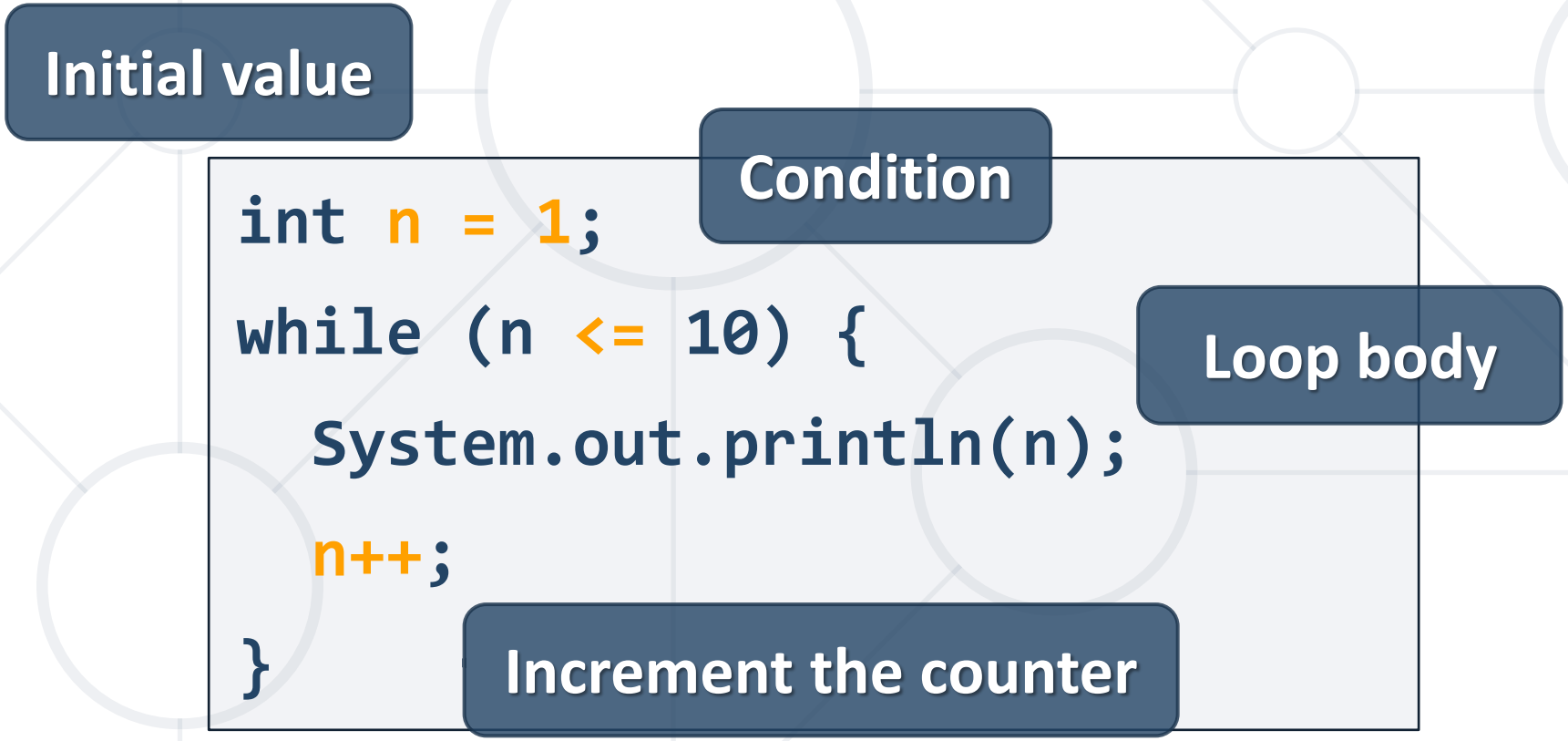
```
int n = Integer.parseInt(sc.nextLine());
int sum = 0;

for (int i = 1; i <= n; i++) {
  System.out.println(2 * i - 1);
  sum += 2 * i - 1;
}
System.out.printf("Sum: %d", sum);
```

# While Loops

## Iterations While a Condition is True

# While Loops

- Executes commands while the condition is true:



# Problem: Multiplication Table

- Print a table holding number*1, number*2, …, number*10

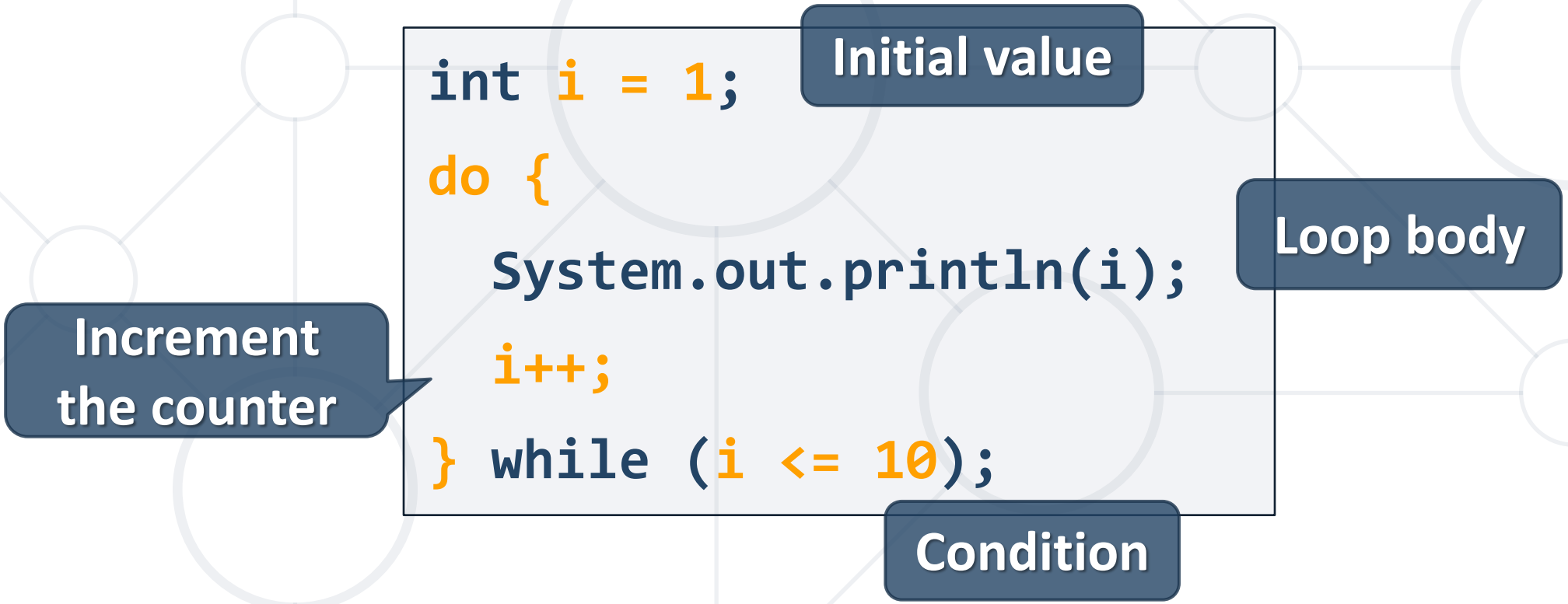
```
int number = Integer.parseInt(sc.nextLine());
int times = 1;
while (times <= 10) {
  System.out.printf("%d X %d = %d%n",
                    number, times, number * times);
  times++;
}
```

# Do…While Loop

Execute a Piece of Code One or More Times

# Do ... While Loop

- Similar to the `while` loop, but always executes at least once:



# Problem: Multiplication Table 2.0

- Upgrade your program and take the initial times from the console

```
int number = Integer.parseInt(sc.nextLine());
int times = Integer.parseInt(sc.nextLine());
do {
  System.out.printf("%d X %d = %d%n",
                    number, times, number * times);
  times++;
} while (times <= 10);
```

# Debugging the Code

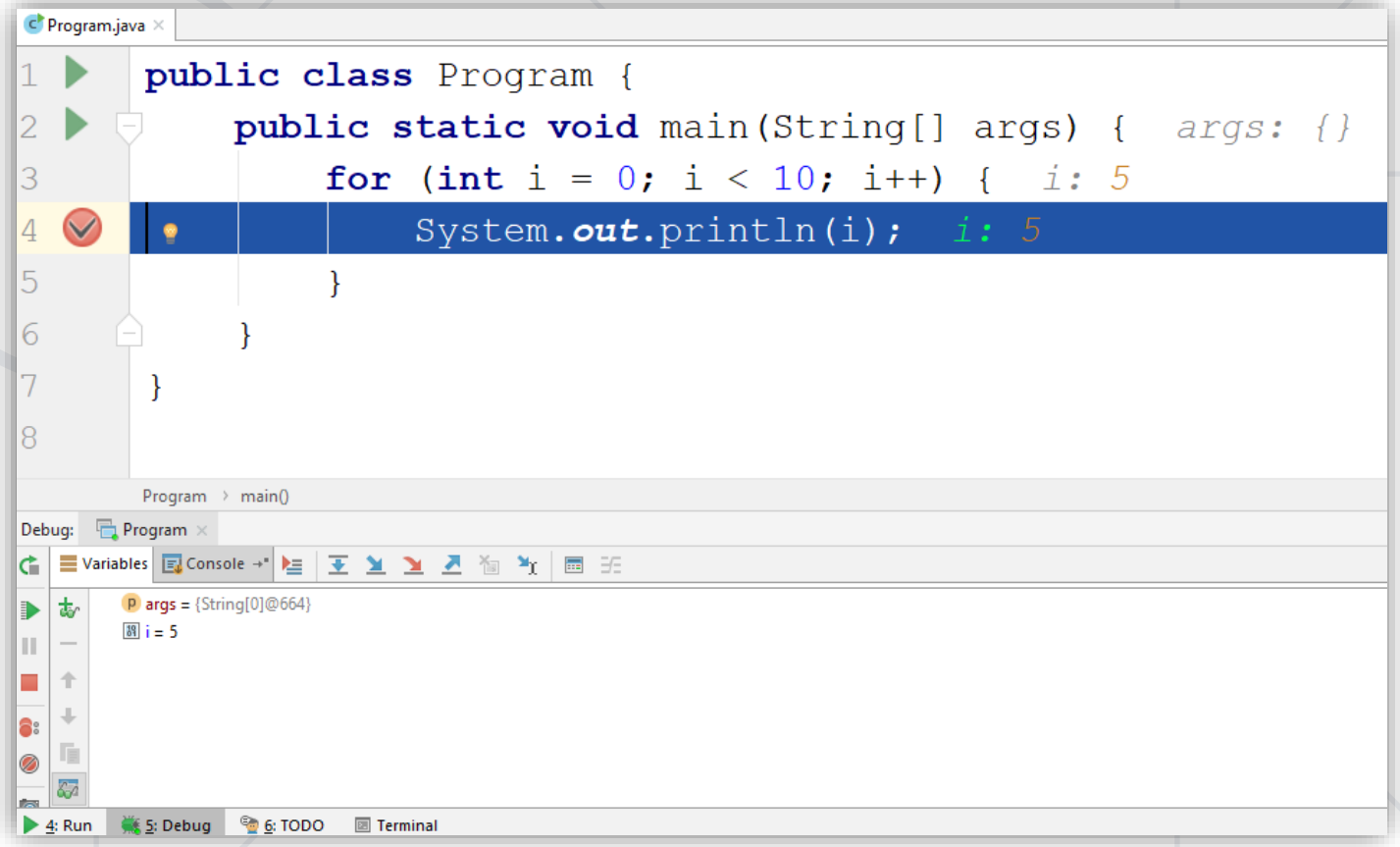
## Using the InteliJ Debugger

# Debugging the Code

- The process of **debugging application** includes:
  - Spotting an error
  - Finding the lines of code that cause the error
  - Fixing the error in the code
  - Testing to check if the error is gone and no new errors are introduced
- Iterative and continuous process

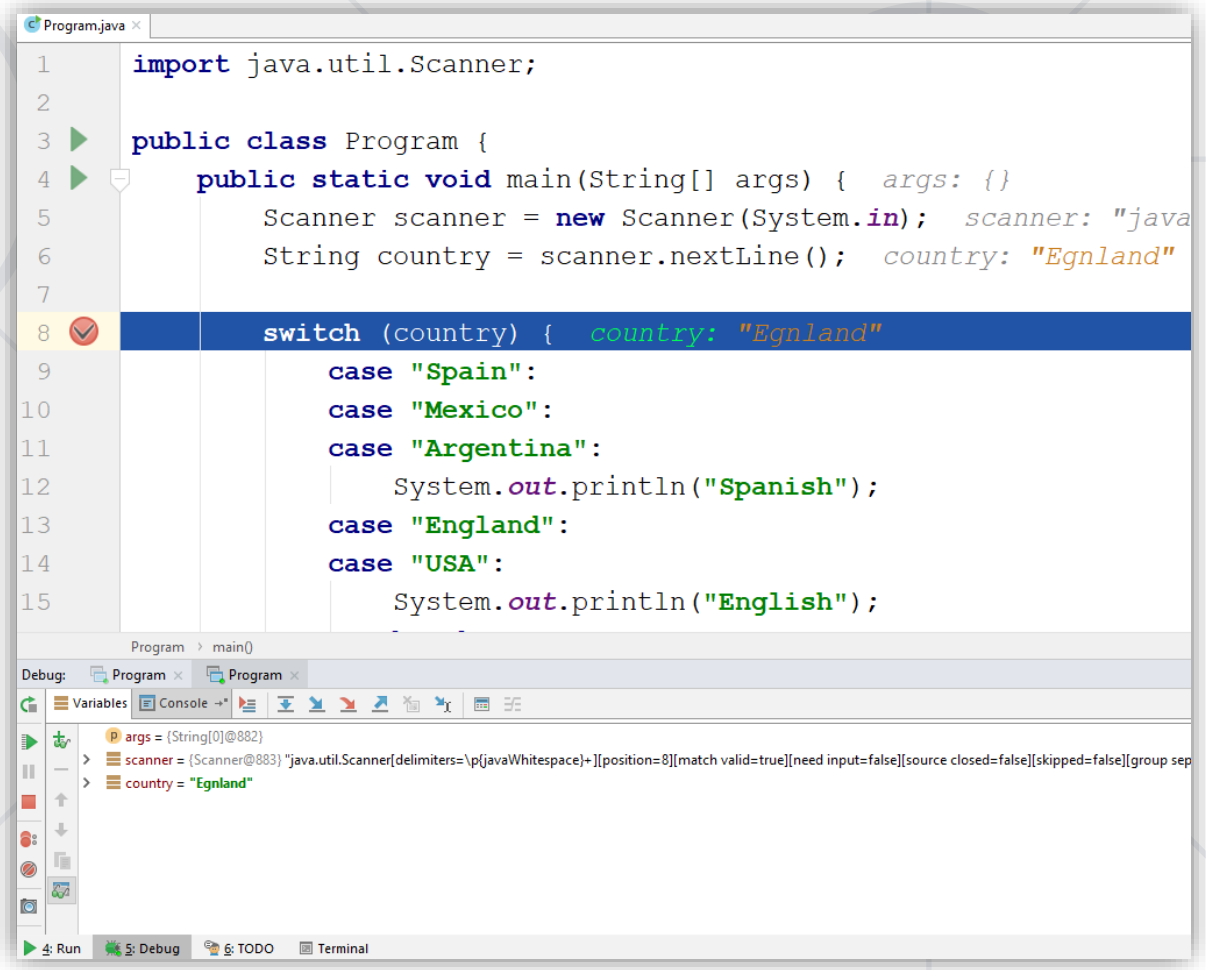
# Debugging in Intellij

- Intellij has a built-in **debugger**
- It provides:
  - **Breakpoints**
  - Ability to **trace** the code execution
  - Ability to **inspect** variables at runtime



# Using the Debugger in Intellij

- Start without Debugger: **[Ctrl+Shift+F10]**
- Toggle a breakpoint: **[Ctrl+F8]**
- Start with the Debugger: **[Alt+Shift+F9]**
- Trace the program: **[F8]**
- Conditional breakpoints



# Problem: Find and Fix the Bugs in the Code

- A program aims to print the first n odd numbers and their sum

```
Scanner sc = new Scanner(System.in);
int n = Integer.parseInt(sc.nextLine());
int sum = 1;
for (int i = 0; i <= n; i++) {
  System.out.print(2 * i + 1);
  sum += 2 * i;
}
System.out.printf("Sum: %d%n", sum);
```

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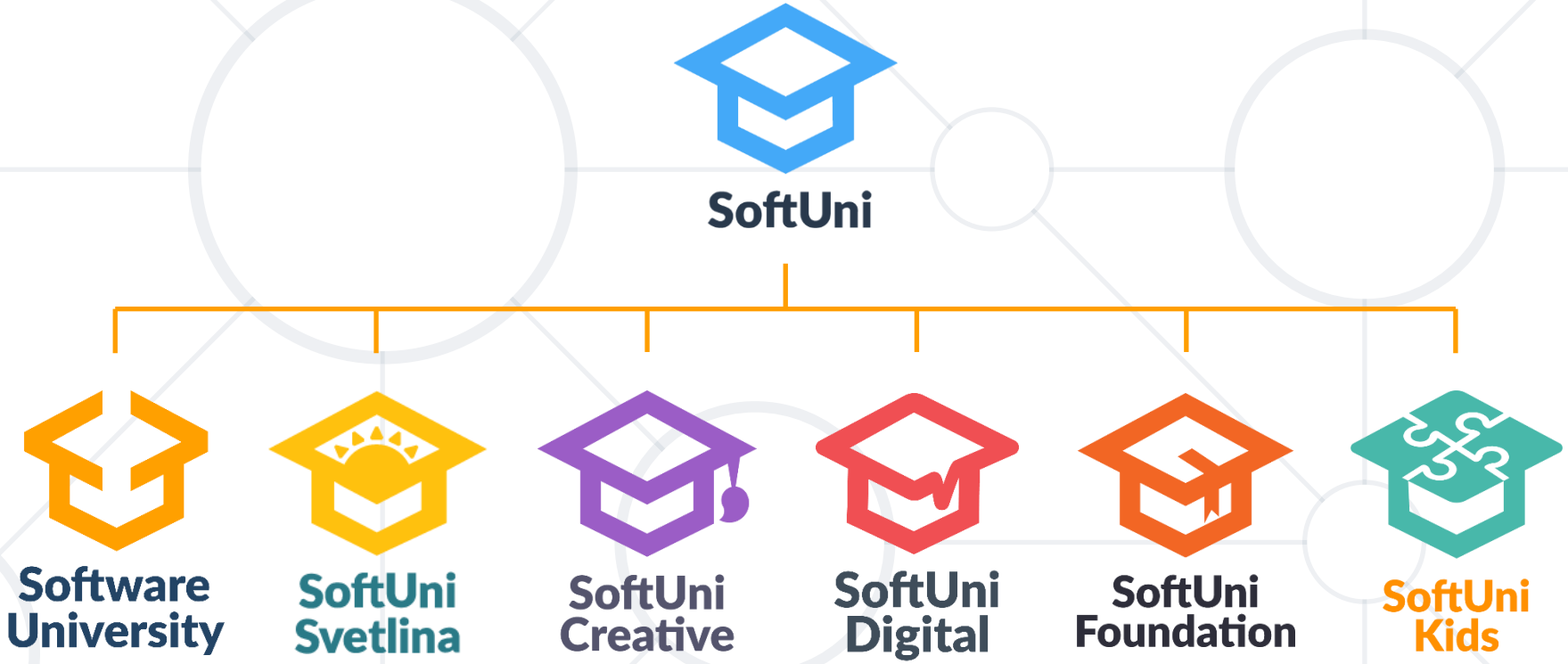
# Summary

- Declaring **Variables**
- **Reading** from / **Printing** to the **Console**
- **Conditional Statements** allow implementing programming logic
- **Loops** repeat code block multiple times
- Using the debugger

# Questions?



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