

# Java Introduction

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



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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



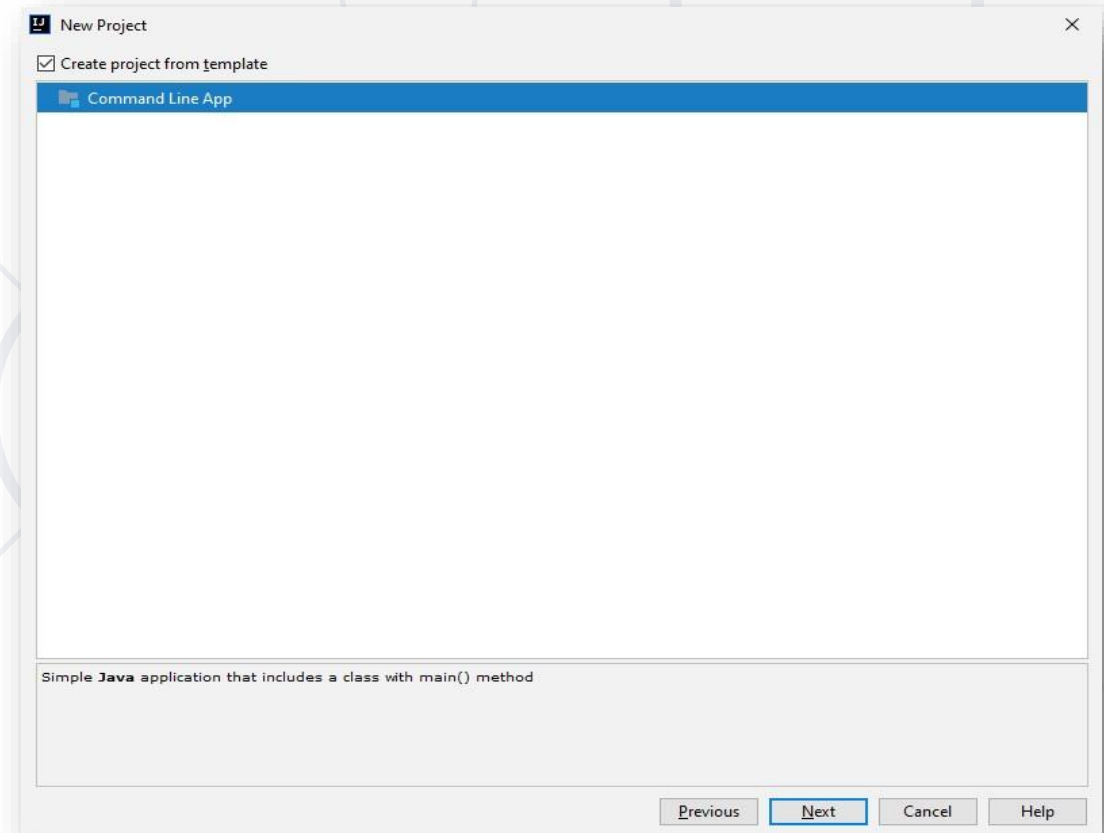
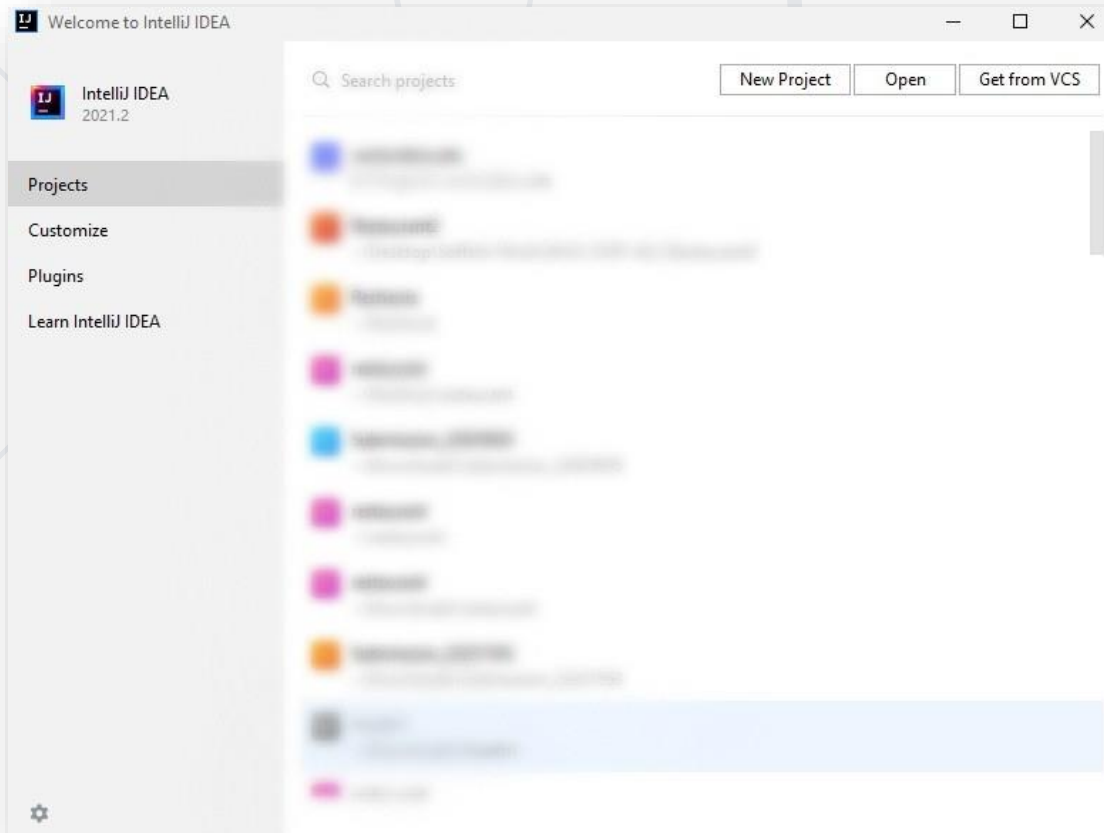
```
static void main(String[] args) {  
    //Source Code  
}
```

Program  
starting  
point

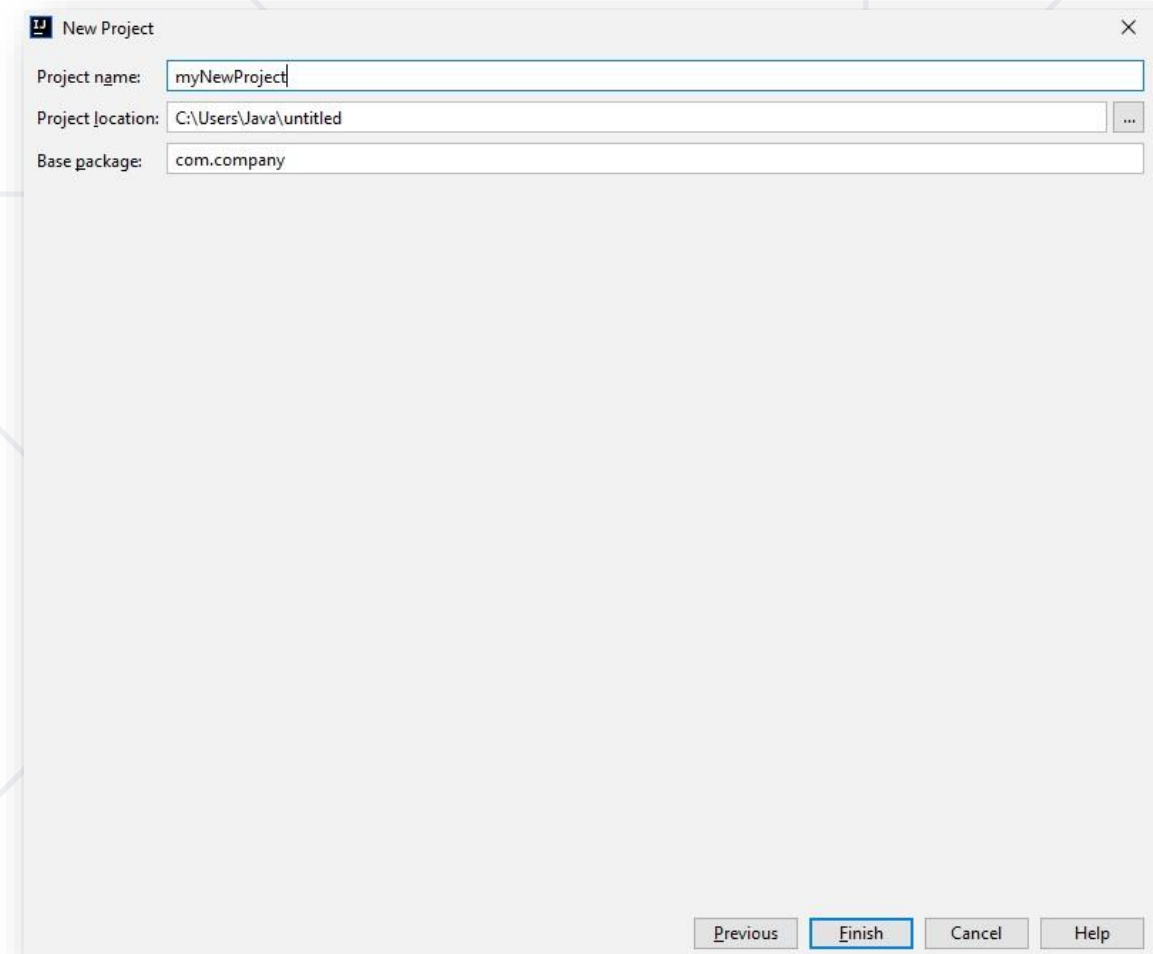
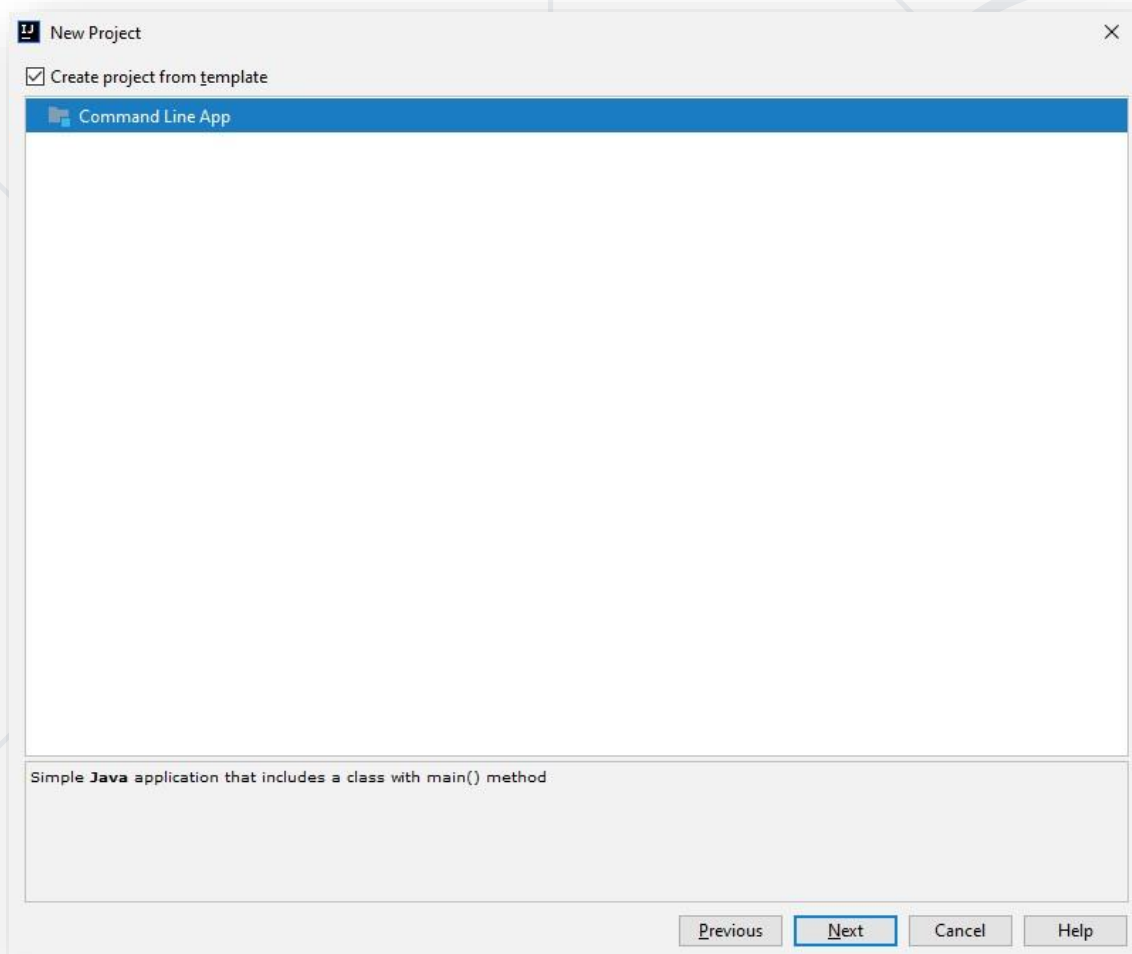
- In this course will use Java Development Kit (JDK) 13

# Using IntelliJ Idea (1)

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



# Using IntelliJ Idea (2)



# Declaring Variables

- Defining and Initializing variables

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

- Example:

Variable name

```
int number = 5;
```

Data type

Variable value







# Console I/O

Reading from and Writing to the Console

# Reading from the Console

- 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

- `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());
```



- 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 **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** 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



# 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);
```

Check your solution here: <https://judge.softuni.org/Contests/1190/>



# Comparison Operators

# Comparison Operators

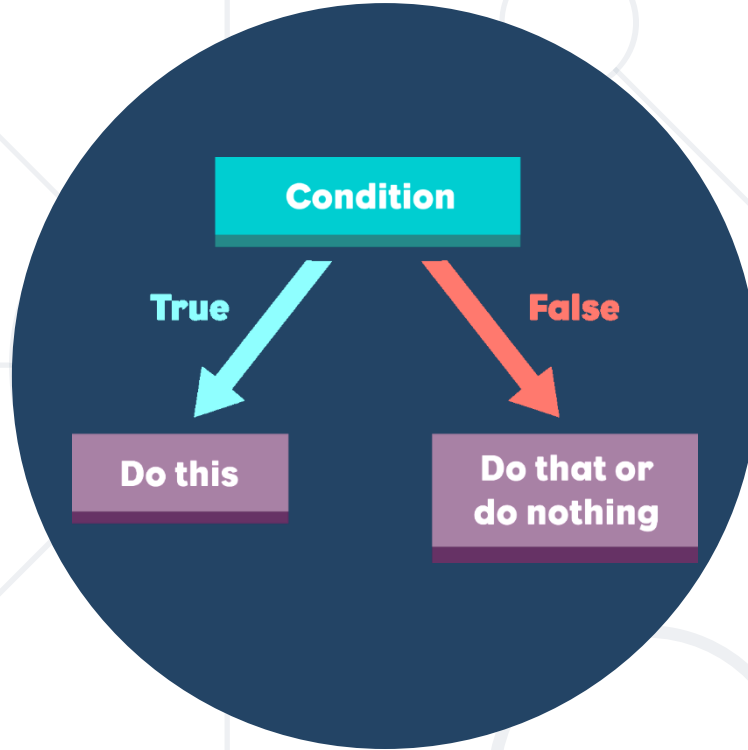
Operator	Notation in Java
Equals	<code>==</code>
Not Equals	<code>!=</code>
Greater Than	<code>&gt;</code>
Greater Than or Equals	<code>&gt;=</code>
Less Than	<code>&lt;</code>
Less Than or Equals	<code>&lt;=</code>

# 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 simplest conditional statement
  - Test for a condition
- Example: Take as an input a grade and check if the student has passed the exam (grade  $\geq$  3.00)

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

In Java the opening bracket stays on the same line

# The If-else Statement

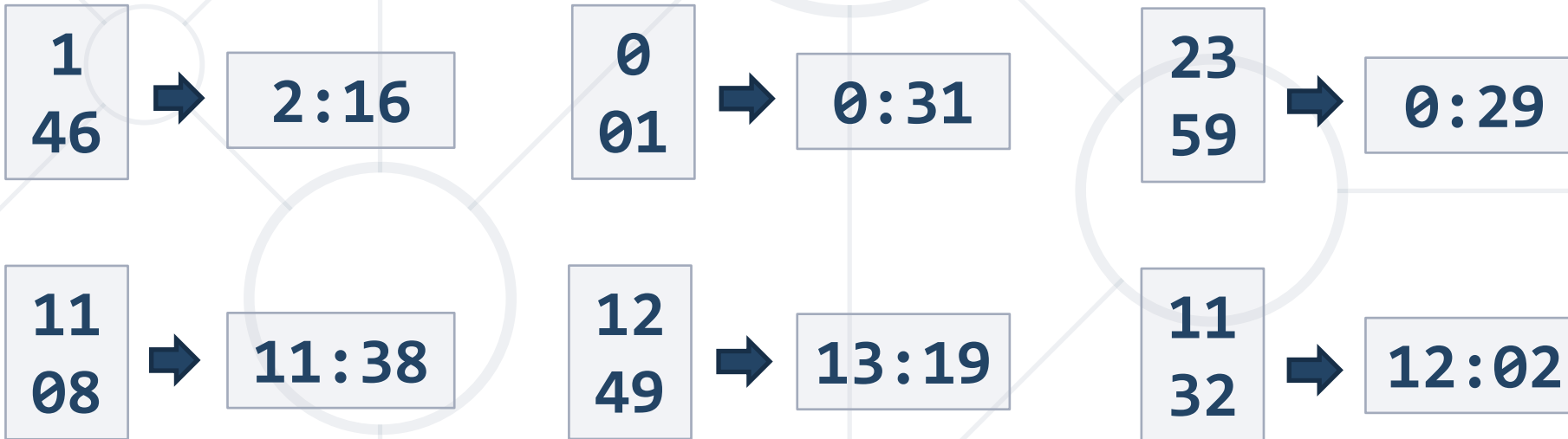
- Executes **one branch** if the condition is **true** and **another**, if it is **false**
- Example: **Upgrade** the last example, so it prints "**Failed!**", if the mark is lower than 3.00:

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

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

# Problem: 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:



Check your solution here: <https://judge.softuni.org/Contests/1190/>



# Solution: 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: 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.org/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



Check your solution here: <https://judge.softuni.org/Contests/1190/>

# 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;  
}
```

Check your solution here: <https://judge.softuni.org/Contests/1190/>

A background network diagram consisting of a grid of light gray lines intersecting at various points. Some of these intersections are marked with small, light gray circles. A larger, solid dark blue circle is centered in the upper half of the image, containing the text '&&'.

**&&**

# **Logical Operators**

Writing More Complex Conditions

- 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	$0 \leq \text{age} \leq 18$	$18 < \text{age} \leq 64$	$64 < \text{age} \leq 122$
Weekday	12\$	18\$	12\$
Weekend	15\$	20\$	15\$
Holiday	5\$	12\$	10\$



Check your solution here: <https://judge.softuni.org/Contests/1190/>

# 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

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

Initial value

End value

Increment

Loop **body**

```
for (int i = 1; i <= 10; i++) {  
    System.out.println("i = " + i);  
}
```

Executed  
at **each**  
**iteration**

The bracket is  
again on the  
same line



# 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

5 →

1  
3  
5  
7  
9  
Sum: 25

3 →

1  
3  
5  
Sum: 9

Check your solution here: <https://judge.softuni.org/Contests/1190/>

# 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

- Executes commands while the condition is true:

Initial value

```
int n = 1;
```

Condition

```
while (n <= 10) {
```

Loop body

```
    System.out.println(n);
```

```
    n++;
```

Increment the counter

```
}
```

# Problem: Multiplication Table

- Print a table holding  $\text{number} \times 1$ ,  $\text{number} \times 2$ , ...,  $\text{number} \times 10$

```
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++;
}
```

Check your solution here: <https://judge.softuni.org/Contests/1190/>



# **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:

```
int i = 1;  
do {  
    System.out.println(i);  
    i++;  
} while (i <= 10);
```

Initial value

Loop body

Increment  
the counter

Condition



# 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**

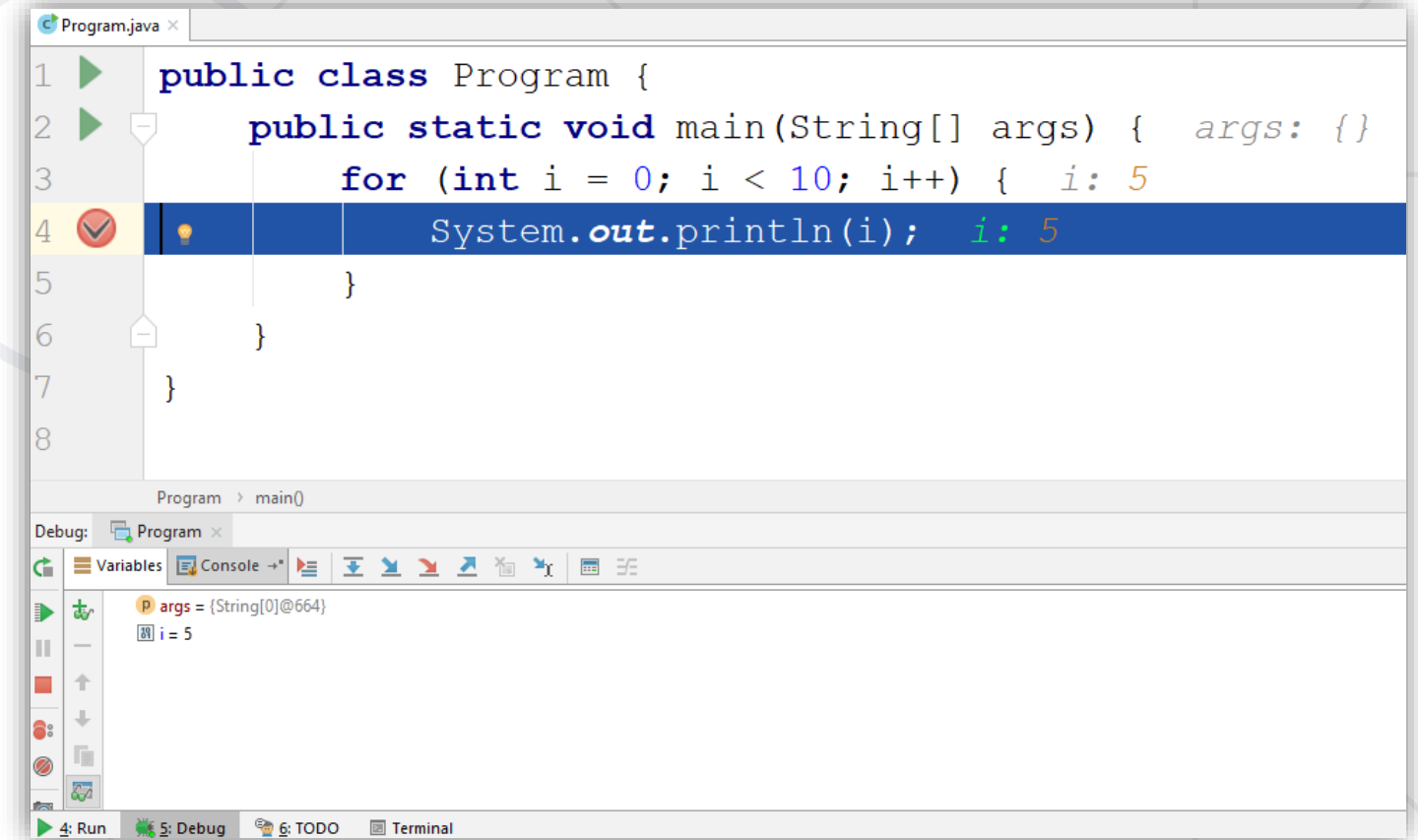
Using the IntelliJ Debugger

- 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



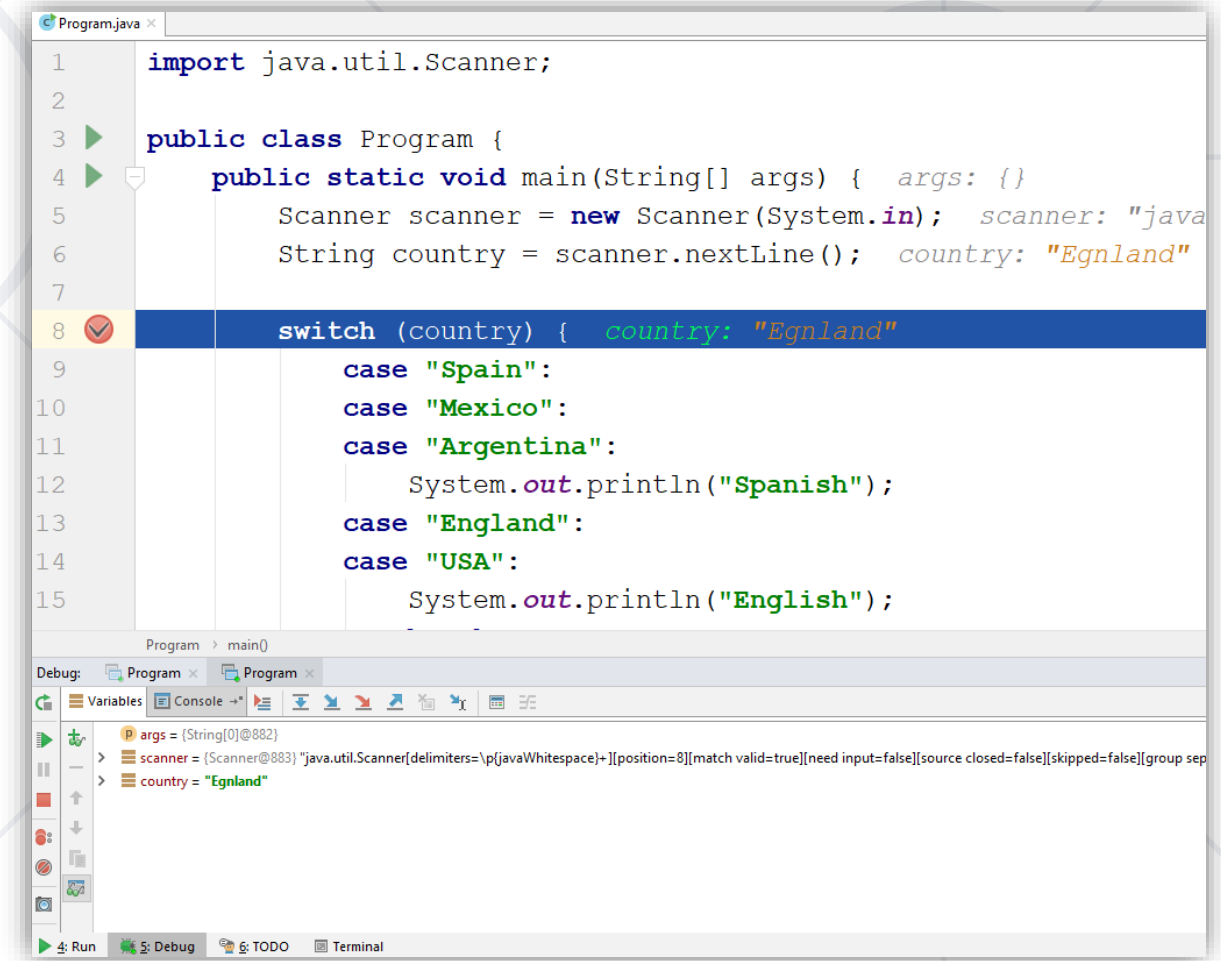
# Debugging in IntelliJ

- 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



The screenshot shows the IntelliJ IDEA IDE with a Java file named `Program.java`. The code is as follows:

```
1 import java.util.Scanner;
2
3 public class Program {
4     public static void main(String[] args) { args: {}
5         Scanner scanner = new Scanner(System.in); scanner: "java
6         String country = scanner.nextLine(); country: "Egnland"
7
8         switch (country) { country: "Egnland"
9             case "Spain":
10             case "Mexico":
11             case "Argentina":
12                 System.out.println("Spanish");
13             case "England":
14             case "USA":
15                 System.out.println("English");
```

A breakpoint is set on line 8, indicated by a red circle with a white checkmark. The debugger is active, and the console shows the following output:

```
args = {String[0]@882}
scanner = {Scanner@883} "java.util.Scanner[delimiters=\p(javaWhitespace)+ ][position=8][match valid=true][need input=false][source closed=false][skipped=false][group sep
country = "Egnland"
```

# 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);
```

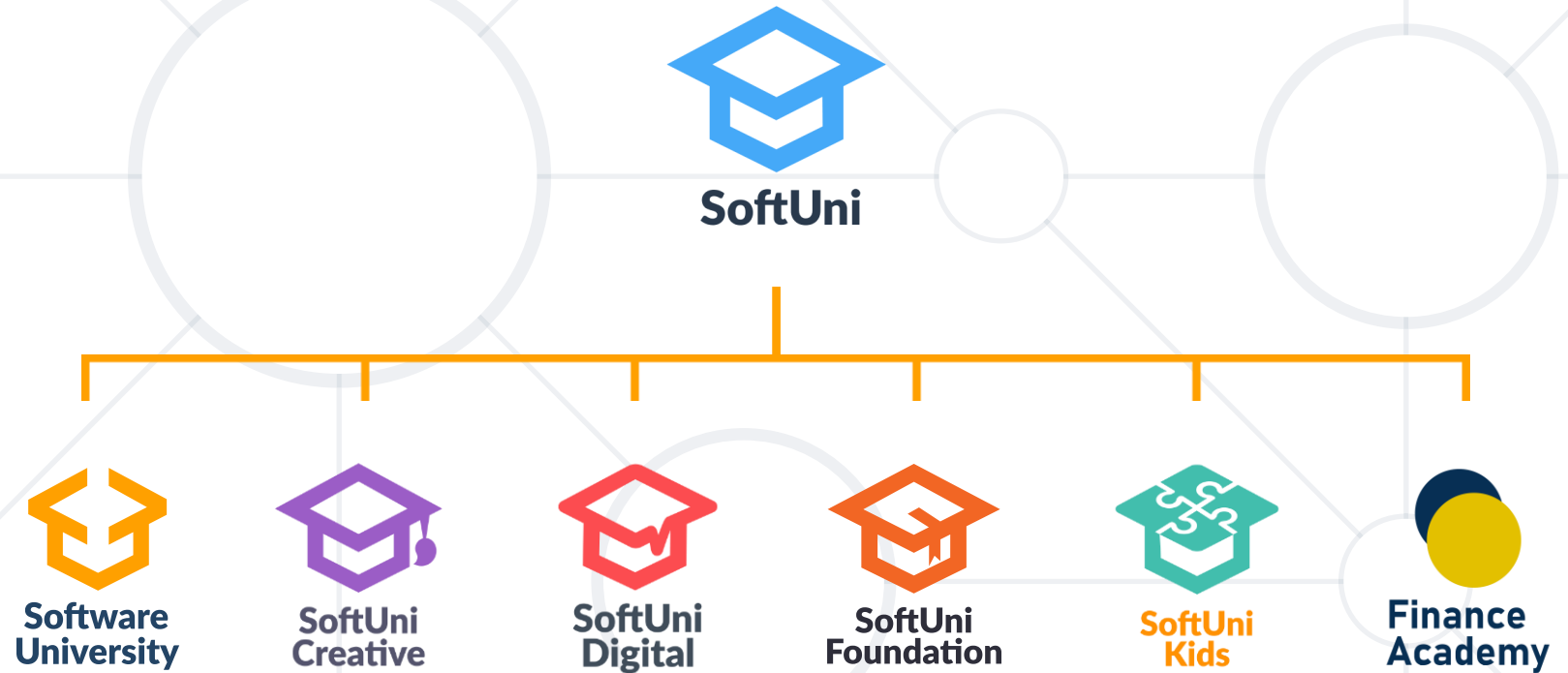
10

Check your solution here: <https://judge.softuni.org/Contests/1190/>

- 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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