What is System.out.println?

Package

Naming conventions

Access modifier

Method, calling a method and method structure.

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92. Creating a menu program with this options(add, remove, display, exit).
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94. Static variable and method(With example)
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    -Default constructor
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96. Introduction to classes and object
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99. This keyword in java
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Basic of JAVA

WHAT IS SYSTEM.OUT. ?

- `out` is an object of the 'PrintStream' Class.
- `out` has the `print()` and `println()` methods.
  → use '.' to access `print()/println()` of `out`.
- `out` refers to the standard output device. (Screen)
- `System` is a Class (pascal case).
- `out` is inside `System` (field).
  → use '.' to access `out` of `System`.

→ `System.out.println()`.

CALLING PRINT()

Displays its parameter on the console window

'ln' is to break to a new line.

PACKAGE

A container for Classes

REMEMBER

- Every Java program contains at least one Class.
- Pascal case is used with classes.
- Camel case is used with methods.
- A method exists inside a class.
- `main()` is the starting point of execution of our program.

NAMING CONVENTIONS

How to write names in programming

Pascal case convention:

→ `ThisIsAName`

Camel case convention:

→ `thisIsAName`

Snake case convention:

→ `this_is_a_name`

ACCESS MODIFIERS

Specify how to access Classes & Methods
Discussed later in OOP

- Public
- Private
- Protected
- Default

CALLING A METHOD

Is basically using the method

```
method_name( give parameters );
```

→ The code block of this method will be executed.

Note: the `main()` method is automatically called when we run our java program.

→ it is the first method that is called.

→ it is the starting point of execution of our program

METHOD STRUCTURE

Each method consists of 4 main parts

```
return_type method_name( parameters ) {
    code block
}
```

Note: every method is written inside a Class.

→ A class is a container of methods.

METHOD

Group of instructions to do a specific task

Examples:
- A method to add two numbers.
- A method to say Hi to the user.
- A method to get the user's name.

We have a special method called '`main`'.

'`class`' is a keyword (syntax).

CLASS

A blueprint to create OBJECTS

OBJECT

An instance of a CLASS

IDE

Integrated development environment

A program that allows us to:
- `Write` | source code.
- `Compile` | machine code.
- `Debug` | tools to find errors.
- `Build` | files that can be executed by JVM.
- `Run` | execute our program.

JDK

Java development kit

- Set of programs that enable us to develop our programs.

- Contains JRE (Java Runtime Environment) that is used to run our programs.

- JRE & JDK contain JVM (Java Virtual Machine).

- JVM executes our java programs on different machines.
  → java is independent .

EDITIONS OF JAVA

Java comes in three editions

- Java Standard Edition (SE): develop applications that run on desktop.

- Java Enterprise Edition (EE): develop server-side applications.

- Java Micro Edition (ME): develop applications for mobile devices.

We will use Java SE.
It is the foundation of all other editions.

API

Application programming interface

- Also known as a 'library'.

- Contains predefined Java code that we can use to develop Java programs.
  → Faster and easier development process | no need to write everything from scratch.

ABOUT JAVA

- Developed at Sun Microsystems which was purchased by Oracle in 2010.

- General-purpose & powerful programming language.

- Used for developing software that run on mobile, desktop, and servers.

- Machine independent.

WHY LEARN JAVA

- High-level , General-purpose , O-O programming language.
  → Easy & used to develop any kind of programs.

- Very Popular.
  → A huge online community for getting help.

- Can be used in Android development.

- C based language.
  → learn C/C++/C# easier.

SYLLABUS

Programming Fundamentals

- Variables
- Data types
- Operators
- Conditions
- Loops
- Methods

Object-Oriented Programming

- Concrete Classes
- Objects
- Abstraction
- Encapsulation
- Inheritance
- Polymorphism
- Exceptions
- Abstract Classes
- Interfaces
- File I/O

1. Java packages, classes and methods.

```java
package javaapplication;

public class Java {

    public static void main(String[] args) {

        System.out.println("Before sayHi");
        kibria();
    }

    public static void kibria() {
        System.out.println("sayHi");
    }
}

/*
    We want to access our system class so we use the dot operator.
    And inside the system class we have the out object. And inside
    the out object we have a method called println(). If we want to
    access the println() method we must use the dot operator.
*/
```

```java
package javaapplication;

public class JavaCode {

    public static void main(String[] args) {

        Java.kibria();
    }
}

/*
    Jodi Java class er kibria() method taky private kory dei tokon
    JavaCode class hoty r access kora jaby na.
*/
```

2. Public, private and static in Java

PUBLIC ACCESS MODIFIER:

Specify how to access class, methods and fields.

The access level is everywhere-

Inside class, Outside class, Inside package, Outside package.

PRIVATE ACCESS MODIFIER:

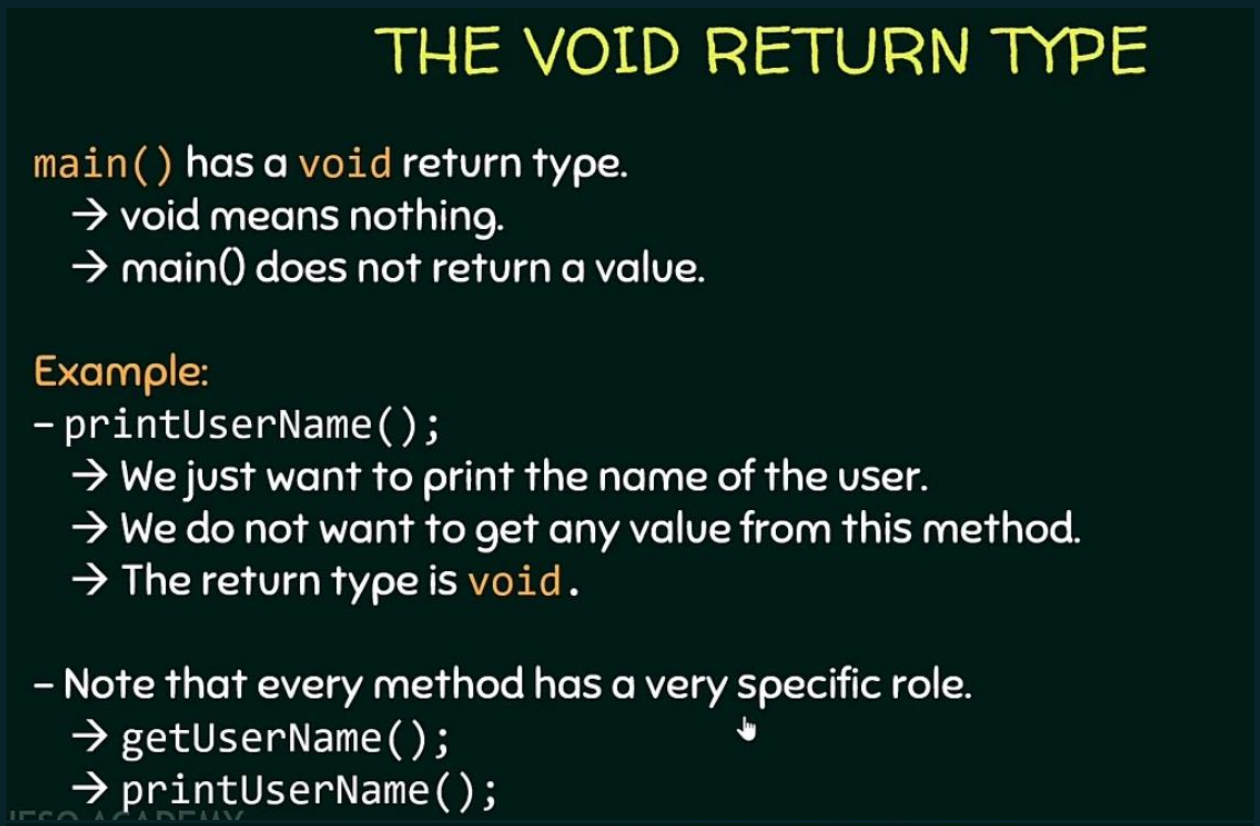
The access level is only inside the class.

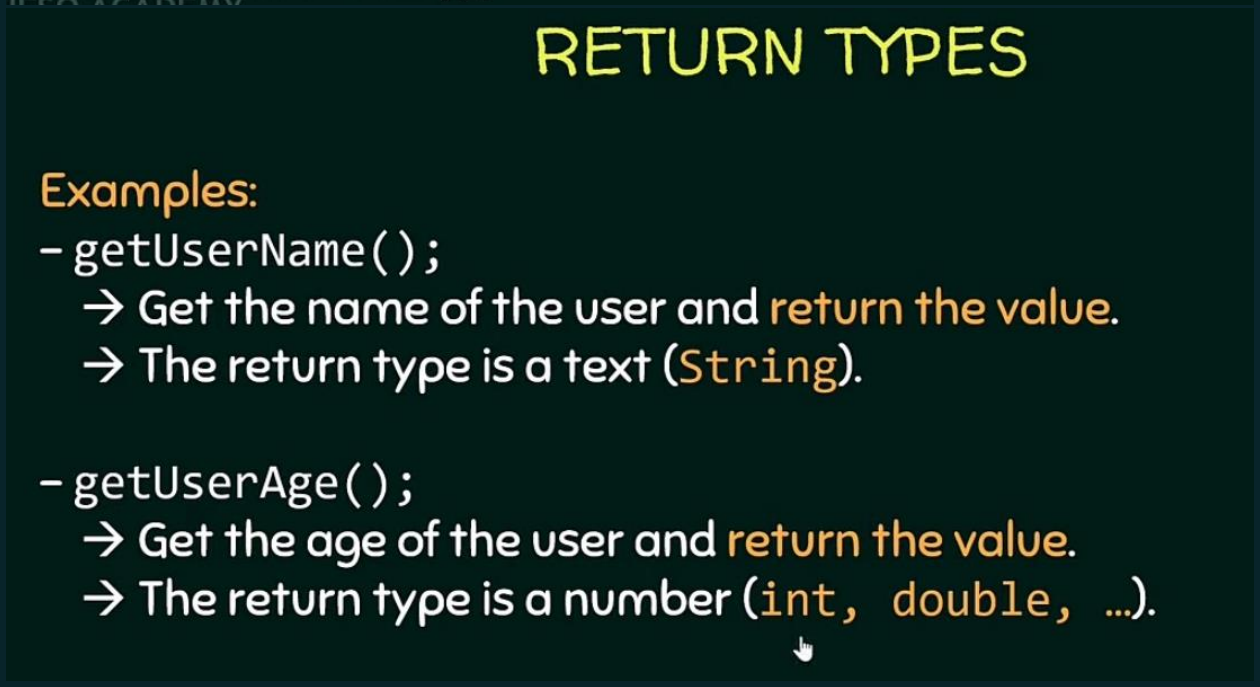
STATIC NON-ACCESS MODIFIER:

We can access field or method using the class name.

Ex. System.out here out is a static field of System.

3.The void return type in Java





RETURN TYPES

The type of data that a method returns/gives

- A method can return/give a value.

- Consider this mathematical function: `f(x) = x + 1`
  → x is a parameter to this function.
  → x + 1 is the return value of this function.
  → This function returns a number (return type).

- The same thing applies for methods/functions in programming.
  → A method can return a value.

4. Programming styles and errors

COMMON ERRORS

```
public class Main {
    public static void Main(string[] args) {
        System.out.println("Neso Academy Java Course!");
    }
}
```

Misspelling Names – Syntax Error

```
public class Main {
    public static void main(String[] args) {
        System.out.println("Neso Academy Java Course!");
    }
}
```

COMMON ERRORS

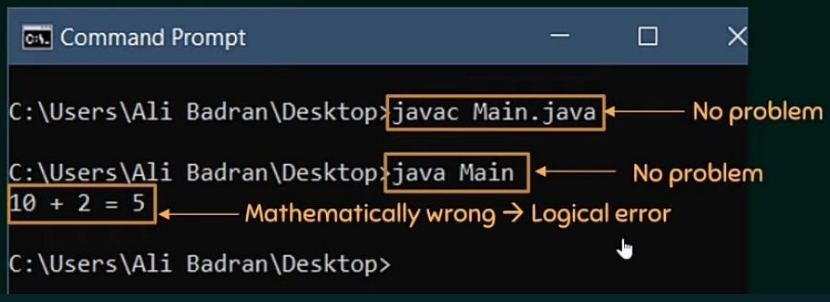
```
public class Main {
    public static void main(String[] args) {
        System.out.println("Neso Academy Java Course!");
}
```

Missing Braces – Syntax Error

```
public class Main {
    public static void main(String[] args) {
        System.out.println("Neso Academy Java Course!");
    }
}
```

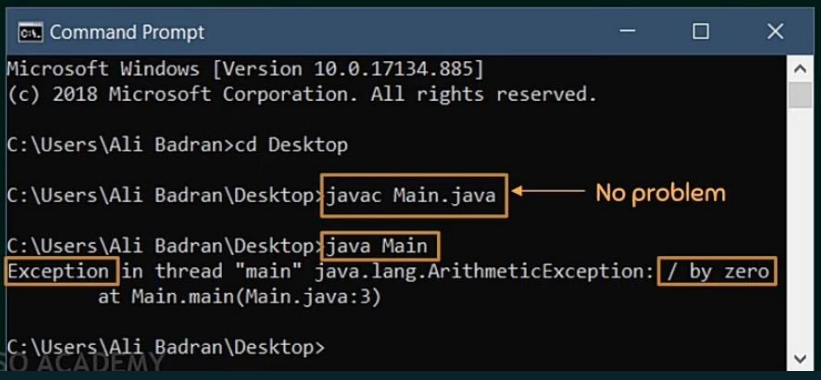
LOGICAL ERRORS

```java
public class Main {
    public static void main(String[] args) {
        System.out.print("10 + 2 = ");
        System.out.println(10 / 2);
    }
}
```



RUNTIME ERRORS

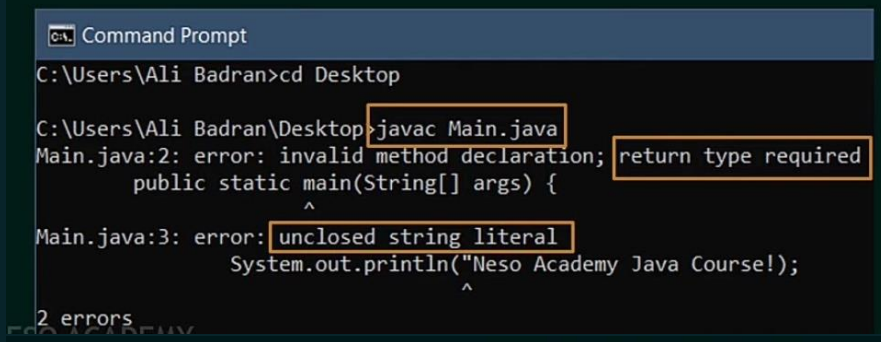
```java
public class Main {
    public static void main(String[] args) {
        System.out.println(1 / 0);
    }
}
```



→ The compiler does not detect runtime errors

SYNTAX ERRORS

```java
public class Main {
    public static main(String[] args) {
        System.out.println("Neso Academy Java Course!);
    }
}
```



→ The compiler reports syntax errors

BLOCK STYLES

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

→ End-of-line style
Used in java API Source code

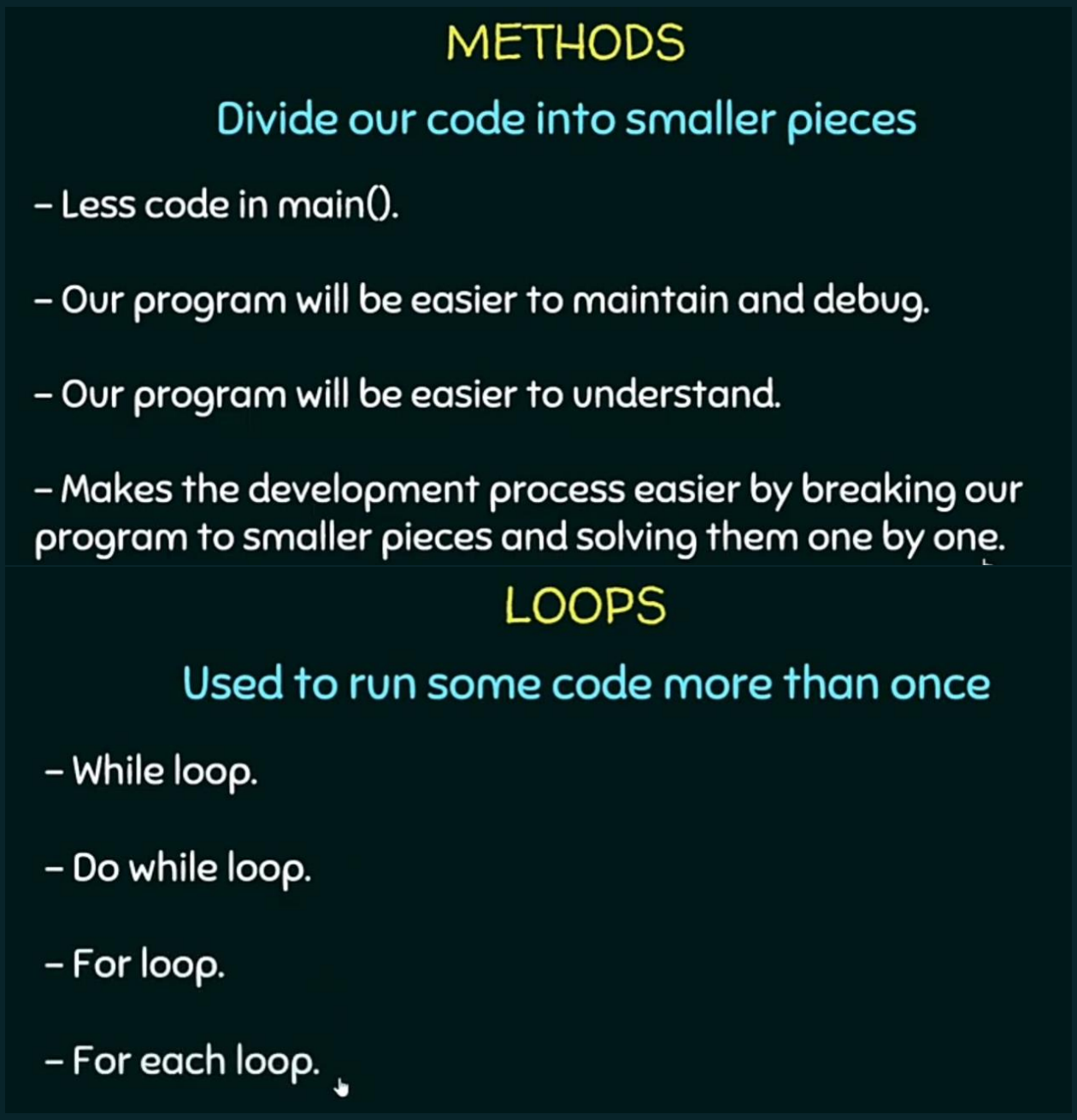
```java
public class Main
{
    public static void main(String[] args)
    {
        System.out.println("hello");
    }
}
```

→ Next-line style

5. Creating classes and methods

```
package javaapplication23;

public class Java {

    public static void sayName(){
        System.out.println("Golam kibria");
    }

    public static void sayAge(){
        System.out.println("21");
    }
}

package javaapplication23;

public class JavaCode {

    public static void main(String[] args) {

        Java.sayName();
        Java.sayAge();

    }
}

Output:
Golam kibria
21
```

6. Java basic in overview



CONDITIONS

Used to control what to execute in our program

- if a condition is true → do something.
- If it is not true → do another thing.

OPERATORS

Arithmetic, relational, and logical operators

- Arithmetic: to do some calculations. (+, −, ...)
- Relational: to do some comparisons. (<, >=, ...)
- Logical: to combine conditions together. (AND, OR, ...)

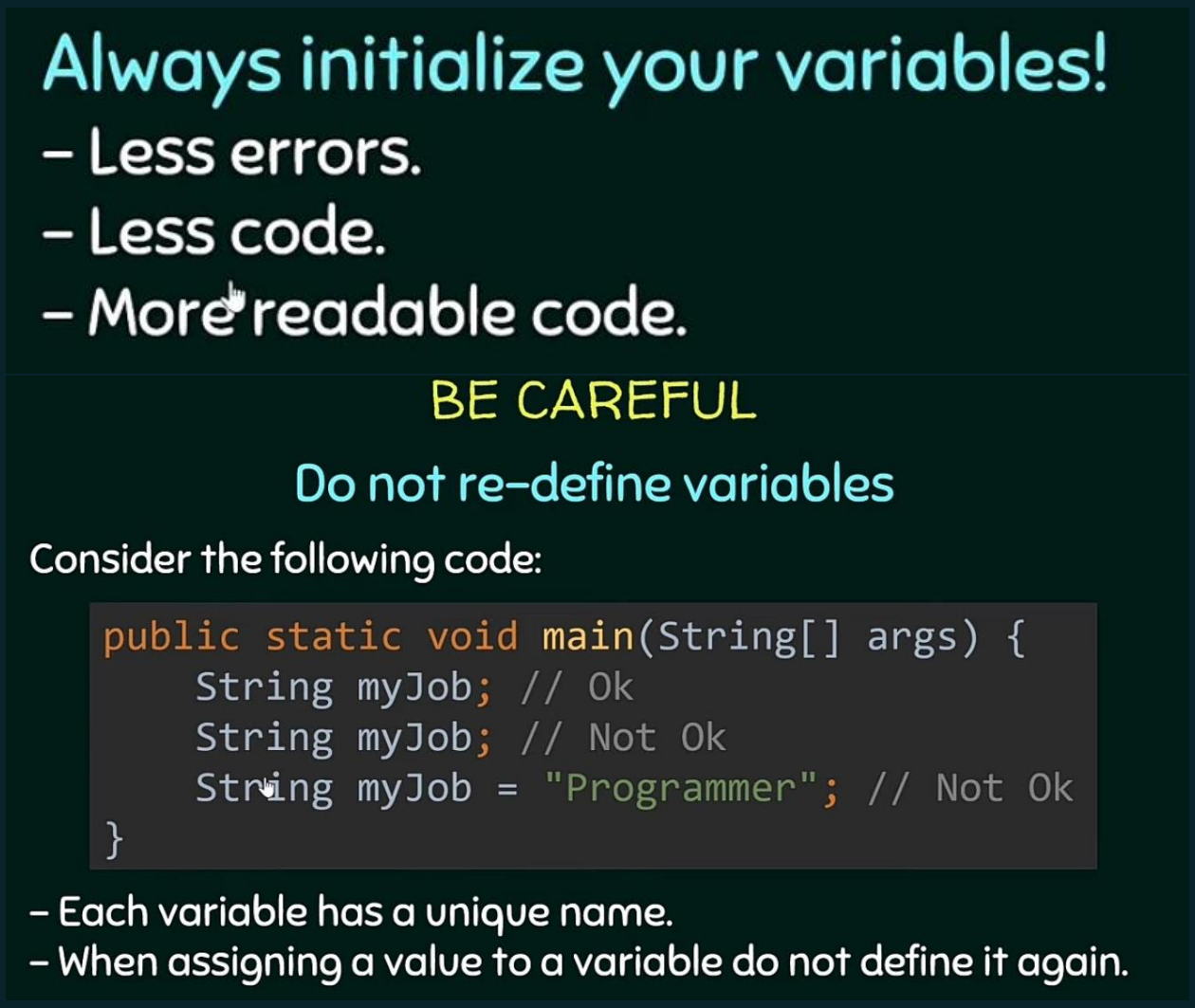
DATA TYPES

We have different types of data

Examples:
- Text.
- Numbers.
- Boolean. (true/false)
- User defined types. (Car, Person, ...)

These types are also for variables.

7. Introduction to variable in Java



ASSIGNMENT

Used to store/put a value inside a variable

- We can assign a value to a variable by using the assignment operator (=).

- variableName = expression
  → `myJob = "Programmer";`
  → "`Programmer`" will be stored inside `myJob`.

- An expression is anything that produces/gives a value.
  Examples: `(1 + 3), (4 * 2)`.

DECLARATION

- To declare multiple variables of the same type:
  `TYPE NAME1, NAME2;`

- `String myName, myJob;`
  → `myName` & `myJob` are two variables that can store a `String`.

- A variable must be declared before it can be used.

DECLARATION

Allocating space inside our memory

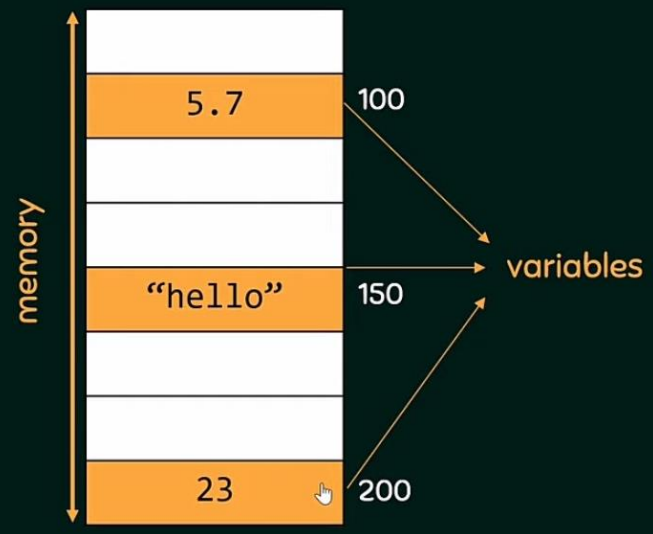
- To allocate space in our memory we declare a variable
  → `TYPE NAME;`

- The type of the variable should be compatible with the data inside it
  → to store a String inside a variable, the variable's type should be String

- `String myName;`
  → Declared a variable called `myName` and can store a String

MEMORY

A variable is like a box in the computer's memory



VARIABLES

Used to store values in our computer's memory

- Our computer has a memory.

- To store values in this memory we need to reserve some space.
  → Use a variable.

- Each variable has a specific type.

- It is called a variable because the value inside it can change.

8. Constants in Java

BENEFITS OF USING CONSTANTS

1. The value will not be changed by accident.
2. You don't have to type the same value if it is used multiple times.
3. A descriptive name for a constant makes the program easy to read and understand.

CONSTANTS

A variable whose value can not be changed

- To define a constant we use the `final` keyword
- Constants can be used like any other variable
- Constants names are written in upper case and using the snake case convention
- You will get a syntax error if you try to change the value of a constant.

```
//USNG OF FINAL KEYWORD
package javaapplication23;

public class Java {

    public static void main(String[] args) {

        final String companyName = "Neso Academy";
        System.out.println(companyName);
    }
}
```

9. Identifier in Java

TIPS

- Use clear and descriptive names
  → `numberOfStudents`, `userName`

- Avoid using abbreviations
  → `numStuds`, `uName`

- Do not use the $ character when naming identifiers

CASE SENSITIVITY IN JAVA

- `area`, `Area`, `ARea`, and `AREA` are four different identifiers
- `X` is different than `x`
- `Main` is different than `main`

EXAMPLES

Legal

1. `$2`
2. `Person`
3. `area`
4. `radius`
5. `Point`
6. `hello`

Illegal

1. 2A
2. a+b
3. user name
4. int
5. main
6. System

NAMING RULES

Every identifier must obey some rules

- Can contain letters, digits, underscores (_), and dollar signs ($)
  → `myName1, my_Name2, my$`

- Must start with a letter, or an underscore, or a dollar sign. It cannot start with a digit and it can not contain spaces.
  → `hello, i, _myName, $1, $myAge` → OK
  → `1hello, @hi, *name, my age` → NOT OK

- Cannot be a reserved word
  → `main, class, String, …`

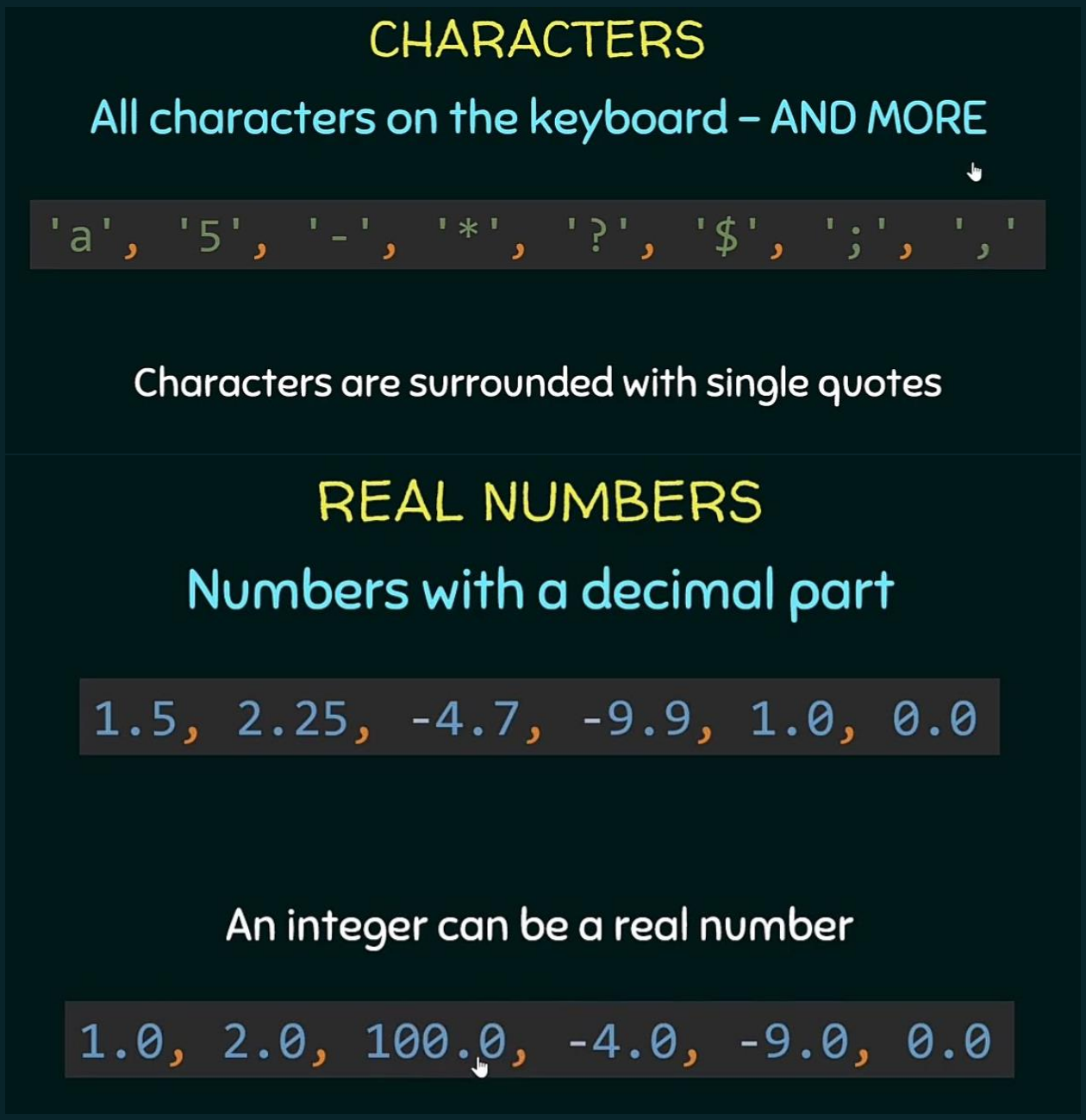
IDENTIFIERS

Identifiers are the names that identify the elements in a program

- Names of classes
- Names of methods
- Names of variables

`myName, myJob, sayName, Main, …`

10. Introduction to data type in Java



11. The int data type in Java

INITIALIZING INT VARIABLES

```
int i1 = 5;
int i2 = 10;
int i3 = -9;
int i4 = 2147483647;
int i5 = -2147483648;

int i6 = 2147483648; // ERROR, > MAX
int i7 = -2147483649; // ERROR, < MIN
```

RANGE OF AN INT VARIABLE

Interval of values that can be stored in an int variable

- Declare an int variable:
  → `int number;`

- All numbers in the interval `[-2147483648, 2147483647]` can be stored in the variable `number`

- All numbers greater than `2147483647` or less than `-2147483648` can not be stored in `number`
  → Error

INTEGERS & THE INT DATA TYPE

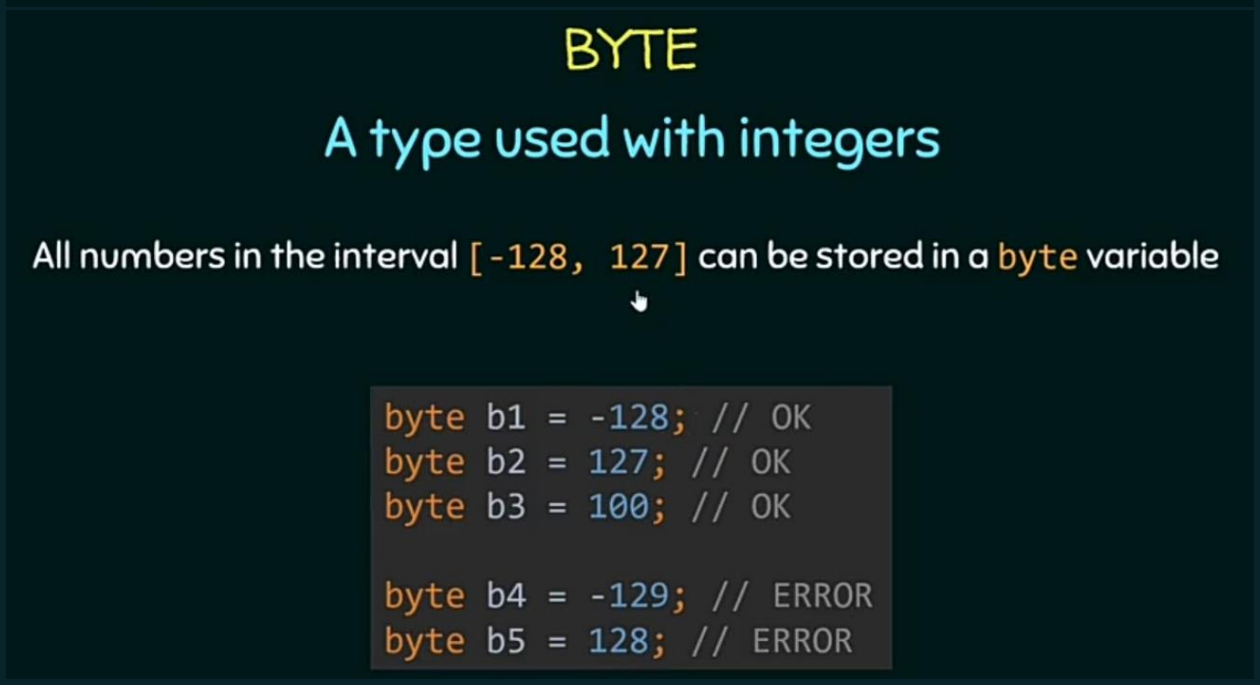
An integer is a number that does not have a decimal part

- Examples:

```
4
1
100
-23
```

- In java, `int` is a data type used to work with integers

12. The byte, short & long data type in Java



SHORT

A type used with integers

All numbers in the interval `[-32768, 32767]` can be stored in a `short` variable

```
short s1 = 5000; // OK
short s2 = 32767; // OK

short s3 = 32768; // ERROR
```

LONG

A type used with integers

– All numbers in the interval
`[-9223372036854775808L, 9223372036854775807L]`
can be stored in a `long` variable

– A letter ‘l’ or ‘L’ should be added to tell the compiler that a number is a `long` and not an `int`

```
long l1 = -9223372036854775808L; // Ok
long l2 = -1839; // Ok
long l3 = -9223372036854775808; // ERROR
```

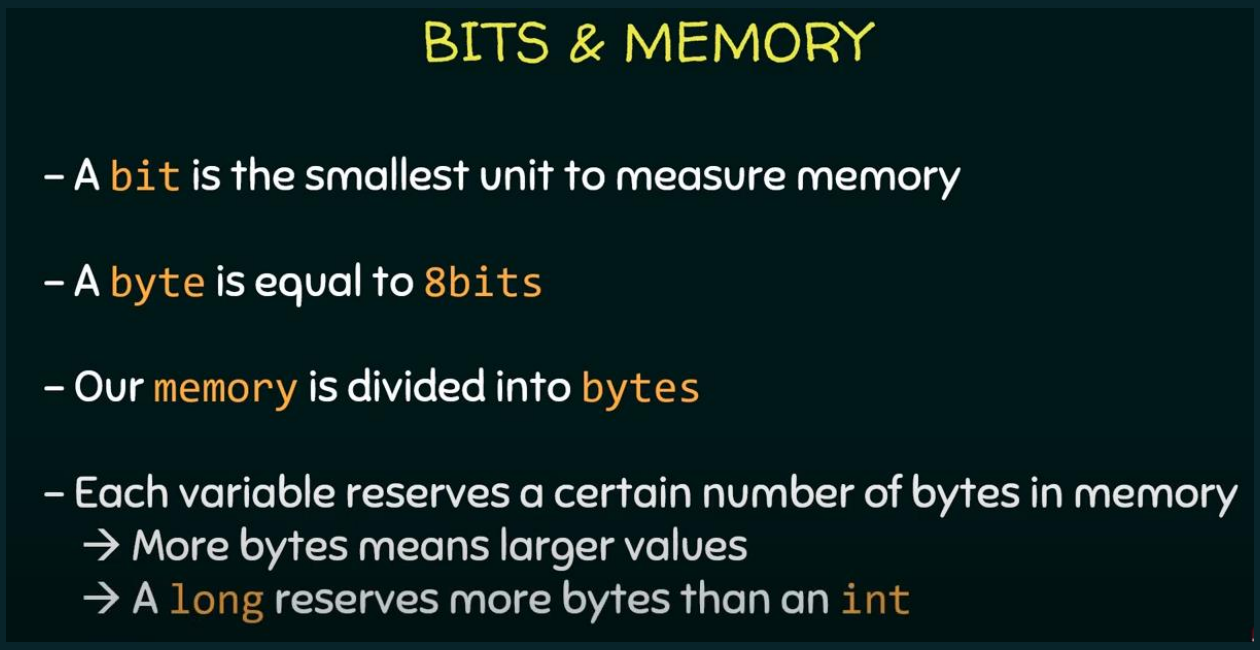
EXAMPLES

```
byte b1 = 5;
short s1 = 10;
int i1 = 20;
long l1 = 100;


l1 = b1 + s1 + i1; // OK, long = int
i1 = s1 + b1; // OK, int = short
s1 = b1; // OK, short = byte

i1 = l1; // NOT OK, int = long
s1 = i1; // NOT OK, short = int
b1 = i1; // NOT OK, byte = int
```

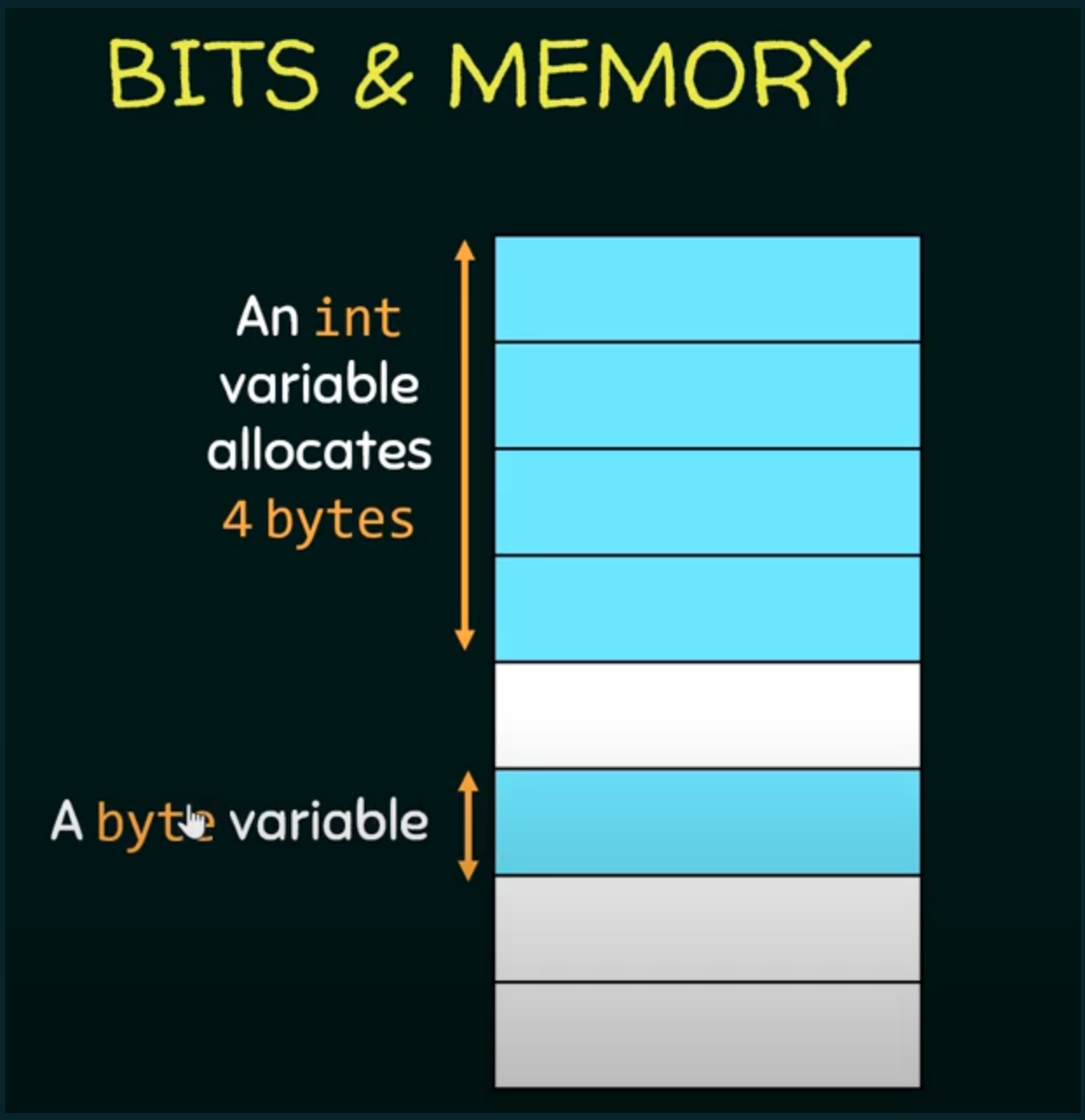
13. Integer data type in Java

```
package javaapplication23;

public class Java {

    public static void main(String[] args) {

        byte b = 5;
        short s = 20;
        int i = 100;
        long g = 999L;

        System.out.println(b);
        System.out.println(s);
        System.out.println(i);
        System.out.println(g);
    }
}
```

14. Bytes and Values in Java



BITS & MEMORY



SIZE OF DIFFERENT INTEGER DATA TYPES

1B = 8b

- byte: 1B
  → 8b
- Short: 2B
  → 16b
- int: 4B
  → 32b
- long: 8B
  → 64b

CALCULATING THE RANGE

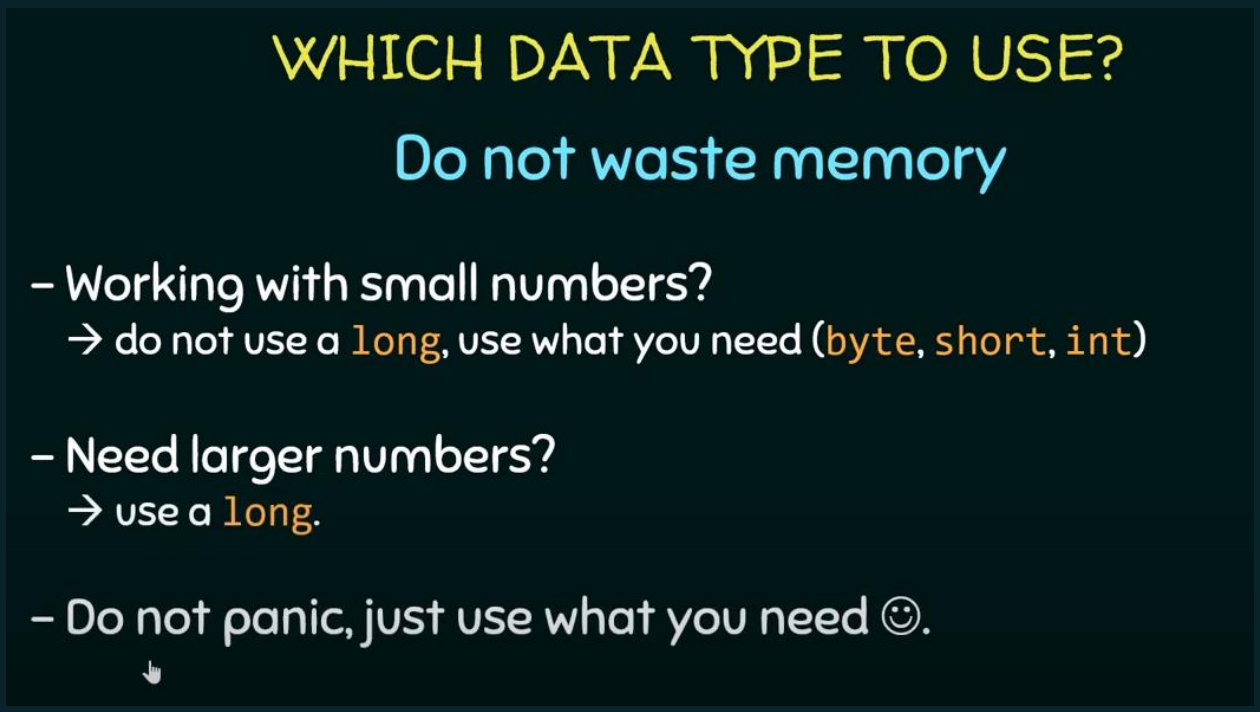
$$[-2^{\text{nbOfBits}-1}, (2^{\text{nbOfBits}-1}) - 1]$$

A short takes 2B in memory
→ 16b

→ Range = $[-2^{16-1}, 2^{16-1} - 1]$

$= [-2^{15}, 2^{15} - 1]$

$= [-32{,}768, 32{,}767]$

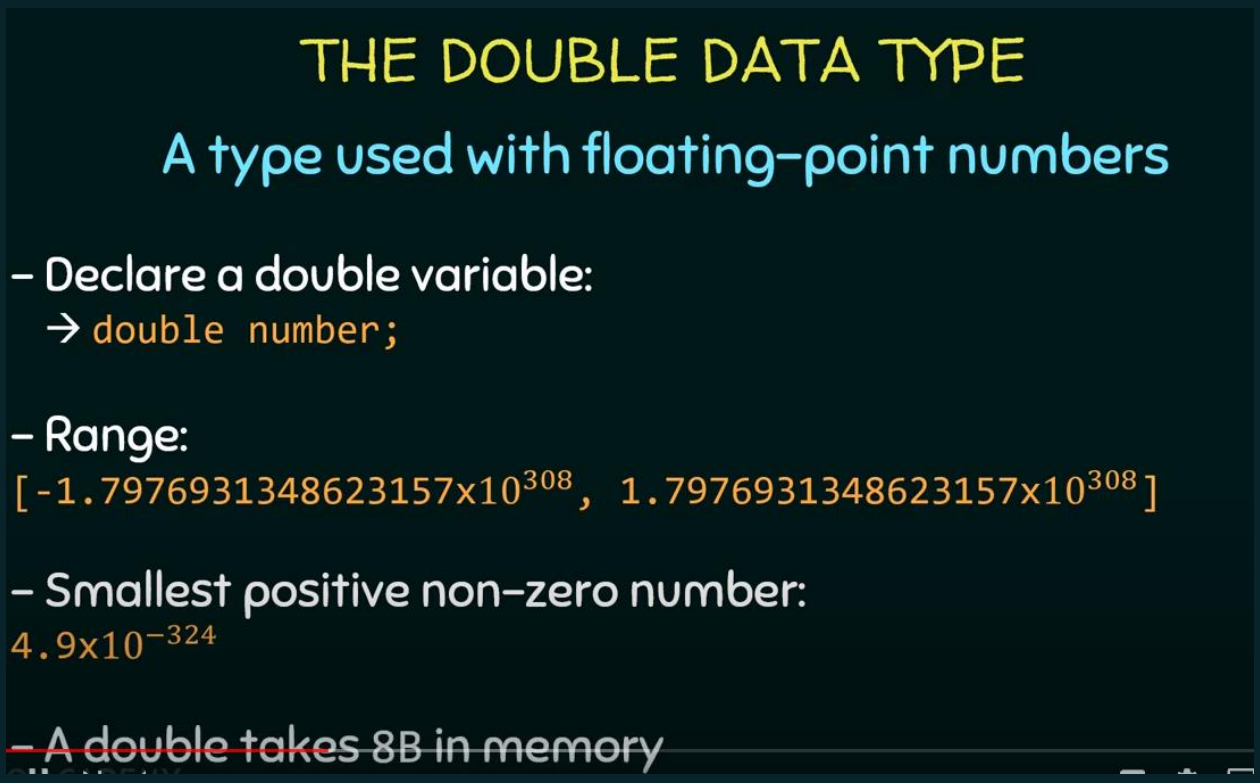


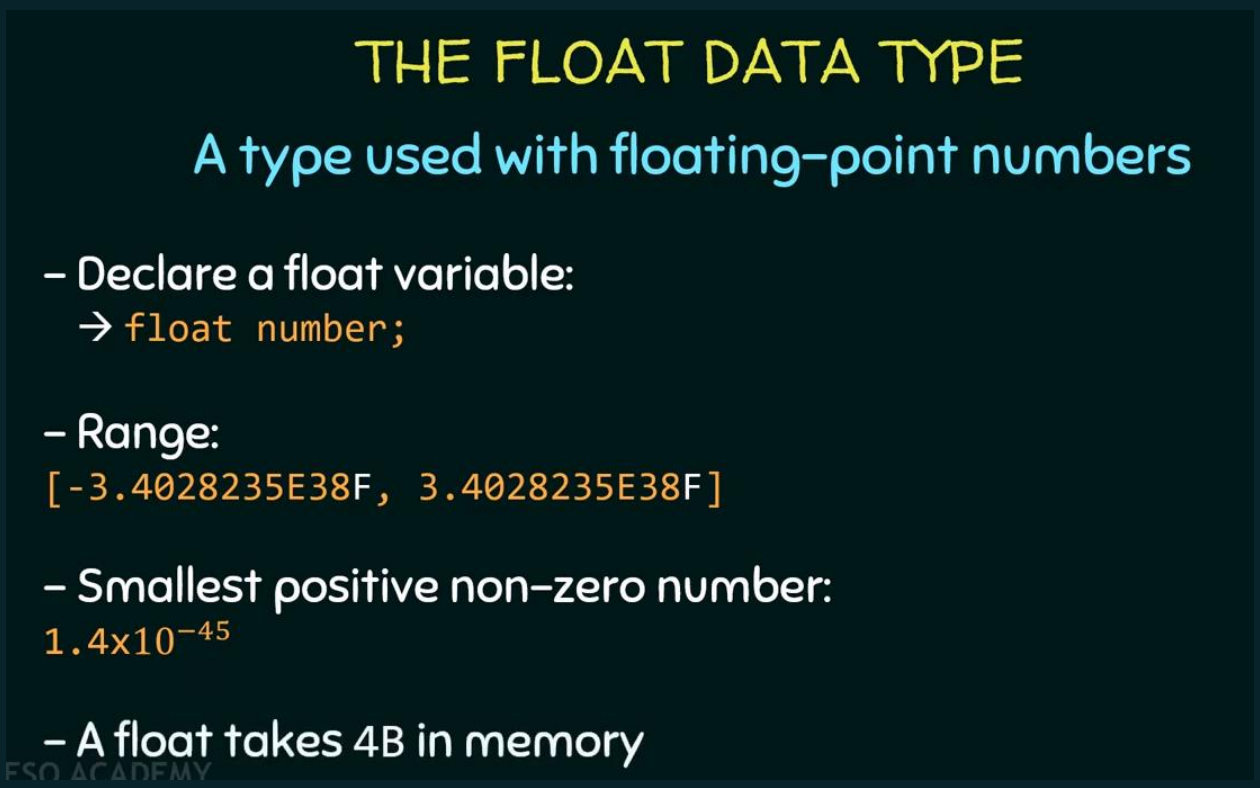

```
public class HelloWorld{

     public static void main(String []args){

        System.out.println(Integer.MAX_VALUE);
        System.out.println(Short.MIN_VALUE);
     }
}
```

Output:

```
2147483647
-32768
```

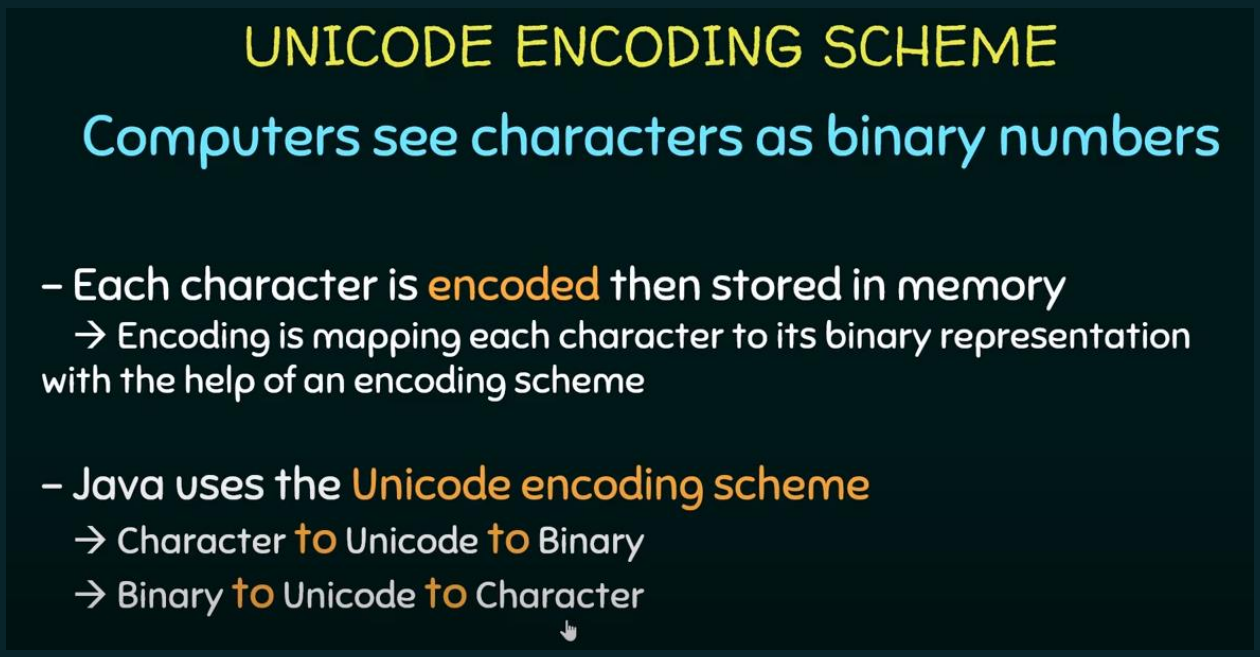
15. The double and float Data Type in Java

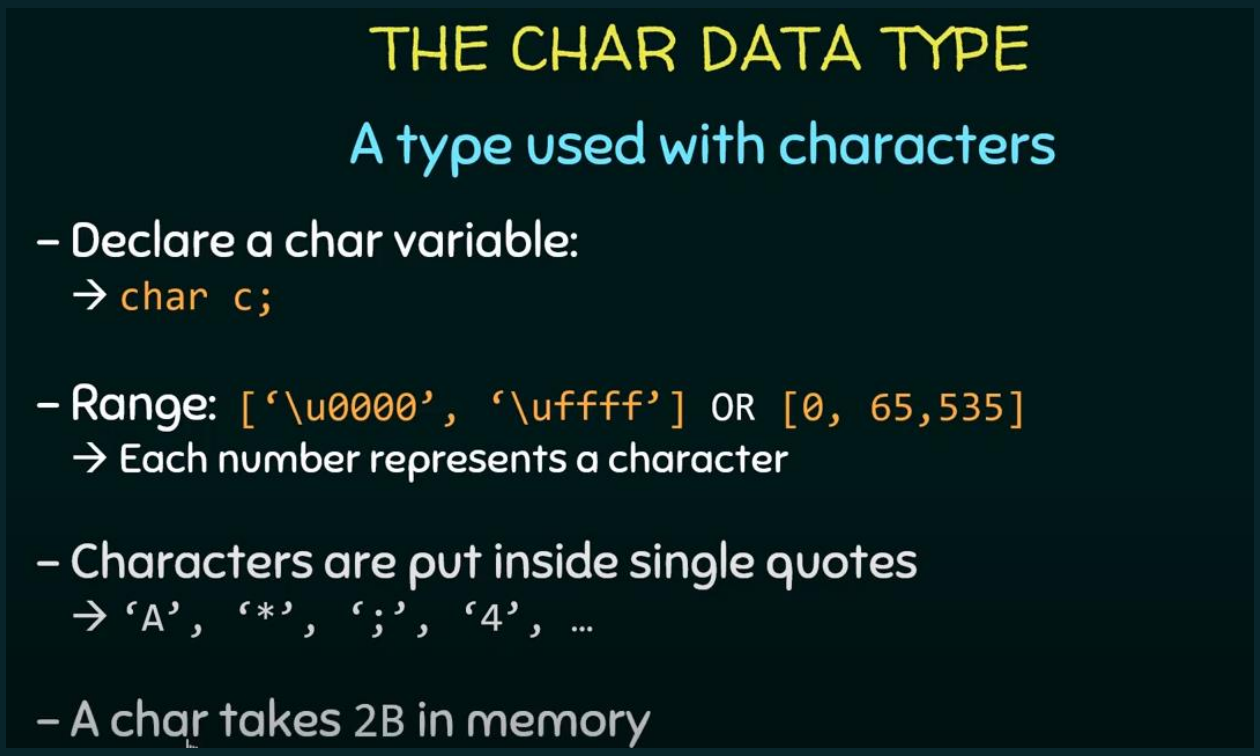




```
package javaapplication23;

public class Java {

    public static void main(String[] args) {

        float f = 12.3F;
        //we can also store a integer value in float.
        double d = 12.4;
        //we can also write 12.4F without having any problem.
        //The float will converted double and then store the value in d

        System.out.println(f);
        System.out.println(d);
    }
}
```

16. The char Data Type in Java





EXAMPLES

Unicode range: [‘\u0000’, ‘\uffff’] OR [0, 65535]

```
'A' → '\u0041' , 65
'a' → '\u0061' , 97
';' → '\u003b' , 59
```

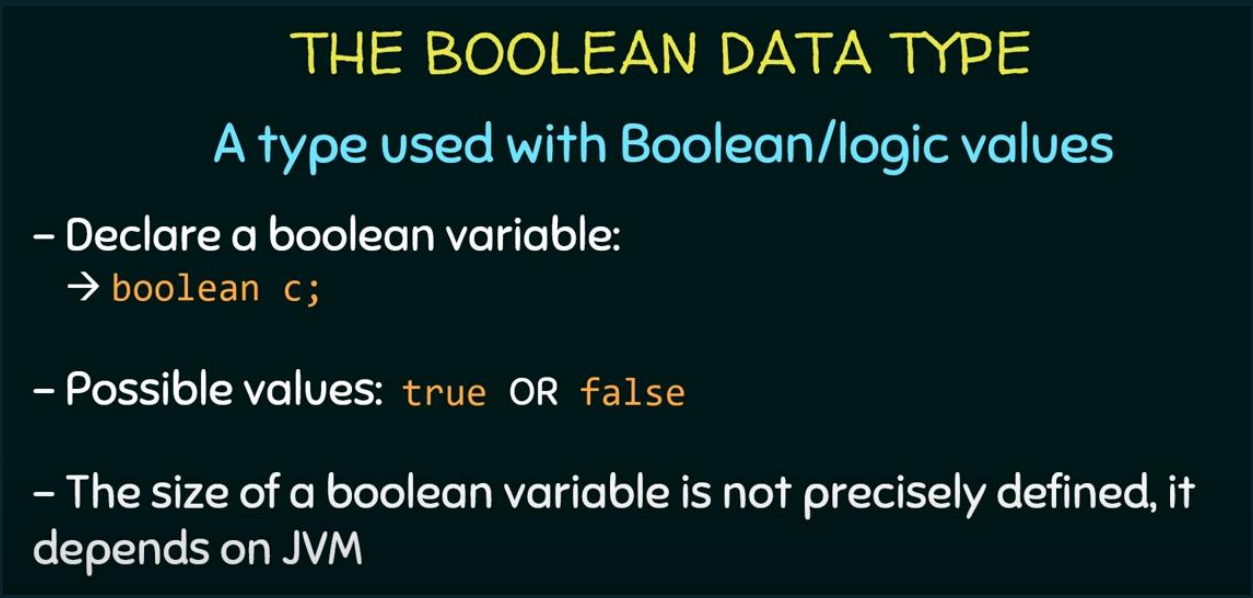
```java
public static void main(String[] args) {
    char c1 = 'A'; // 'A'
    char c2 = 65; // 'A'
    char c3 = '\u0041'; // 'A'

    System.out.println(c1); // A
    System.out.println(c2); // A
    System.out.println(c3); // A
}
```

```
package javaapplication23;

public class Java {

    public static void main(String[] args) {

        char c1 = 'A';
        char c2 = 65;
        char c3 = '\u0041'; //unicode
        System.out.println(c1);
        System.out.println(c2);
        System.out.println(c3);

        int x = 'A';
        int y = '\u0041';
        System.out.println(x);
        System.out.println(y);
    }
}
```

Output:

```
A
A
A
65
65
```

17. Boolean data type in Java



```
package javaapplication23;

public class Java {

    public static void main(String[] args) {

        boolean b1 = true;
        boolean b2 = false;
        boolean b3 = 2 > 1;
        boolean b4 = 2 < 1;

        System.out.println(b1);
        System.out.println(b2);
        System.out.println(b3);
        System.out.println(b4);

        boolean isAlive = true;
        if(isAlive)
            System.out.println("Alive");
        else
            System.out.println("Not Alive");
    }
}
//boolean helps us to create condition in our program.
//so we will be execute certain condition of code depending on the condition
//so we have more contron what our program does
```

```
Output:
true
false
true
false
Alive
```

18. String data types and calling string method

text.toUpperCase() → Create a new String "THIS IS SOME TEXT"
→ The method will return the new String
→ The new String can be stored inside a variable
→ The new String is just like any other String

```
package JavaCode;


public class Javaa {


    public static void main(String[] args) {


        String s = "Golam kibria";
        String s1 = s.toUpperCase();
        System.out.println(s1);
        System.out.println(s.toLowerCase());
        System.out.println(s.length());
        System.out.println(s.isEmpty());
        //System.out.println(s.isBlank()); //output: False
        System.out.println(s.charAt(3));
        System.out.println(s.indexOf('m'));
        System.out.println(s.charAt(s.length() - 1));
        System.out.println(s.lastIndexOf('a'));
        String s2 = s.concat(" Ezaz");
        System.out.println(s2);
    }
}
```

Output:

GOLAM KIBRIA

golam kibria

12

false

a

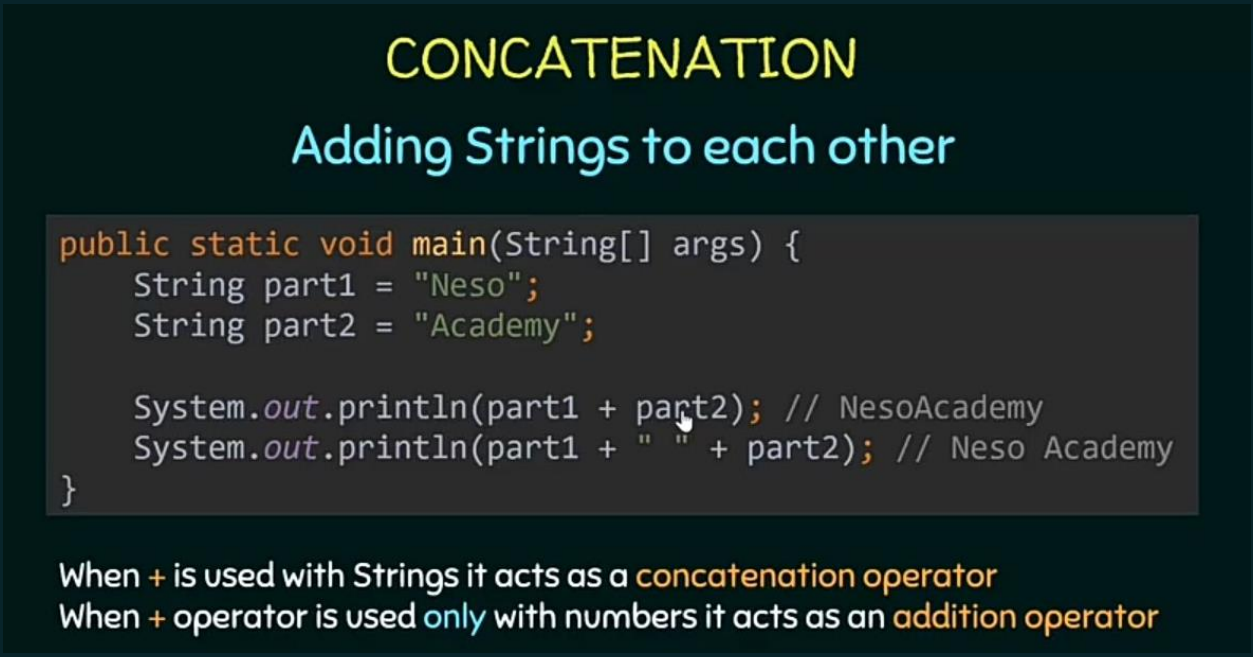
4

a

11

Golam kibria Ezaz

19. Concatenating string in java

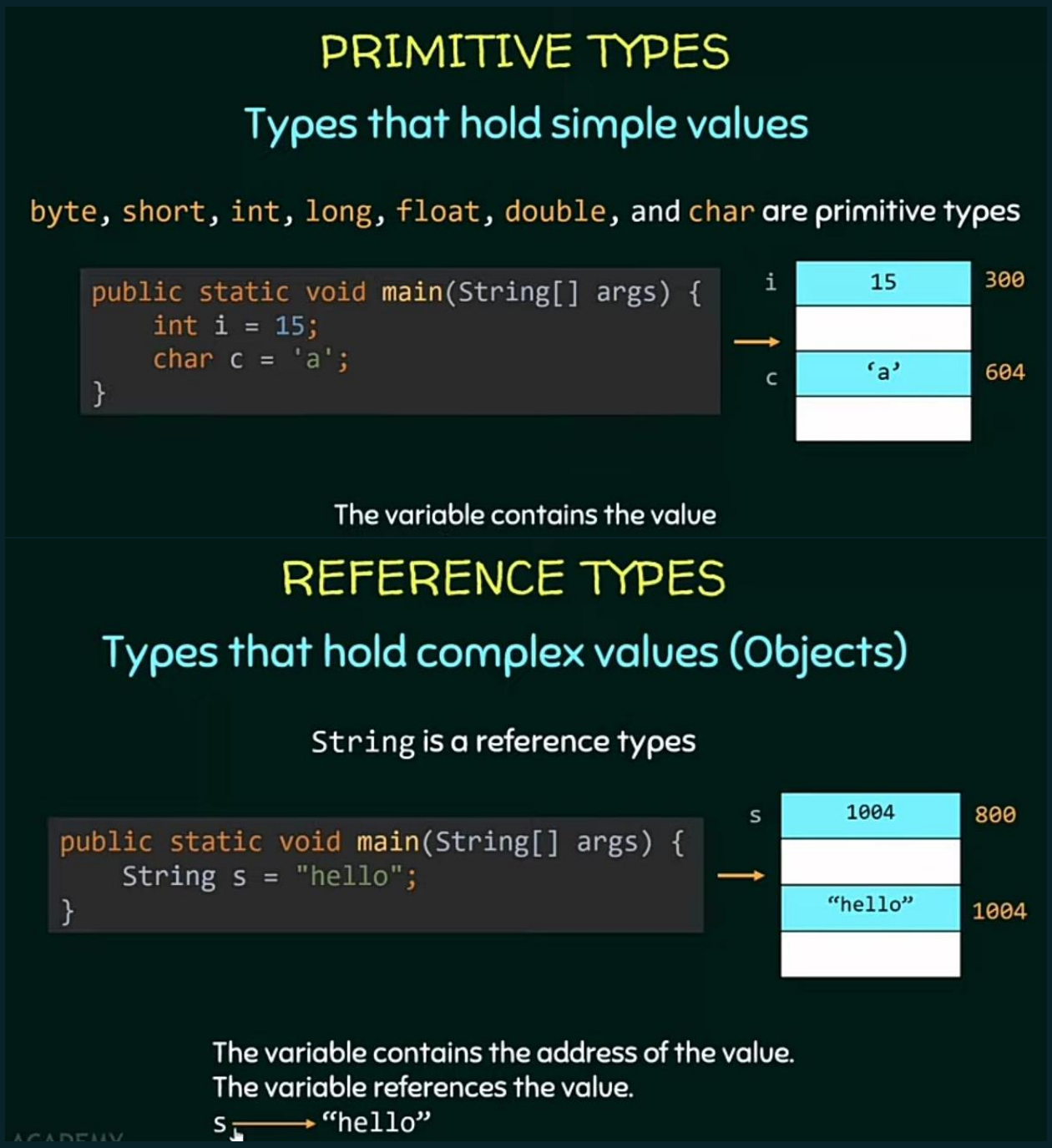



```
package JavaCode;
public class Javaa {

    public static void main(String[] args) {

        String s1 = "Golam";
        String s2 = " Kibria";
        System.out.println(s1 + s2);
        System.out.println("My favourite number is: " + 5);
        //automatically converty 5 to "5"
        System.out.println("My favourite number is: " + 5 + 3);
        System.out.println("Golam".concat(" Kibria"));
        System.out.println("Golam".concat(" Kibria").concat(" Ezaz"));
        System.out.println("Golam".concat(" Kibria").isEmpty());
    }
}
```

Output:

```
Golam Kibria
My favourite number is: 5
My favourite number is: 53
Golam Kibria
Golam Kibria Ezaz
False
```

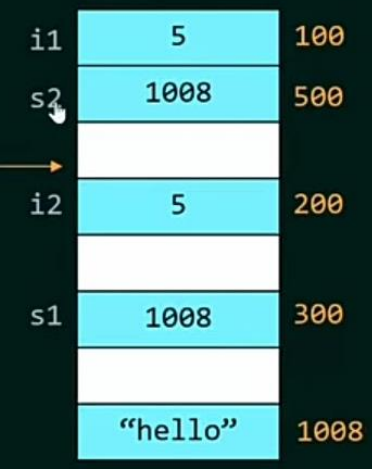
20. Primitive and reference type



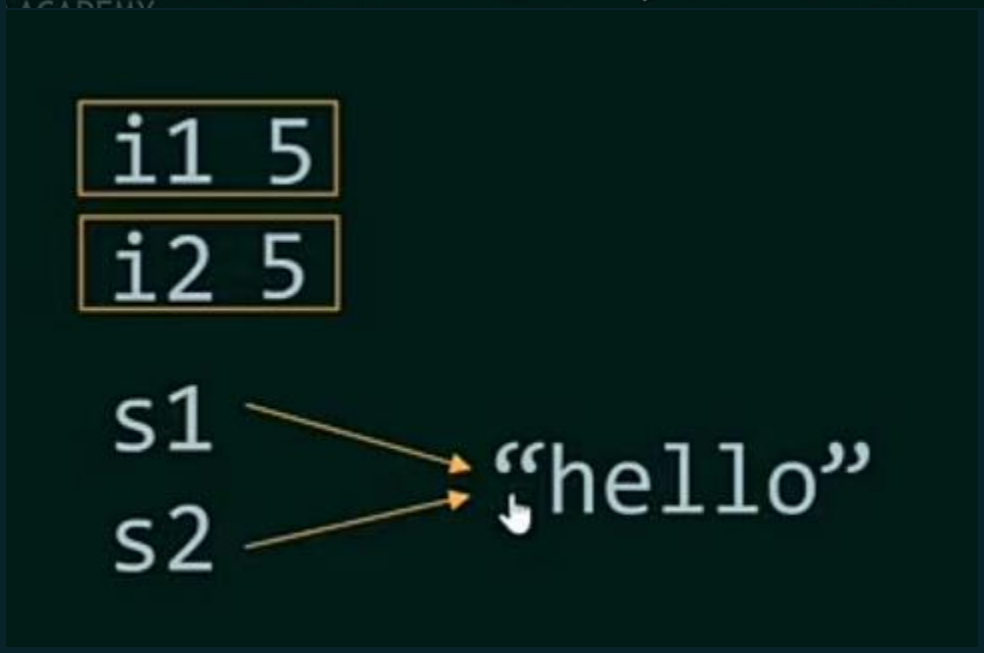
PRIMITIVE TYPES VS REFERENCE TYPES

```
String s2 = s1;
```

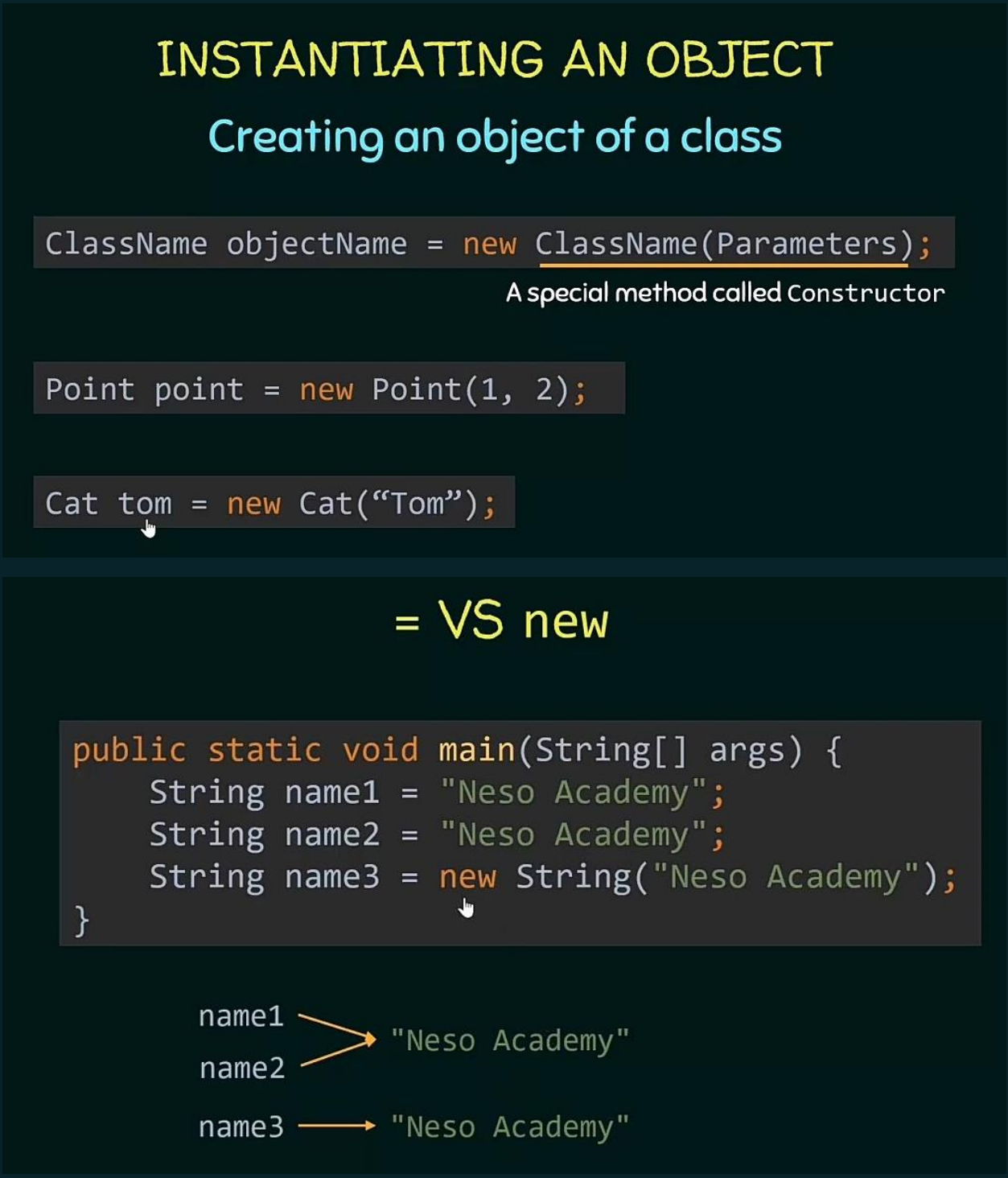
Create a new variable s2 and assign the value of s1 to it



s1 and s2 are different, but they reference the same value



21. Instantiating a string object



```
package JavaCode;

public class Javaa {

    public static void main(String[] args) {

        String s1 = "Golam kibria";
        String s2 = new String("Golam kibria");
        System.out.println(s1);
        System.out.println(s2);
    }
}
```

Output:

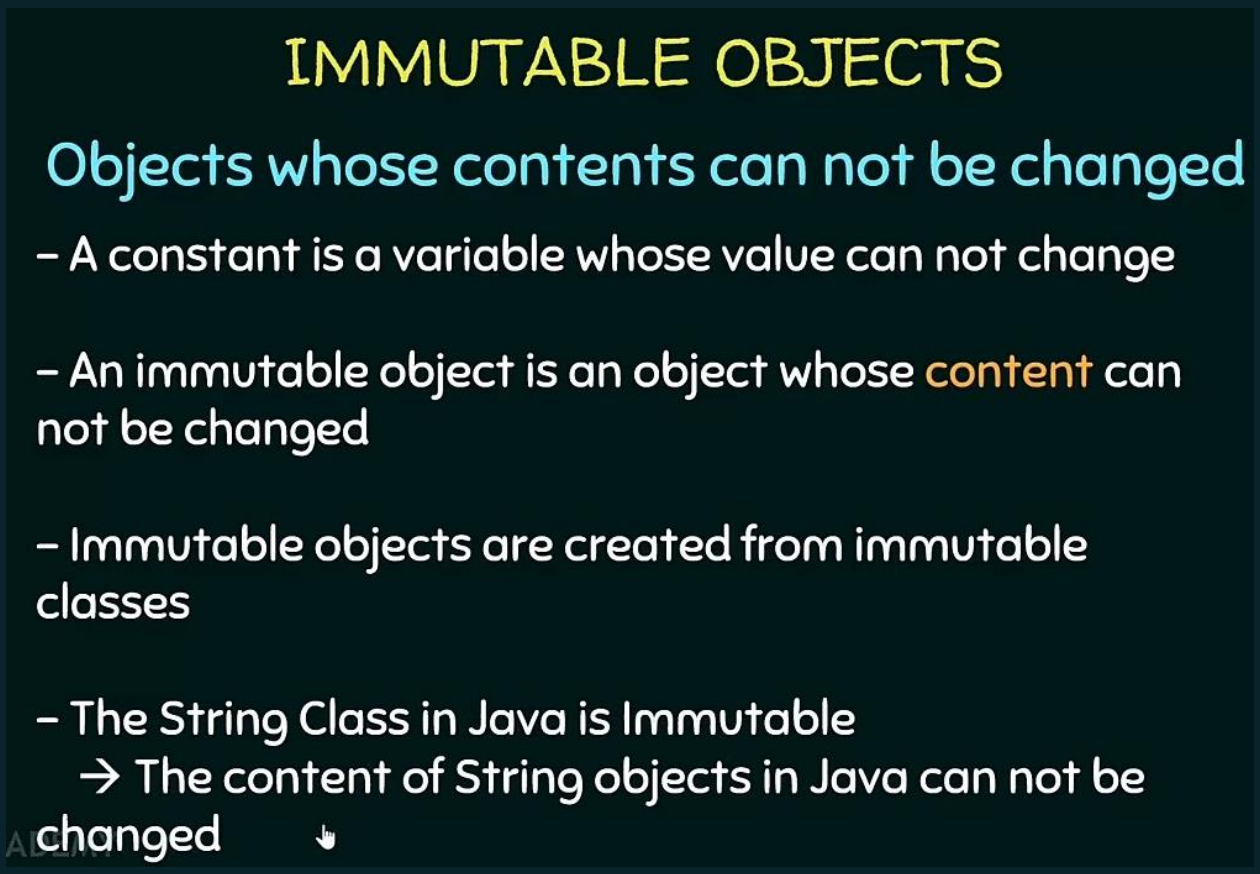
Golam kibria

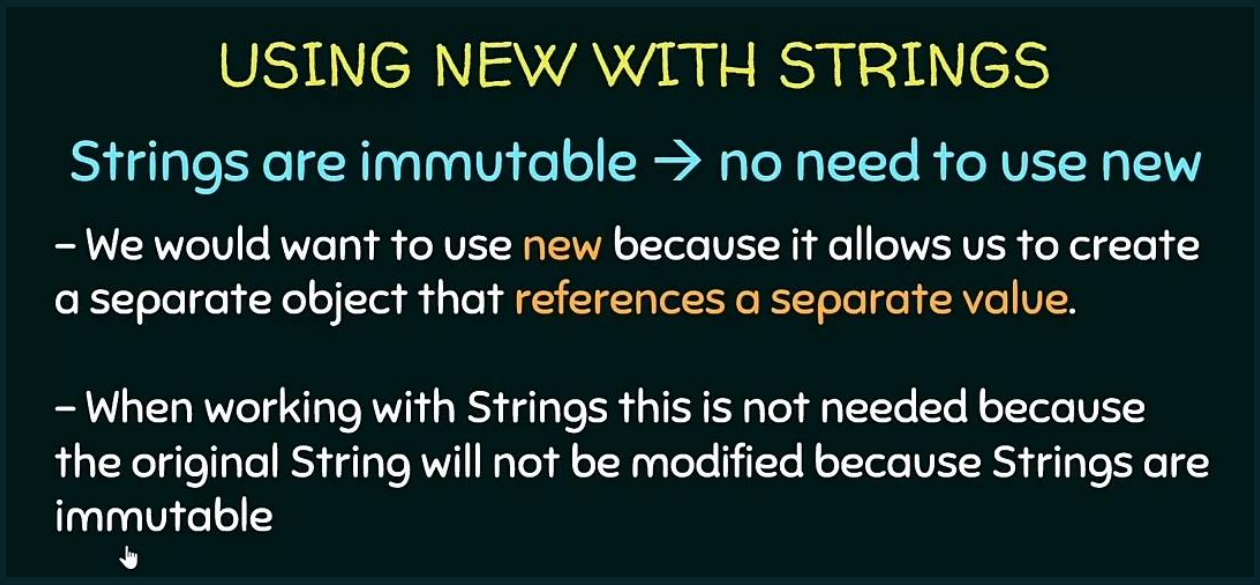
Golam Kibria

New is a special keyword in java used to create new object.

And we can use the new keyword in order to create new string cuz string is a class.

22. String are immutable in java



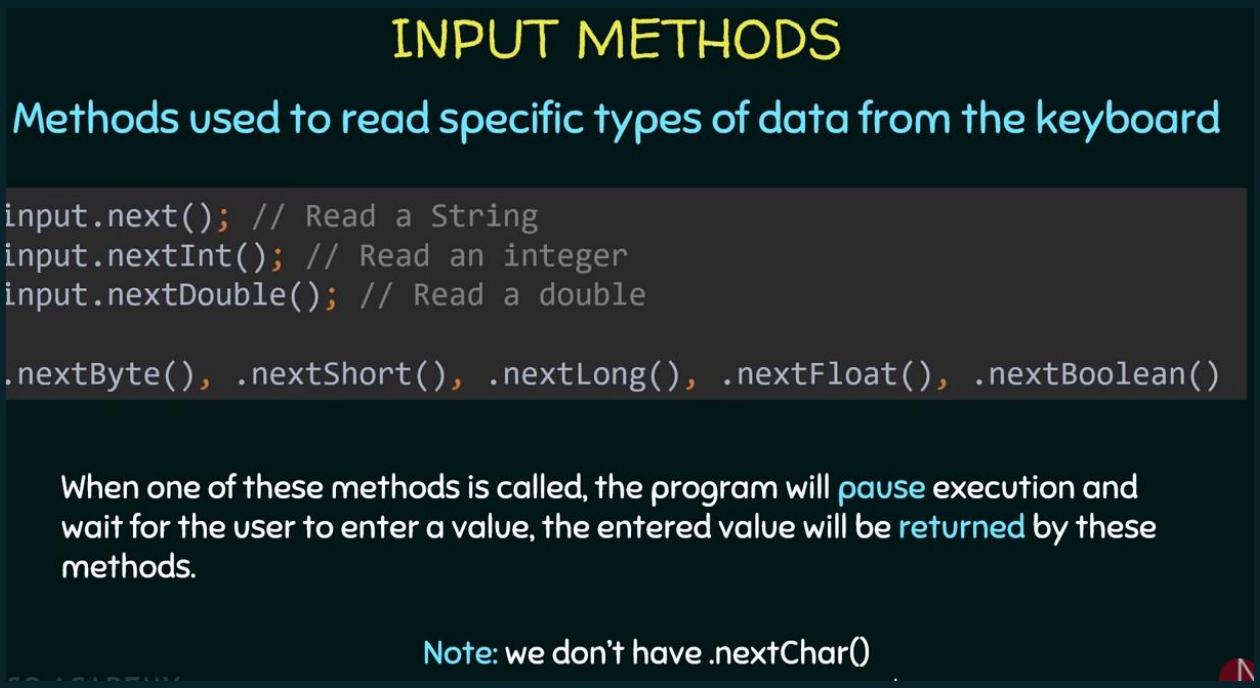


```
package JavaCode;


public class Javaa {


    public static void main(String[] args) {


        String s1 = "Old value";

        s1 = "New value";

        System.out.println(s1);

        //The ole value is now garbage. So it will be remove from the
memory by the java garbage collector.


        String str1 = "Dhaka";

        String str2 = str1;

        str2 = "Bangladesh";

        System.out.println(str1);

        System.out.println(str2);

    }

}
```

Output:

```
New value

Dhaka

Bangladesh
```

23. Scanner class in java



```java
package JavaCode;

import java.util.Scanner;

public class Javaa {

    public static void main(String[] args) {

//        String userName = " Kibria";
//        System.out.println("Golam"+userName);
        Scanner input = new Scanner(System.in);
//        System.out.println(input.next());
//        program will pause until i type a string

        System.out.println("Enter your name: ");
        System.out.println("Your name is: " + input.next());
        System.out.println("Your full name is: " + input.nextLine());
    }
}

//System.in mutotw use kora hoy keyboard hoty data read korar jonno.
//input.next() dara bujay ami dot operator er sahajjy next() method e access
korbo
//next() method read untill the first space


Output:
Enter your name:
golam kibria
Your name is: golam
Your name is:  kibria
```

24. Reading input from the keyboard

```
package JavaCode;

import java.util.Scanner;

public class Javaa {

    public static void main(String[] args) {

        Scanner input = new Scanner(System.in);
        System.out.println(input.nextDouble());

        float f = input.nextFloat();
        System.out.println(f);

        System.out.println(input.nextBoolean());
    }
}
```

Output:

```
1
1.0
2
2.0
true
true
```

25. Printing a number

```
package JavaCode;

import java.util.Scanner;

public class Javaa {

    public static void main(String[] args) {

        Scanner input = new Scanner(System.in);
        System.out.print("Enter your favourite integer: ");

        System.out.println(input.nextInt() +" is my favourite integer");
    }
}
```

Output:

```
Enter your favourite integer: 5
5 is my favourite integer
```

26. Printing name and age

```
package JavaCode;

import java.util.Scanner;

public class Javaa {

    public static void main(String[] args) {

        Scanner input = new Scanner(System.in);
        System.out.println("Enter your name and age: ");

        System.out.println(input.nextLine()  +  "  You  are!  "  +
input.nextInt() + " years old");
    }
}
```

Output:

```
Enter your name and age:
Golam kibria
20
Golam kibria You are!20 years old
```

27. Literals in Java

```
package JavaCode;

public class Javaa {

    public static void main(String[] args) {

        System.out.println(12.4);
        System.out.println(12.4F);
    }
}
```

Output:

12.4

12.5

28. Assignment operator

ASSIGNMENT OPERATOR

An operator to assign a value/expression to a variable

- Using '='.

- `lvalue = rvalue;`
  - → the `lvalue` should be a variable
  - → the `rvalue` is an expression that evaluates to a value
  - → `rvalue` is evaluated and then the result is stored in `lvalue`
  - → `lvalue` can be used in `rvalue`

Example:

`int x = 3 + 1;` → `3 + 1` is evaluated and then the result is stored in `x`

- We can assign multiple variables in the same statement:

```
int y;
int x = y = 4 + 1;
```

This is done from right to left
- → Step 1: `y = 4 + 1`
- → Step 2: `x = y`
- → x and y are equal to 5

```
int i1 = 1; → evaluates to 1
double d = 5.0; → evaluates to 5.0
int i2 = i1 = 4 + 1; → evaluates to 5
```

```java
double d;
int i1, i2;

System.out.println(d = 5.0); // 5.0
System.out.println(i1 = 3); // 3
System.out.println(i2 = i1 = 5); // 5
```

```java
int i1 = 2;
i1 *= 5 + 1;
```

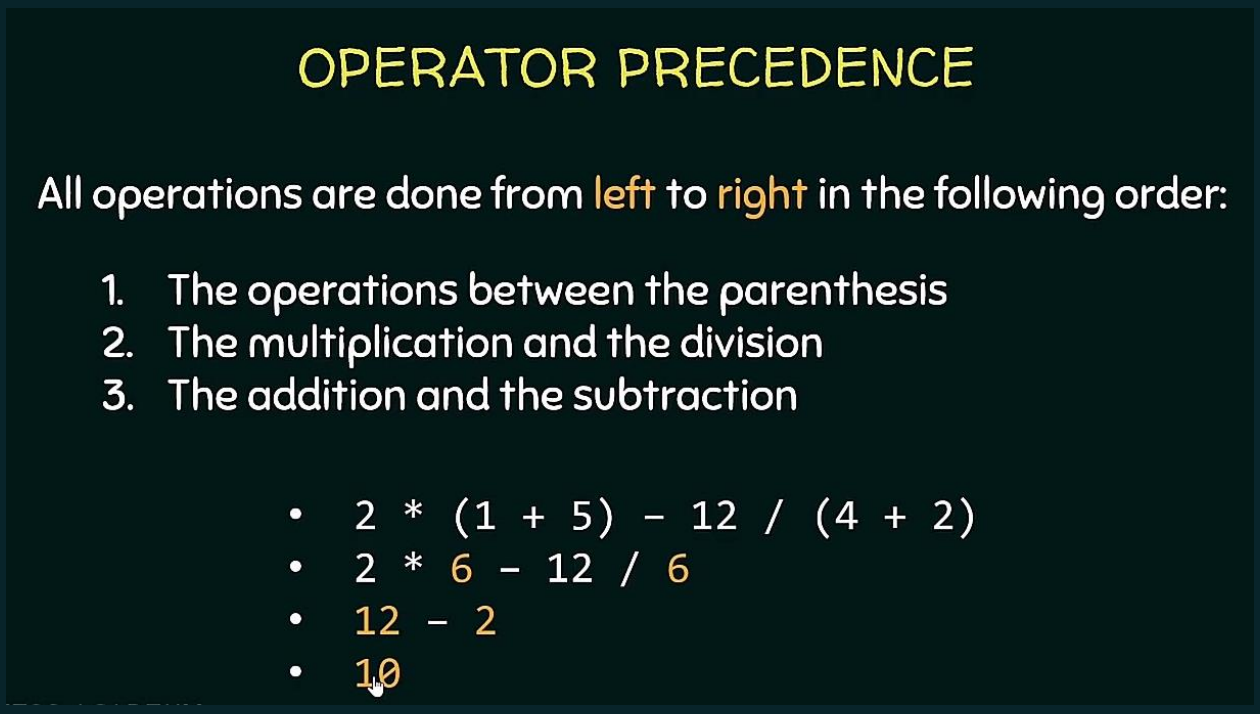
→ Equivalent to:

```java
i1 = i1 * (5 + 1) // 12
```

→ Not to:

```java
i1 = i1 * 5 + 1 // 11
```

29. Arithmetic operator



30. Increment and Decrement operator

THE INCREMENT OPERATOR

Used to increase the value of a variable by 1

- Increment operator: ++
- Can be placed before the variable (pre-increment).
  → ++i
- Can be placed after the variable (post-increment).
  → i++

```
int i = 4;
i++;
System.out.println( i ); // 5
```

```
int i = 4;
++i;
System.out.println( i ); // 5
```

i++ VS ++i

```
int i = 1;
int j = ++i;
System.out.println("i is " + i + ", j is " + j ); // i is 2, j is 2
```

BUT

```
int i = 1;
int j = i++;
System.out.println("i is " + i + ", j is " + j ); // i is 2, j is 1
```

`++i` increments the value of `i` by 1 and uses the new value in the statement

`i++` increments the value of `i` by 1 and uses the original value in the statement

```java
int i = 1;
int j = i++ + 4;
System.out.println("i is " + i + ", j is " + j ); // i is 2, j is 5
```

```java
int i = 1;
int j = ++i + 4;
System.out.println("i is " + i + ", j is " + j ); // i is 2, j is 6
```

THE DECREMENT OPERATOR

Used to decrease the value of a variable by 1

- Increment operator: --
- The same rules apply.

```java
int i = 4;
System.out.println( i-- ); // 4
```

```java
int i = 4;
System.out.println( --i ); // 3
```

```java
package JavaCode;

public class Javaa {

    public static void main(String[] args) {

//        int i = 4;
//        i++;
//        System.out.println(i); //5 cuz i++ means i = i+1

//        int i = 4;
//        ++i;
//        System.out.println(i); //5 cuz i er man saty saty bery jaby pre
increment a

//        int i = 4;
//        int j = i++;
//        System.out.println("i = "+i);//5
//        System.out.println("j = "+j);//4
//        i++ increment the value of i by 1 and use the original value of i

//        int i = 4;
//        int j = ++i;
//        System.out.println("i = "+i);//5
//        System.out.println("j = "+j);//5
//       ++i increment the new value of i by 1 and use the new value in the
statement.

//        int i = 4;
//        int j = i++ + 1;
//        System.out.println("i = " + i);//5
//        System.out.println("j = " + j);//5

//        int i = 4;
//        int j = ++i + 1;
//        System.out.println("i = " + i);//5
//        System.out.println("j = " + j);//6

//        int i = 2;
//        System.out.println(i--);//2
//        post decrement: original value of i

//        int i = 2;
//        System.out.println(--i);//1
    }
}
```

31. Casting

CASTING

Converting a data type to another type

- Implicit casting: Happens automatically when converting from a narrower range data type to a wider range data type
  → converting an int to a double/float/long
  → converting a float to a double

- Explicit casting: Does not happen automatically. Should be done by the programmer when converting from a wider to a narrower data type
  → converting a double/float/long to an int
  → converting a double to a float

IMPLICIT CASTING

```
double d1 = 4; // int → double
double d2 = 5.7f; // float → double
long l1 = 100; // int → long
```

Implicit casting happens because:
- The range of a `double` is wider than an `int`
- The range of a `double` is wider than a `float`
- The range of a `long` is wider than an `int`

EXPLICIT CASTING

```
int i1 = 4.5; // ERROR
int i2 = 8L; // ERROR
float f1 = 4.5; // ERROR
```

Implicit casting can not happen because:

- The range of an `int` is narrower than a `double`
- The range of an `int` is narrower than a `long`
- The range of a `float` is narrower than a `double`

→ Explicit casting is used

EXPLICIT CASTING

`(new data type) expression`

```
int i1 = (int) 4.5;
int i2 = (int) 8L;
float f1 = (float) 4.5;
```

The programmer tells Java to do the casting:

- `(int) 4.5` → `4` `(data loss)`
- `(int) 8L` → `8`
- `(float) 4.5` → `4.5F`

NOTE

```
int i1 = 4.5;
```

This statement produces a syntax error.

We are trying to store a double inside a variable of type int.

double → Wider Range

int → Narrower Range

```
int i1 = (int) 4.5;
```

NOTE

```
double d1 = 4.5 + 3;
```

Every arithmetic operator should be applied between values of the same type.

→ `3` will be automatically casted to `3.0`

→ `4.5 + 3.0` will be calculated and stored in `d1`

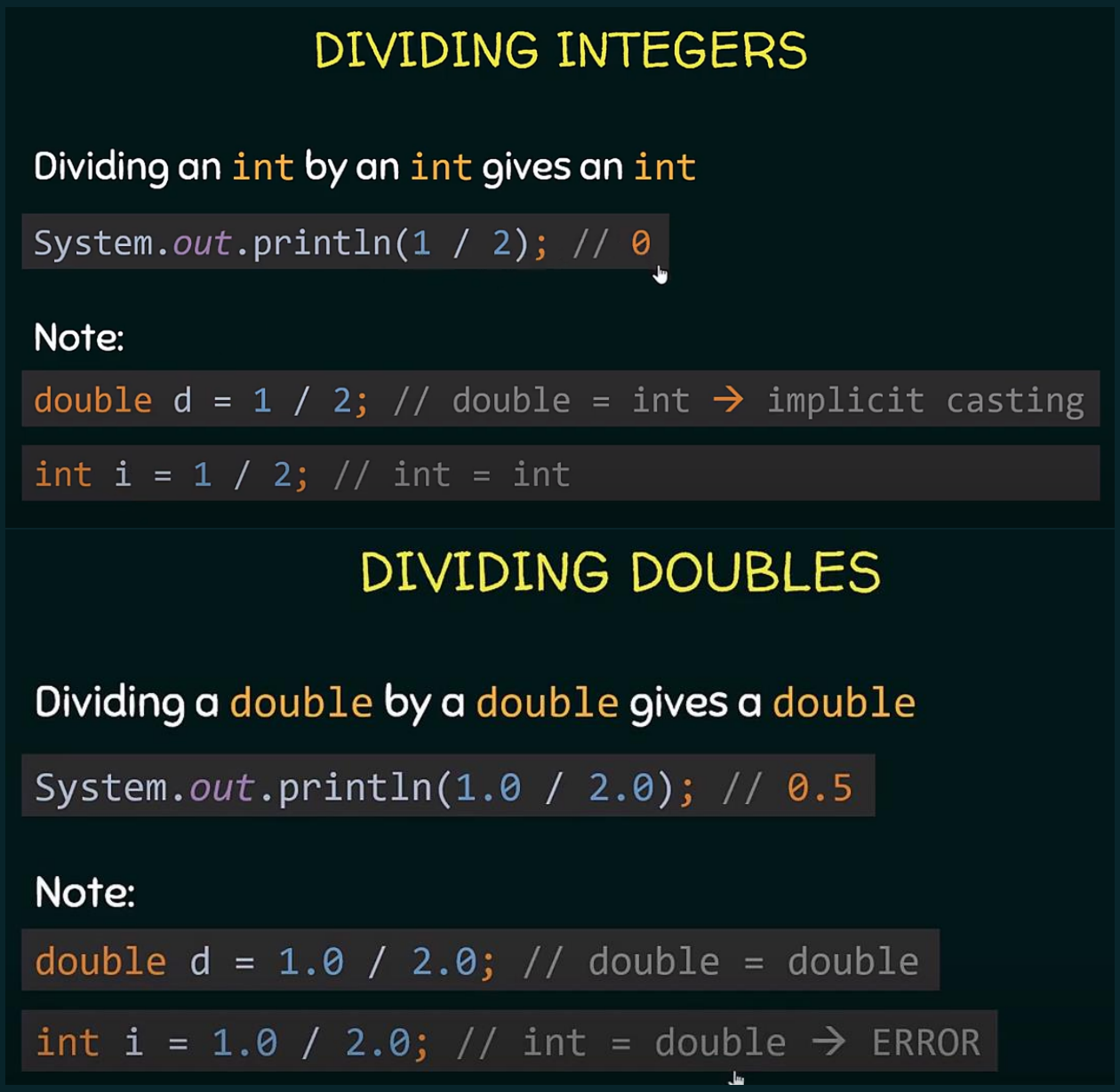
Also:

```
double d1 = 4.5 + (double)3;
```

```
double d = 4.2;
int i = (int) d;
// i = 4, d = 4.2
```

The variable being casted does not change.

32. The division operator in Java



DIVIDING FLOATS

Dividing a `float` by a `float` gives a `float`

```
System.out.println(1.0f / 2.0f); // 0.5f
```

Note:

```
double d = 1.0f / 2.0f; // double = float → implicit casting
```

```
int i = 1.0f / 2.0f; // int = float → ERROR
```

DIVIDING INTEGERS AND DOUBLES

The `integer` will be casted to a `double` automatically

```
System.out.println(1 / 2.0); // 0.5
```

```
System.out.println(1.0 / 2); // 0.5
```

Note:

```
double d = 1 / 2.0; // double = double
```

```
int i = 1 / 2.0; // int = double → ERROR
```

DIVIDING FLOATS AND DOUBLES

The `float` will be casted to a `double` automatically

```
System.out.println(1.0f / 2.0); // 0.5
```

```
System.out.println(1.0 / 2.0f); // 0.5
```

Note:

```
double d = 1.0f / 2.0; // double = double
```

```
float f = 1.0f / 2.0; // float = double → ERROR
```

DIVIDING FLOATS AND INTEGERS

The `integer` will be casted to a `float` automatically

```
System.out.println(1.0f / 2); // 0.5f
```

```
System.out.println(1 / 2.0f); // 0.5f
```

Note:

```
double d = 1.0f / 2; // double = float →
implicit casting
```

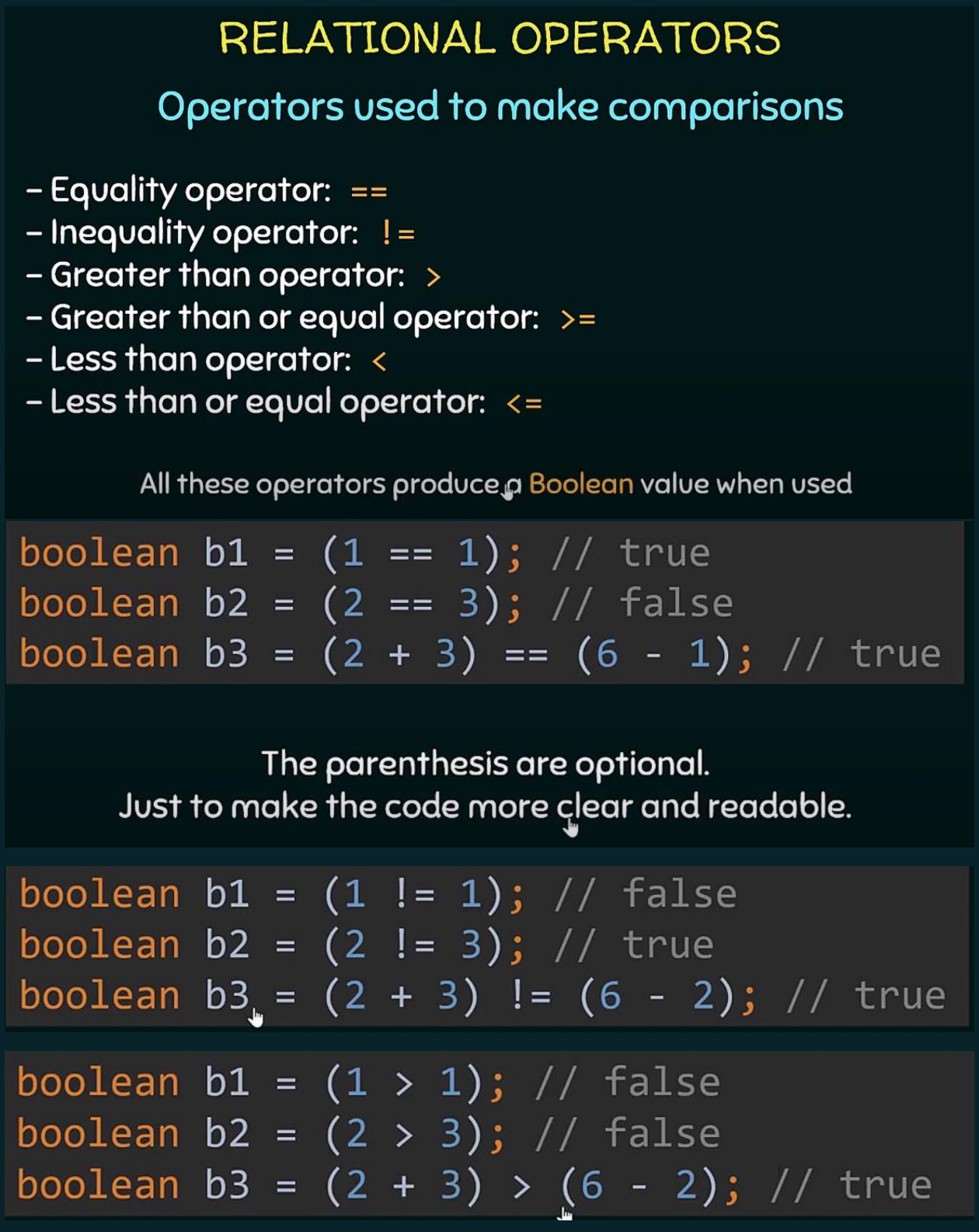
```
int i = 1.0f / 2; // int = float → ERROR
```

33. The divisor operator example

```
int i1 = 1 / 2; // OK, int = int
int i2 = 1.0 / 2; // ERROR, int = double
int i3 = (int) (1.0 / 2); // OK, int = int
int i4 = (int) (1.0f / 2); // OK, int = int
int i5 = (int) 1.0f / 2; // OK, int = int
int i6 = 1.0f / (int) 2; // ERROR, int = float
double i7 = 1.0 / 2; // OK, double = double
double i8 = 1 / 2; // OK, double = int
double i9 = (double) 1 / 2; // OK, double = double
float i10 = 1.0f / 2.0f; // OK, float = float
float i11 = 1 / 2; // OK, float = int
```

```
int i1 = 3;
int i2 = 2;
double d1 = 2;

System.out.println(i1 / i2); // 1
System.out.println(i1 / d1); // 1.5
System.out.println((double) i1 / i2); // 1.5
System.out.println(i1 / (double) i2); // 1.5
System.out.println((double) i1 / (double) i2); // 1.5
System.out.println((double) (i1 /i2)); // 1.0
```

34. The relational operator in java

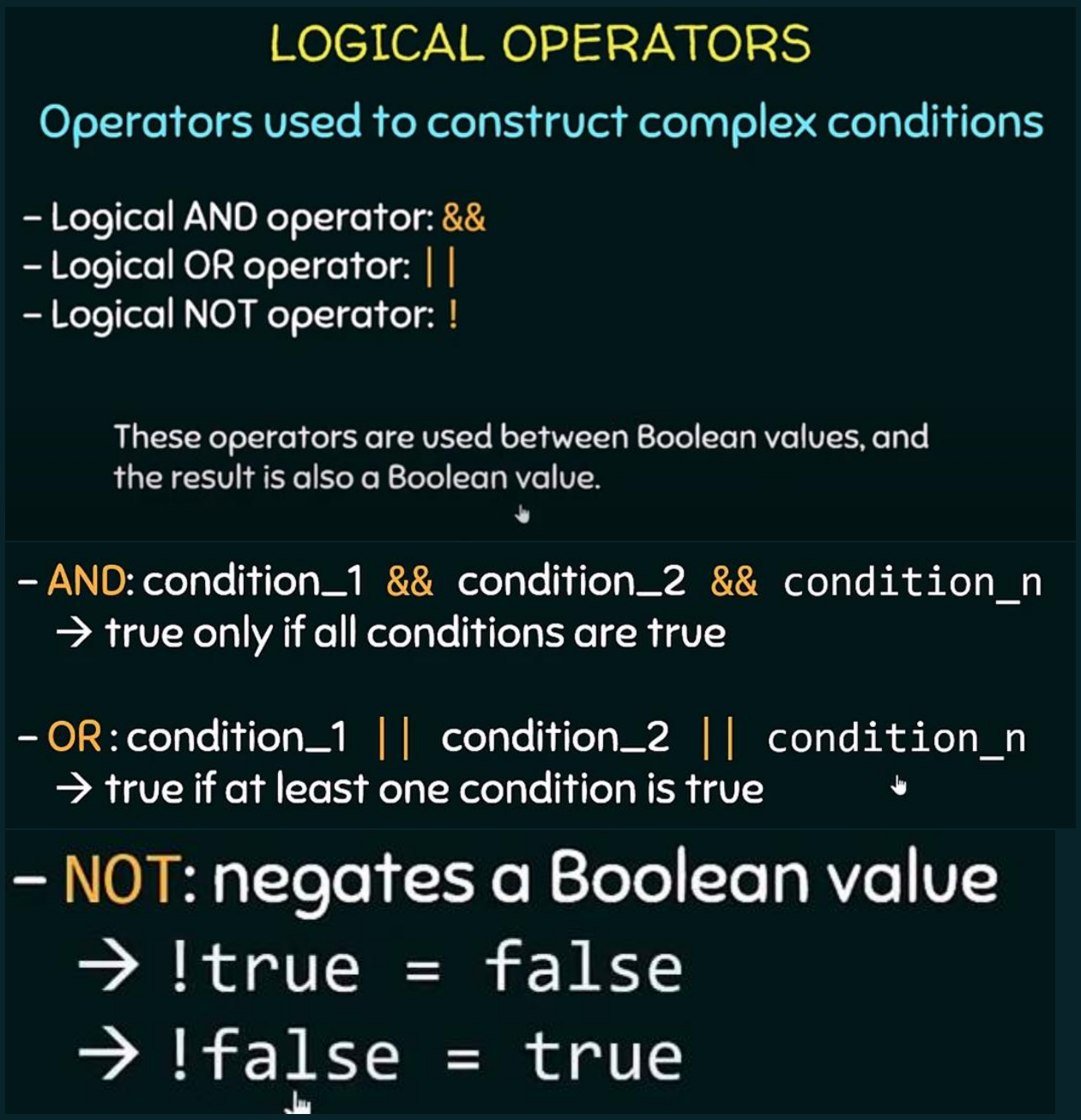


```java
boolean b1 = (1 >= 1); // true
boolean b2 = (2 >= 3); // false
boolean b3 = (2 + 3) >= (6 - 2); // true
```

```java
boolean b1 = (1 < 1); // false
boolean b2 = (2 < 3); // true
boolean b3 = (2 + 3) < (6 - 2); // false
```

```java
boolean b1 = (1 <= 1); // true
boolean b2 = (2 <= 3); // true
boolean b3 = (2 + 3) <= (6 - 2); // false
```

35. Logical operator in java



```java
boolean b1 = true && true; // true
boolean b2 = b1 && false && true; // false
boolean b3 = b2 || true; // true
boolean b4 = !b2; // true
boolean b5 = !(b4 && b2); // true
```

```
if isRaining || isCold → wear a jacket
if n >= 1 && n <= 10 → n is between 1 and 10
```

36. Conditional operator in Java

CONDITIONAL OPERATOR

An operator that evaluates an expression based on a condition

```
boolean-expression ? expression1 : expression2
```

Evaluates to:

expression1 if boolean-expression is true
expression2 if boolean-expression is false

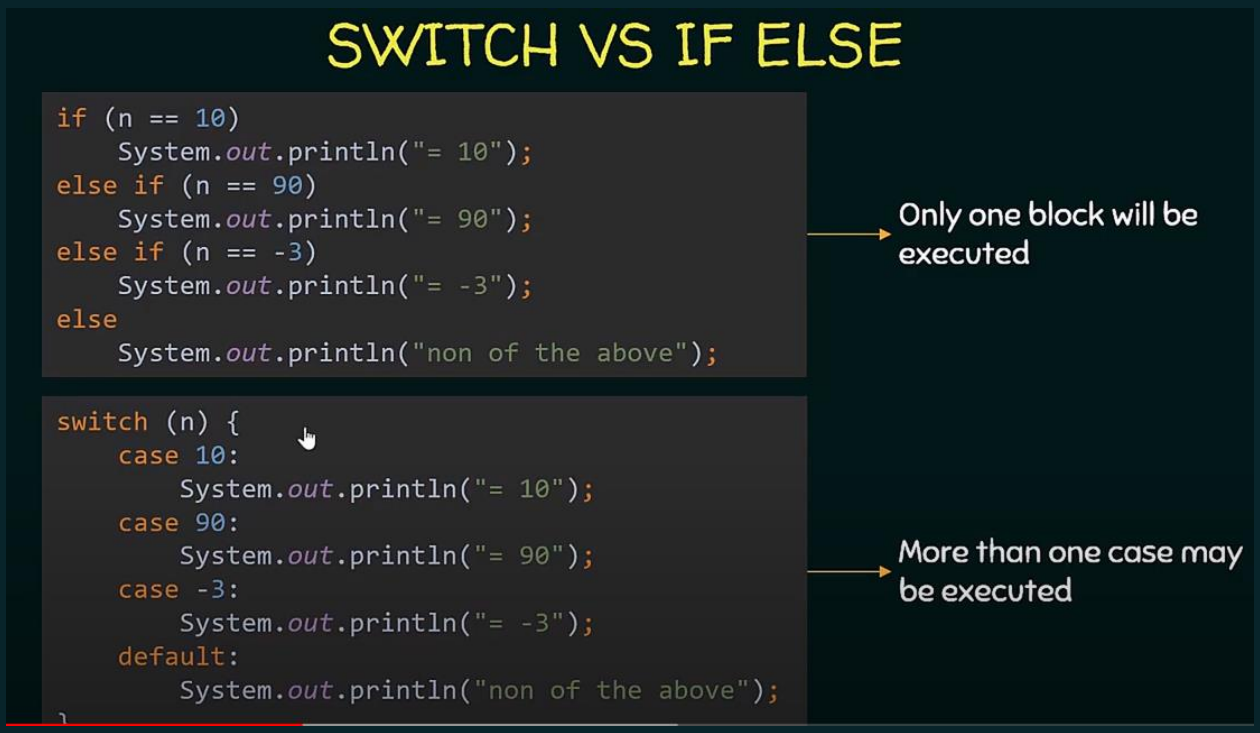
```
int a = 10;
int b = 15;

int max = a > b ? a : b;
System.out.println(max); // 15
```

```
String name = "Neso Academy";

System.out.println( name.isEmpty() ? "The name is not
valid" : name ); // Neso Academy
```

```
String name = "";

System.out.println( name.isEmpty() ? "The name is not
valid" : name ); // The name is not valid
```

```java
String name = "Neso Academy";

System.out.println( !name.isEmpty() ? name : "The name is
not valid" ); // Neso Academy
```

37. Difference between switch and if else



If the beak keyword is executed we will break out from the switch statement in other words we will stop executing the switch statement.

```
public static void main(String[] args) {
    Scanner s = new Scanner(System.in);
    int n = s.nextInt();

    switch (n % 2) {
        case 0:
            System.out.println("even");
            break;
        default:
            System.out.println("odd");
    }
}
```

```java
public static void main(String[] args) {
    Scanner s = new Scanner(System.in);
    int n = s.nextInt();

    switch (n % 2) {
        case 0:
            System.out.println("even");
            break;
        case 1:
            System.out.println("odd");
    }
}
```

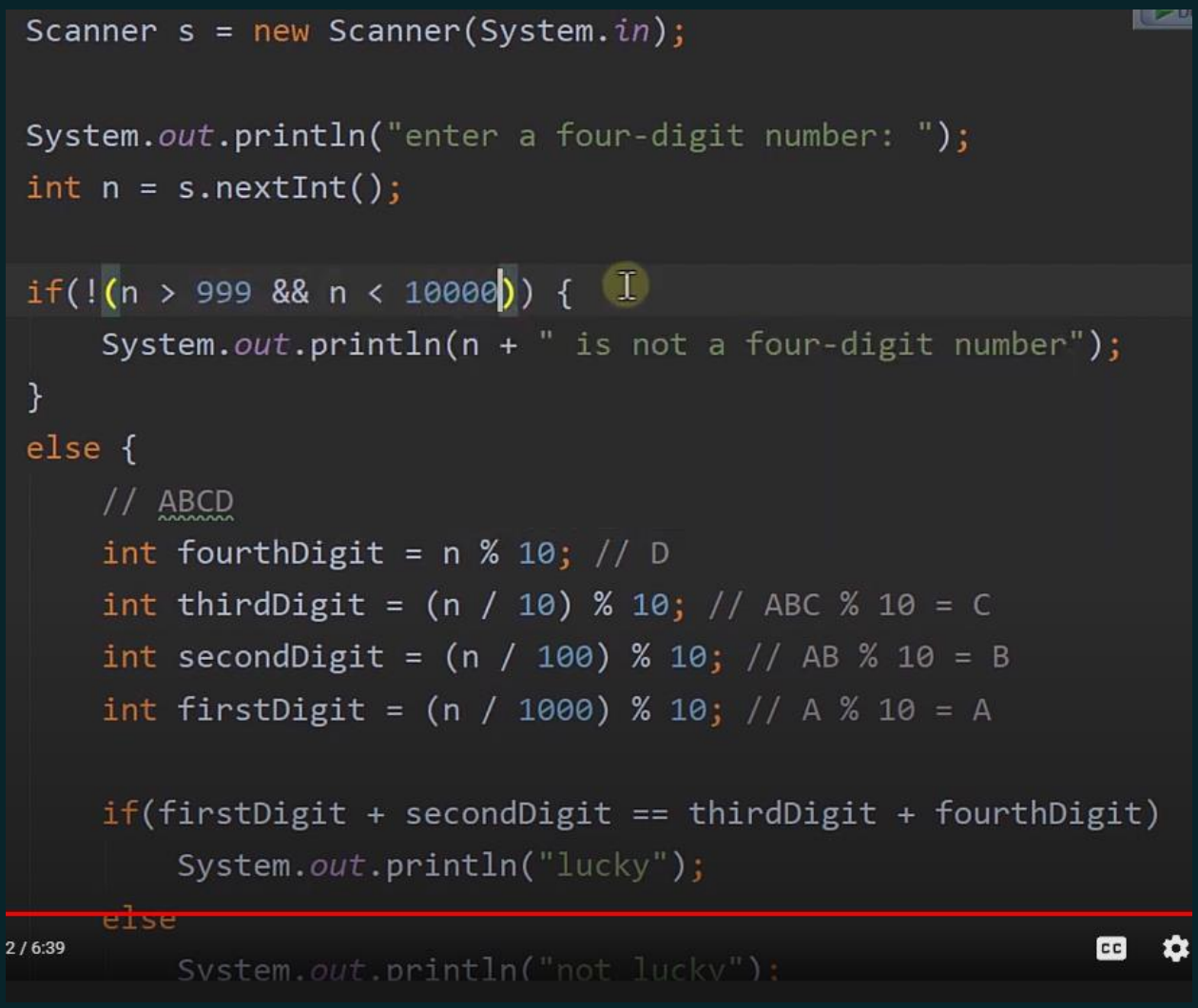
39. Making simple calculator using if else

```
public static void main(String[] args) {
    System.out.print("enter num1 op num2 (5 * 7): ");

    Scanner s = new Scanner(System.in);
    double d1 = s.nextDouble();
    char op = s.next().charAt(0);
    double d2 = s.nextDouble();

    if( op == '+' )
        System.out.println((int)(d1 + d2));
    else if( op == '-' )
        System.out.println((int)(d1 - d2));
    else if( op == '/' )
        System.out.println(d1 / d2);
    else if( op == '*' )
        System.out.println((int)(d1 * d2));
```

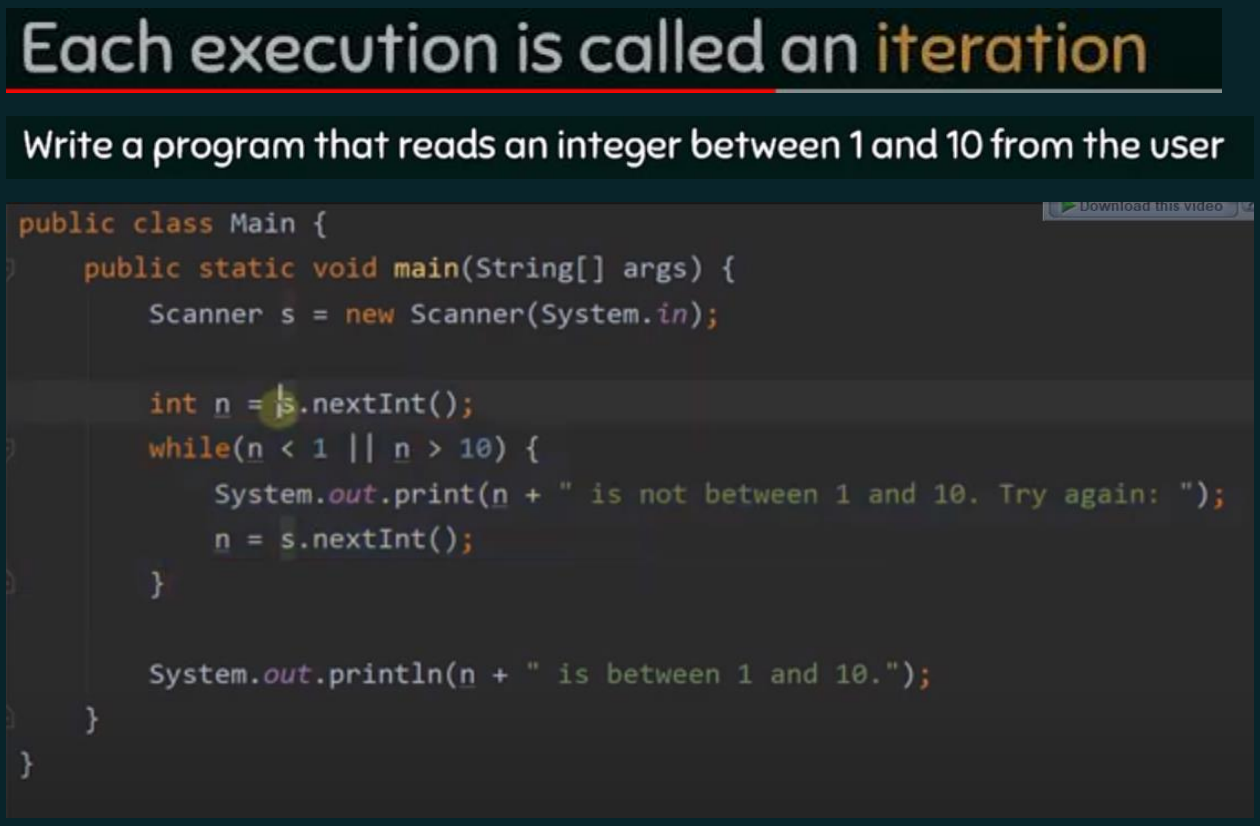
else

System.out.println(“Invalid operator”);

40. Lucky number

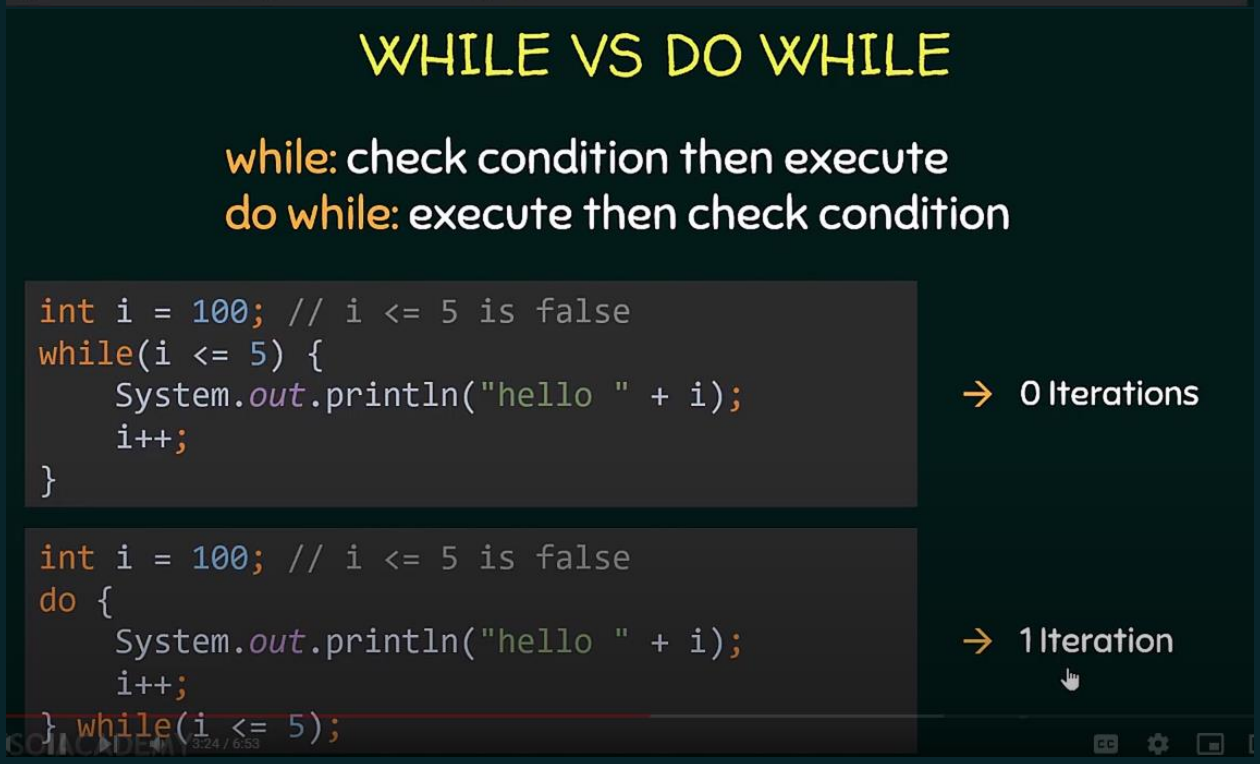


41. While loop



42. do while loop

```java
int i = 1;
do {
    System.out.println("hello " + i);
    i++;
} while(i <= 3);
```



```java
package com.NesoAcademy;

import java.util.Scanner;

public class Main {
    public static void main(String[] args) {
        Scanner s = new Scanner(System.in);

        int n;
        do {
            System.out.print("enter a number between 1 and 10: ");
            n = s.nextInt();
        } while (n < 1 || n > 10);

        System.out.println(n + " is between 1 and 10.");
    }
```

43. structure of for loop

The variable can be initialized outside:

```
int i = 1;
for( ; i <= 5; i++) {
    System.out.println("Hello " + i);
}

System.out.println("Hello " + i); // Hello 6
```

i can be accessed outside the loop.

INFINITE FOR LOOP

```
for( ; ; )
    System.out.println("Hello");
```

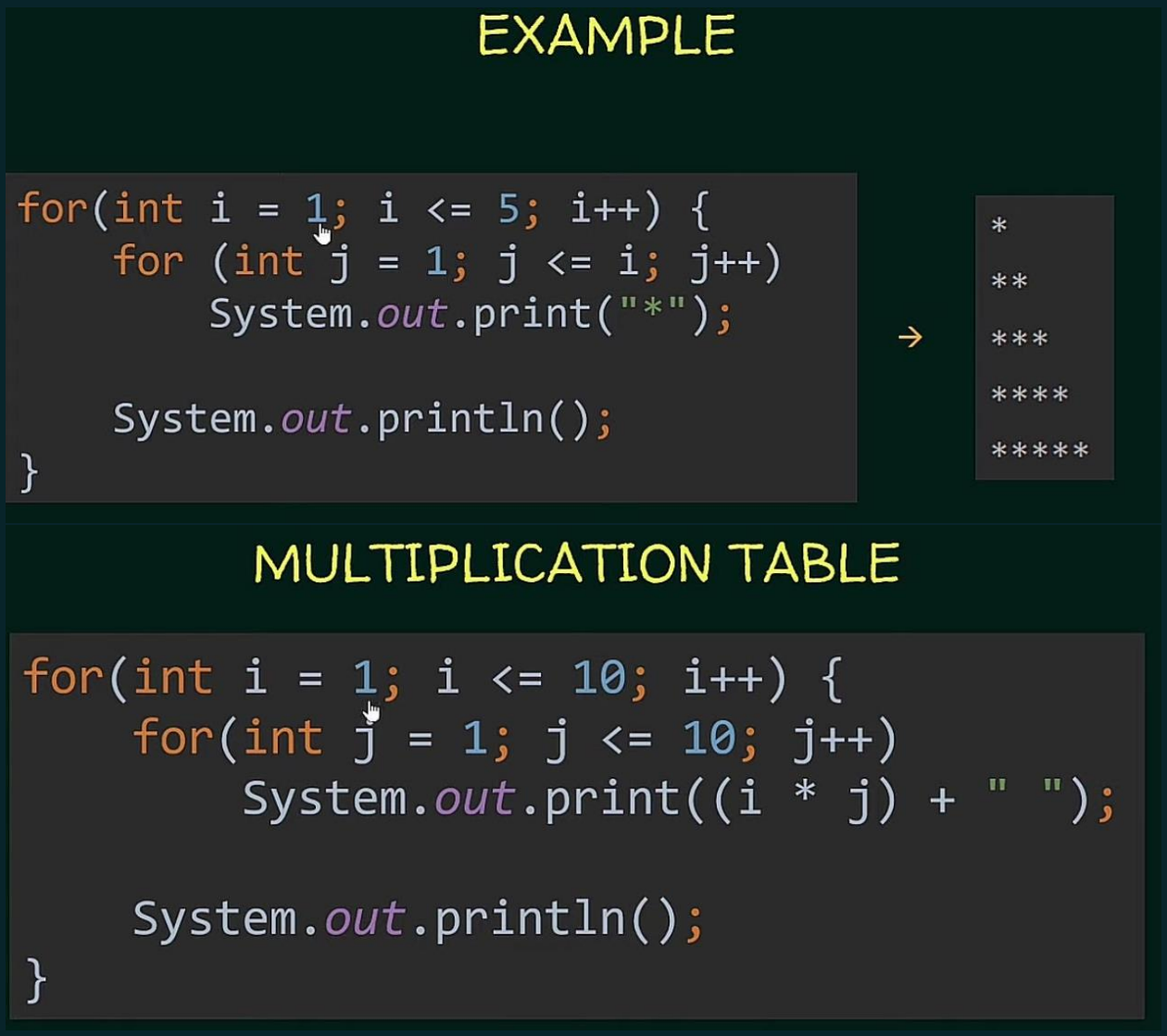
```
for( ; true; )
    System.out.println("Hello");
```

FOR LOOP ↔ WHILE LOOP

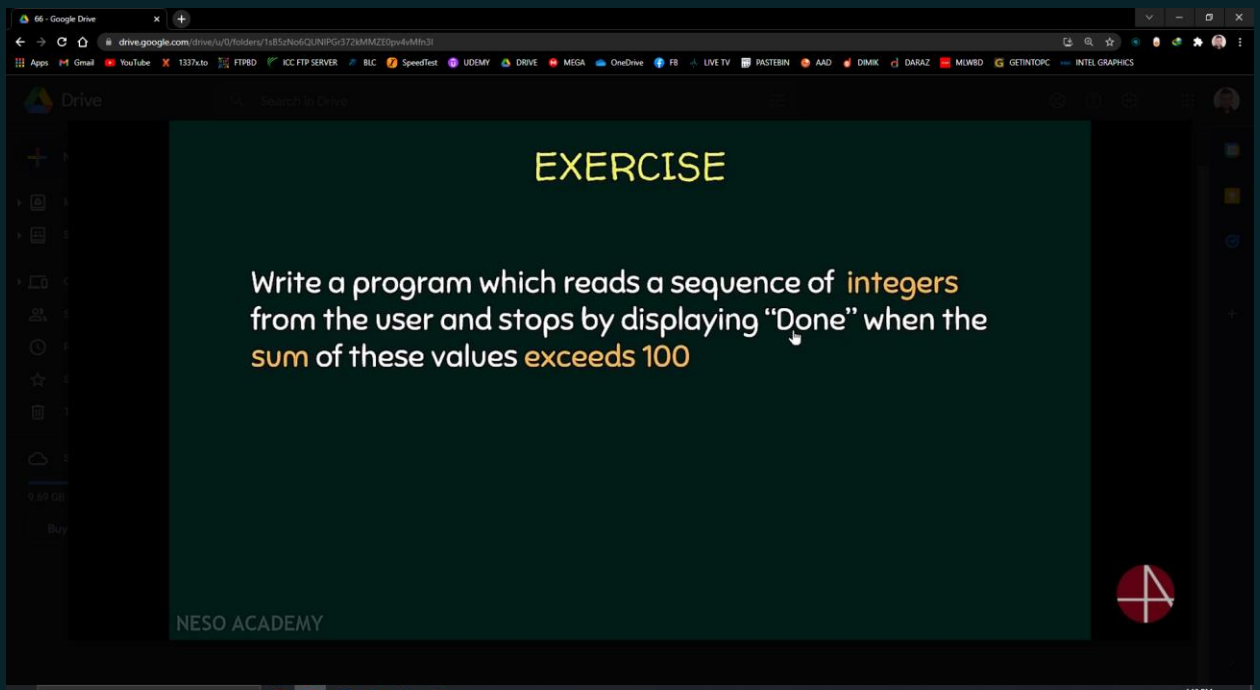
```java
int i = 1;
for ( ; i <= 5; ) {
    System.out.println("Hello");
    i++;
}
```

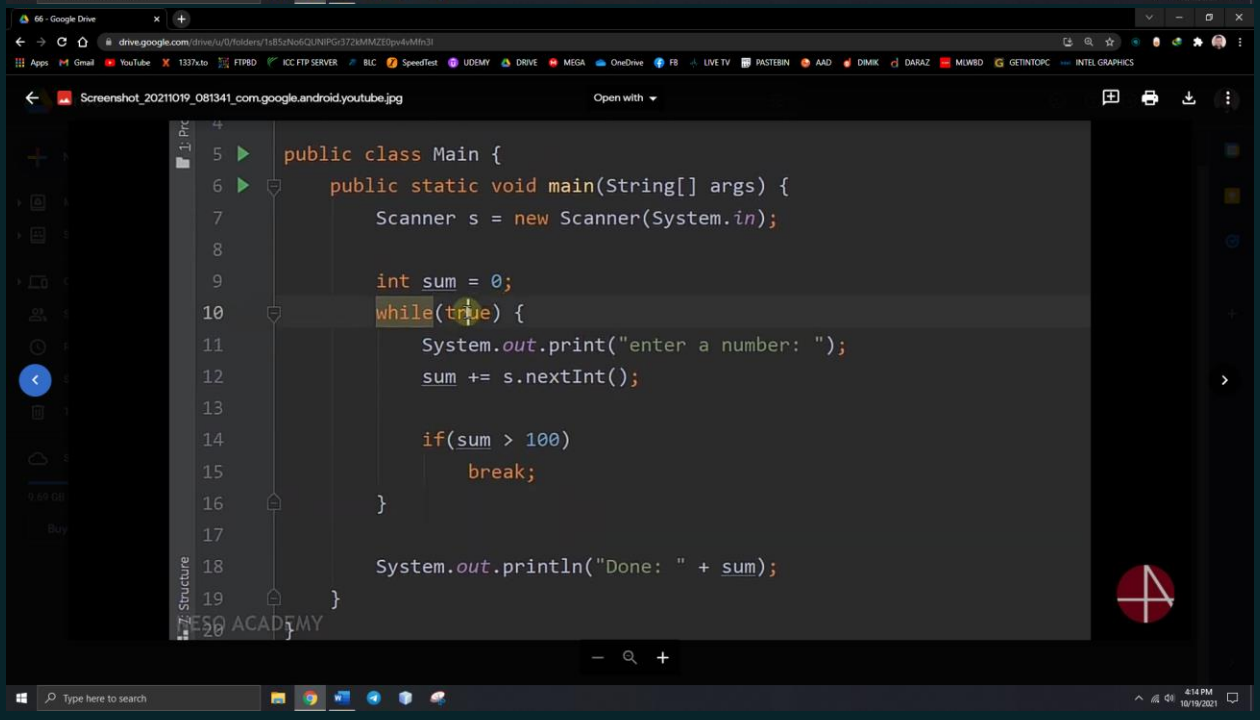
```java
int i = 1;
while ( i <= 5 ) {
    System.out.println("Hello");
    i++;
}
```

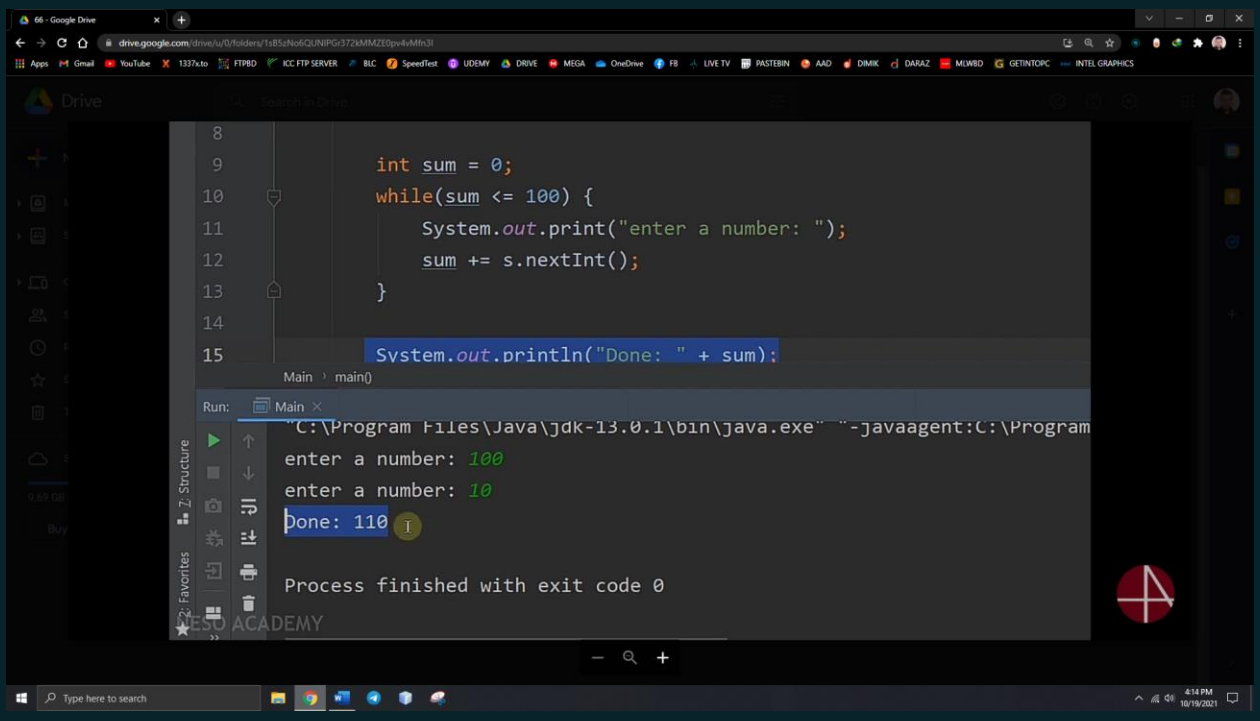
44. for loop printing star and multiplication table

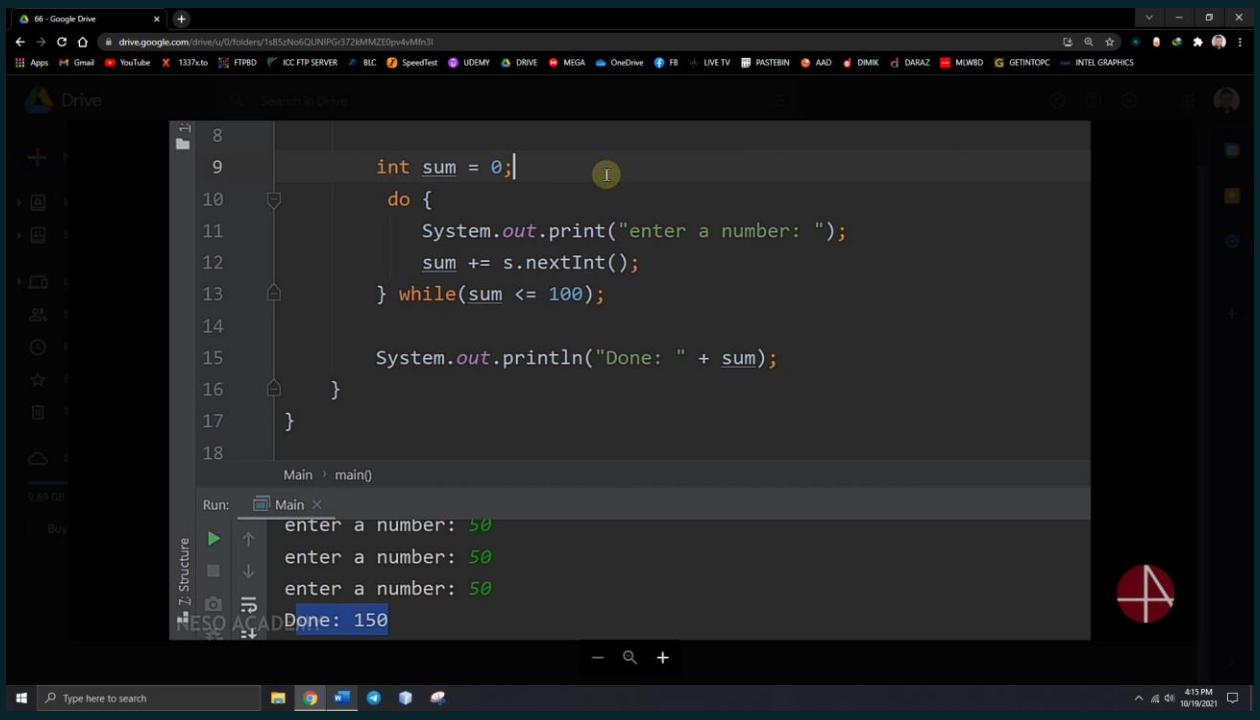


45. sum of the values

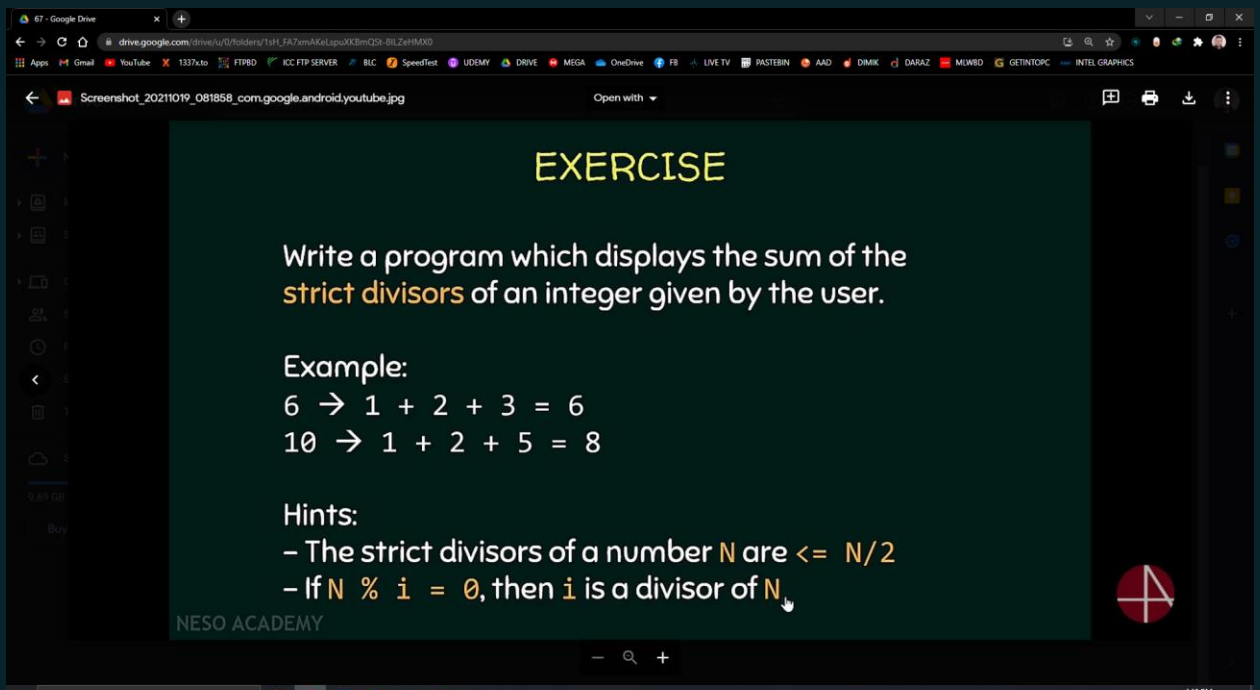


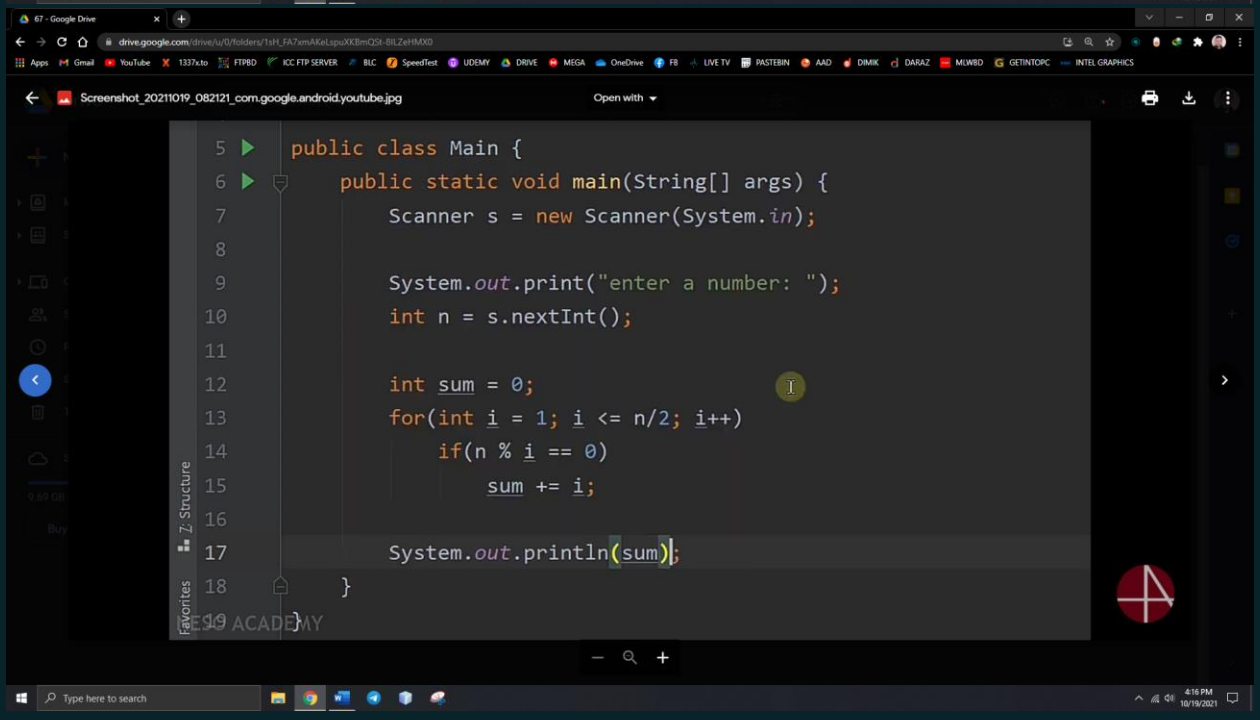


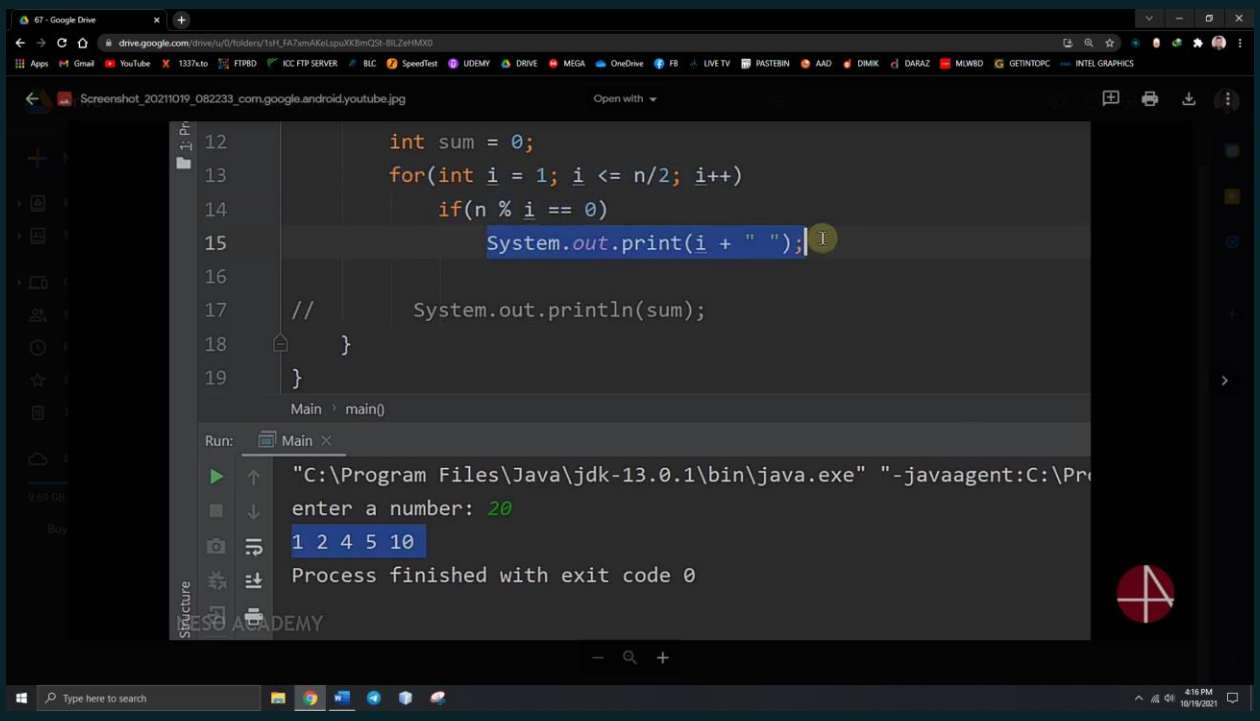

int sum = 0;
while(sum <= 100) {
System.out.print("enter a number: ");
sum += s.nextInt();
}
System.out.println("Done: " + sum);
Main › main()
Run: Main
"C:\Program Files\Java\jdk-13.0.1\bin\java.exe" "-javaagent:C:\Program
enter a number: 100
enter a number: 10
Done: 110
Process finished with exit code 0
RESO ACADEMY


int sum = 0;
do {
System.out.print("enter a number: ");
sum += s.nextInt();
} while(sum <= 100);
System.out.println("Done: " + sum);
}
}
Main › main()
Run: Main
enter a number: 50
enter a number: 50
enter a number: 50
Done: 150
RESO ACADEMY

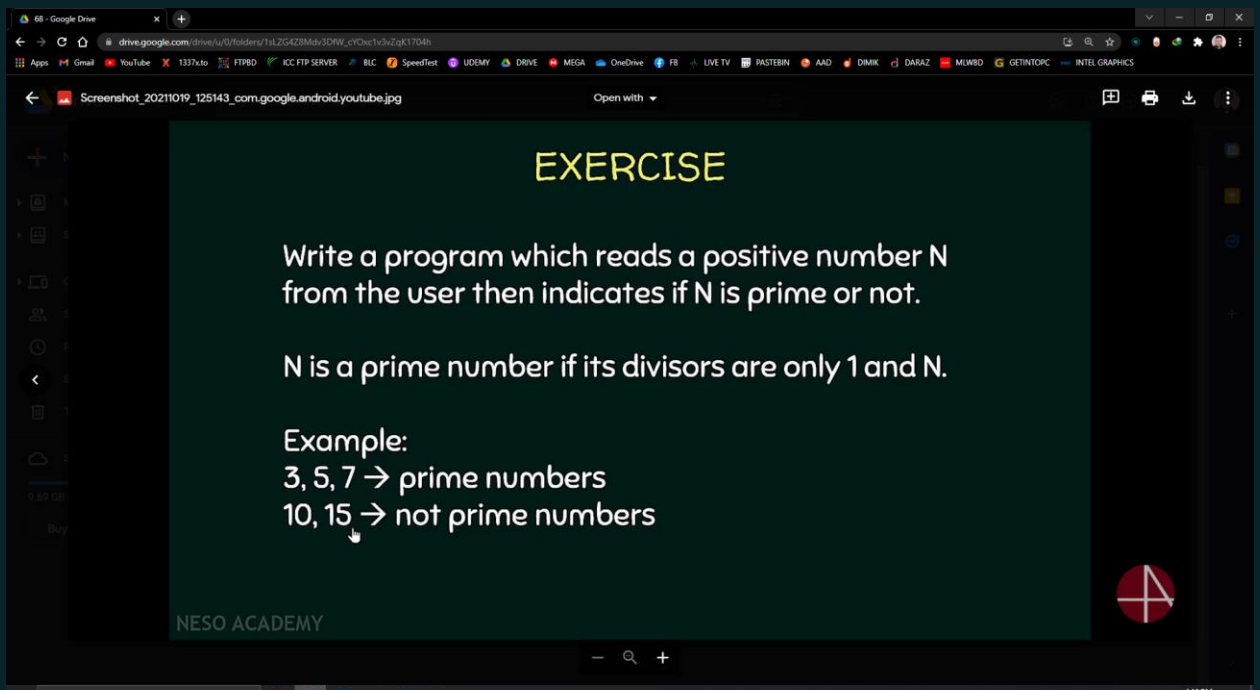
46. Sum of the strict divisors

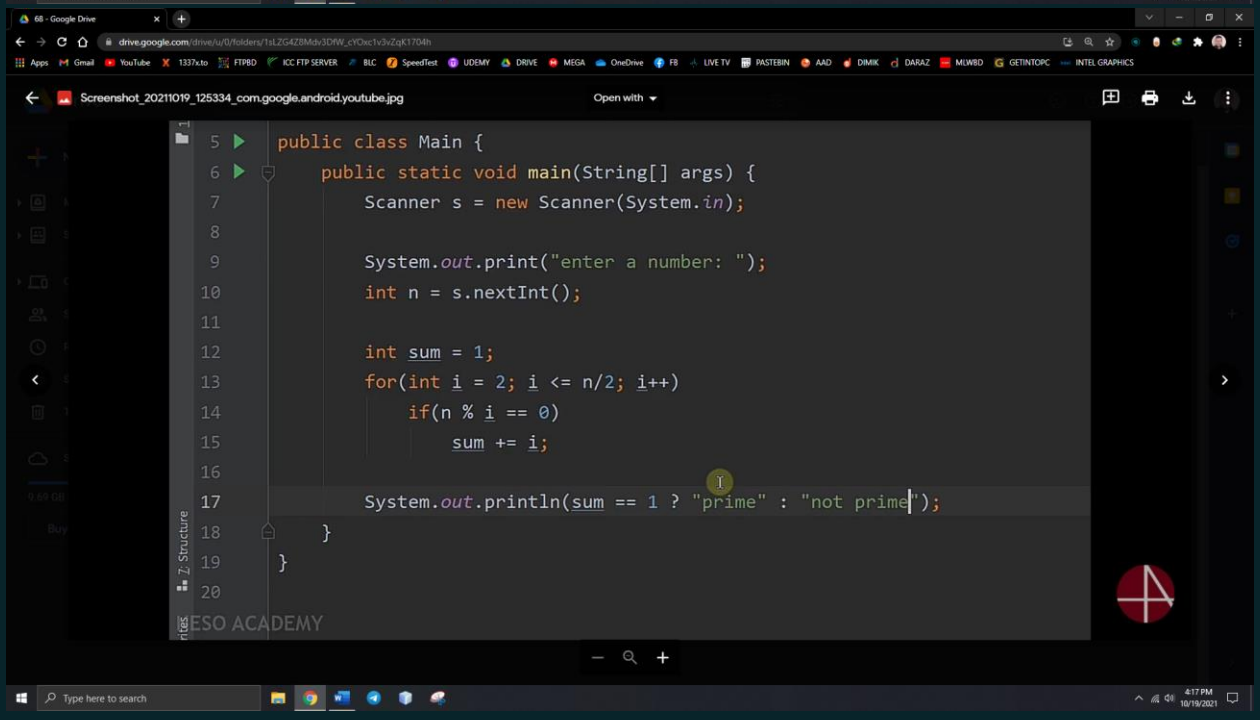


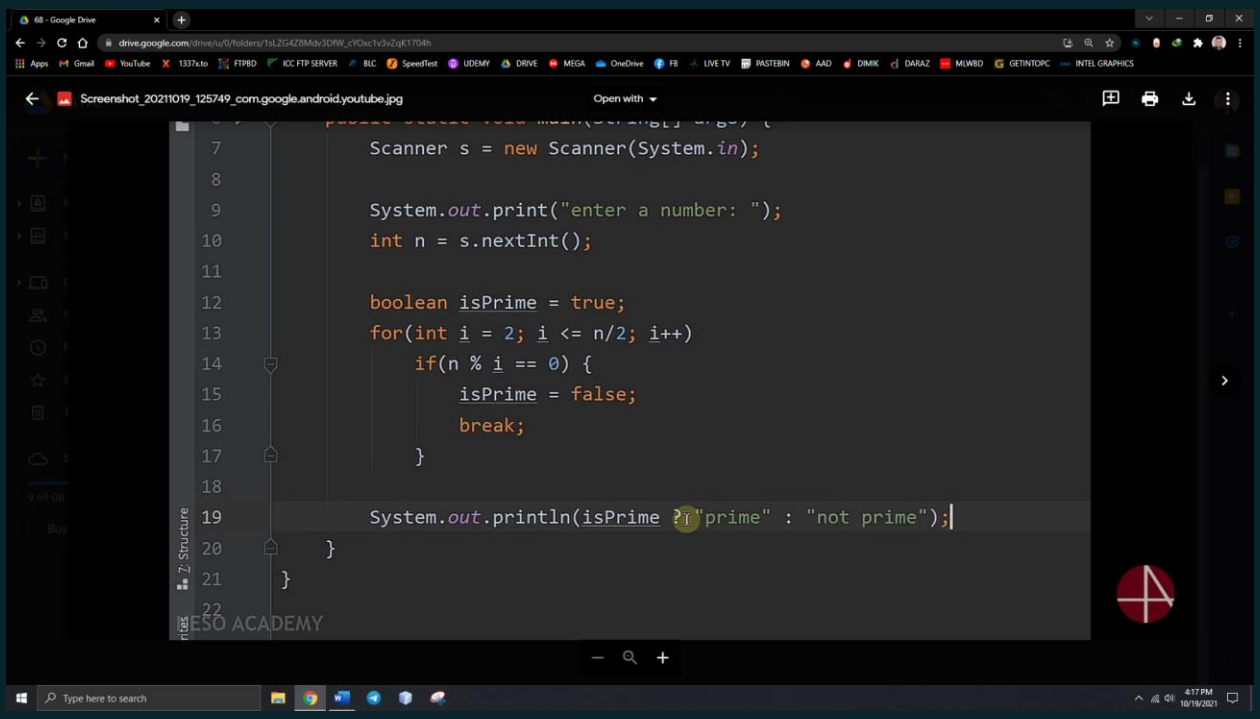



Screenshot_20211019_082233_com.google.android.youtube.jpg
Open with
int sum = 0;
for(int i = 1; i <= n/2; i++)
if(n % i == 0)
System.out.print(i + " ");
// System.out.println(sum);
}
}
Main › main()
Run: Main
"C:\Program Files\Java\jdk-13.0.1\bin\java.exe" "-javaagent:C:\Pr
enter a number: 20
1 2 4 5 10
Process finished with exit code 0
Structure
Type here to search

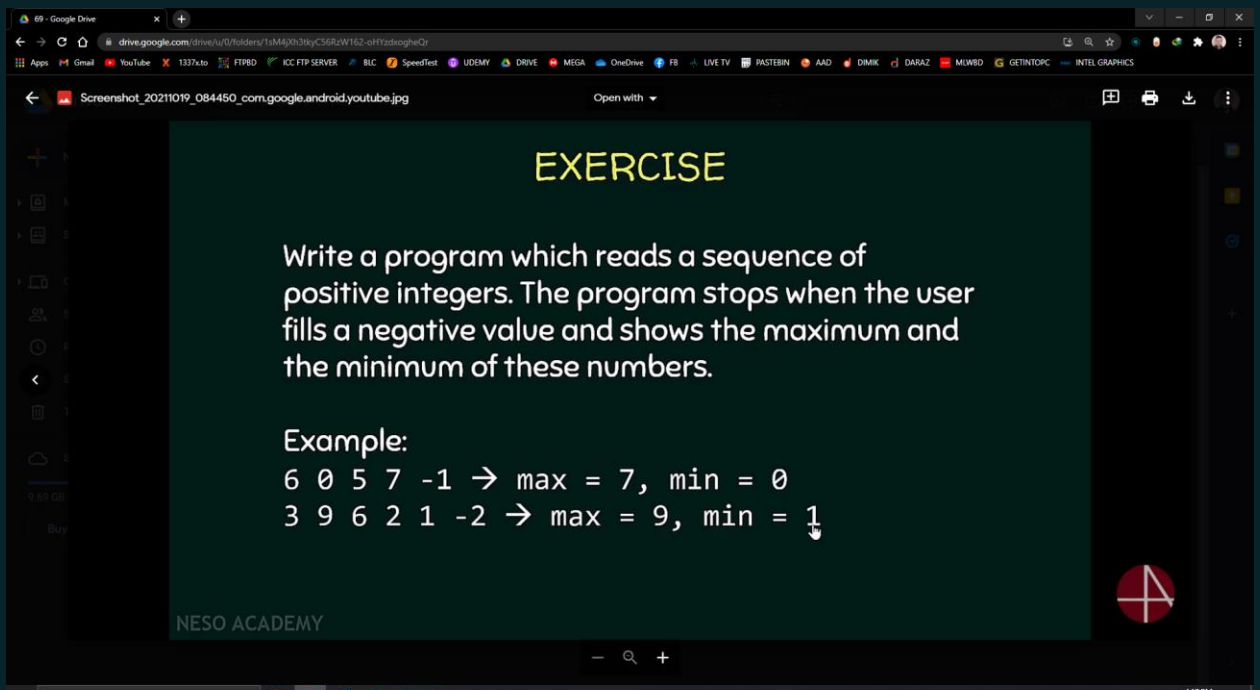
47. Prime number

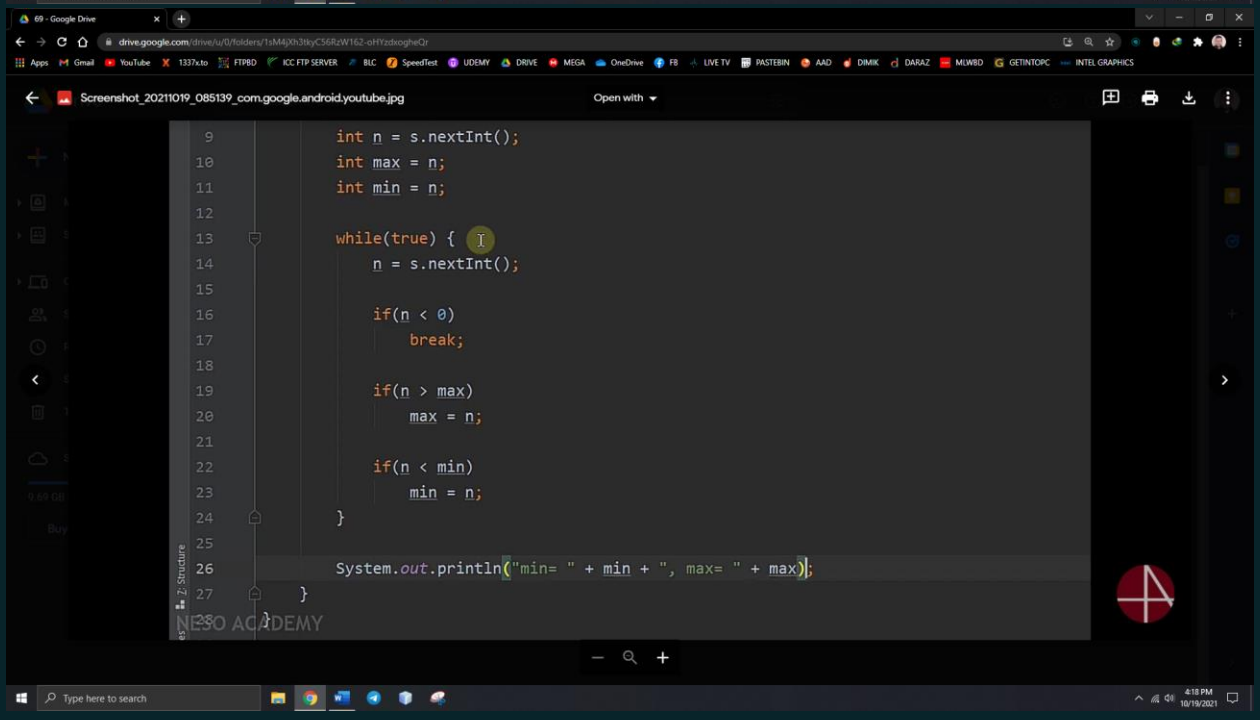


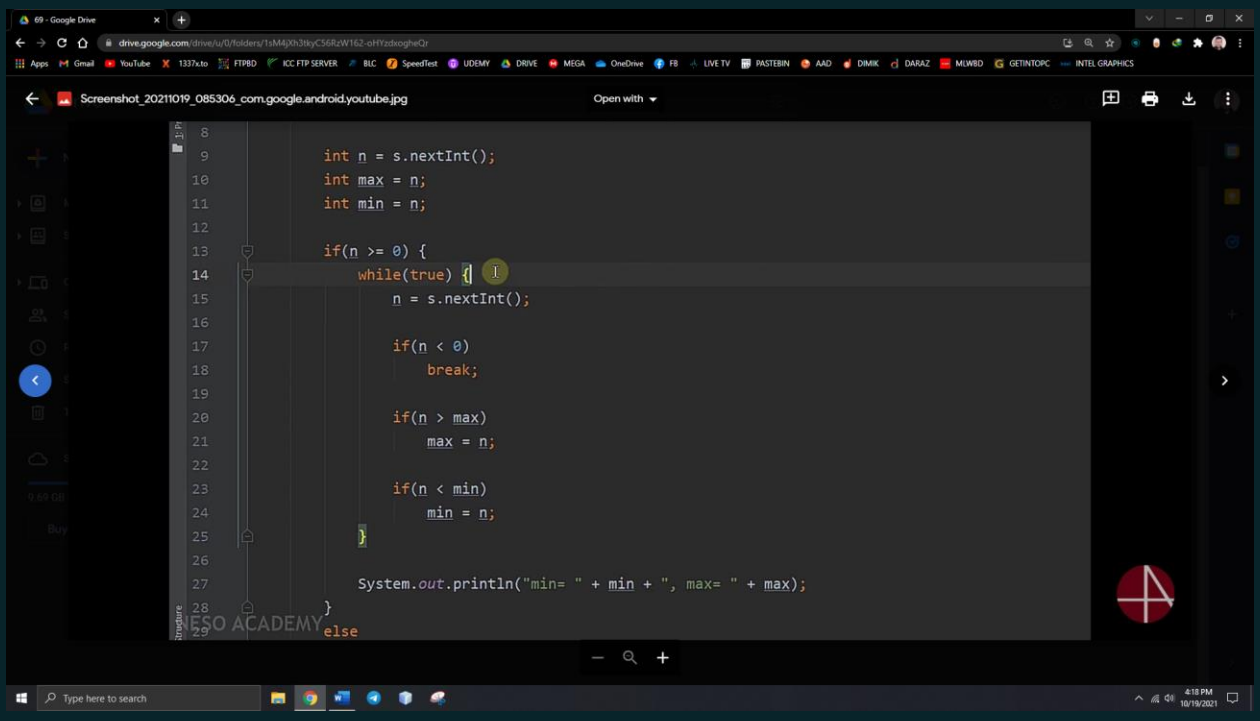



Screenshot_20211019_125749_com.google.android.youtube.jpg
Open with
Scanner s = new Scanner(System.in);
System.out.print("enter a number: ");
int n = s.nextInt();
boolean isPrime = true;
for(int i = 2; i <= n/2; i++)
if(n % i == 0) {
isPrime = false;
break;
}
System.out.println(isPrime ? "prime" : "not prime");
}
}
VESO ACADEMY

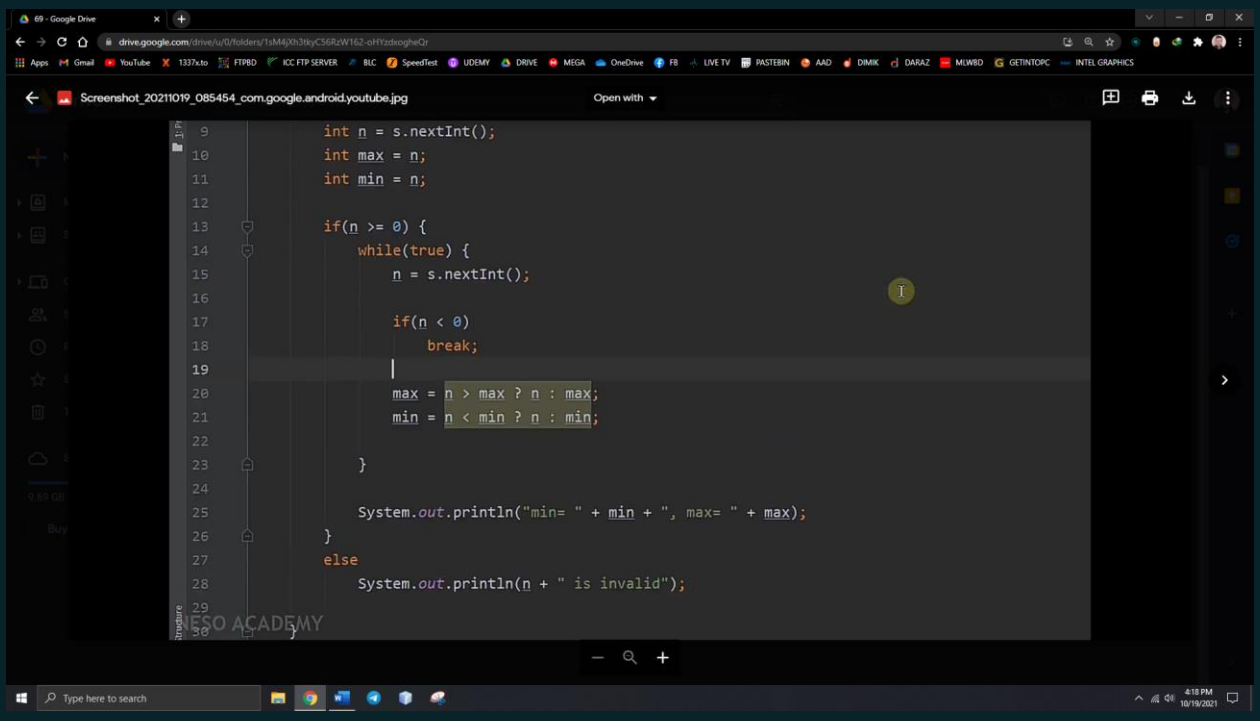
49. finding max and min







Else invalid number



50. display the sum of the digit

Write a program which displays the sum of digits of an integer read from the user.

Example:

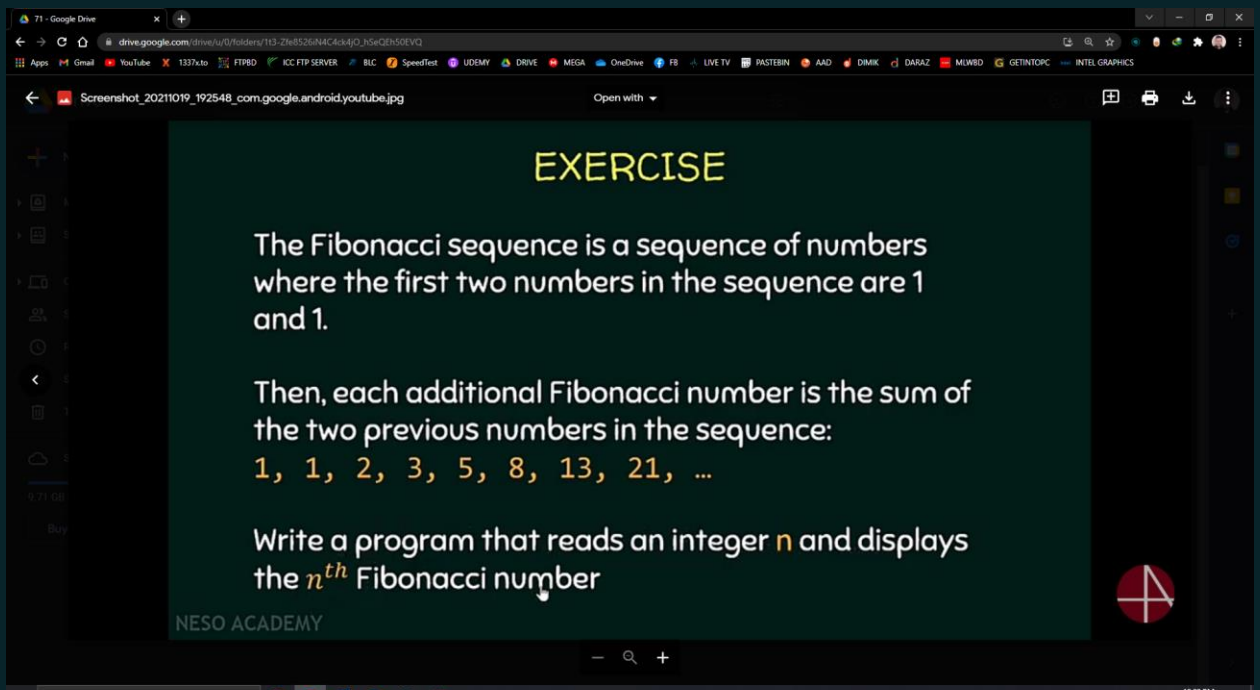
108 → 1 + 0 + 8 = 9

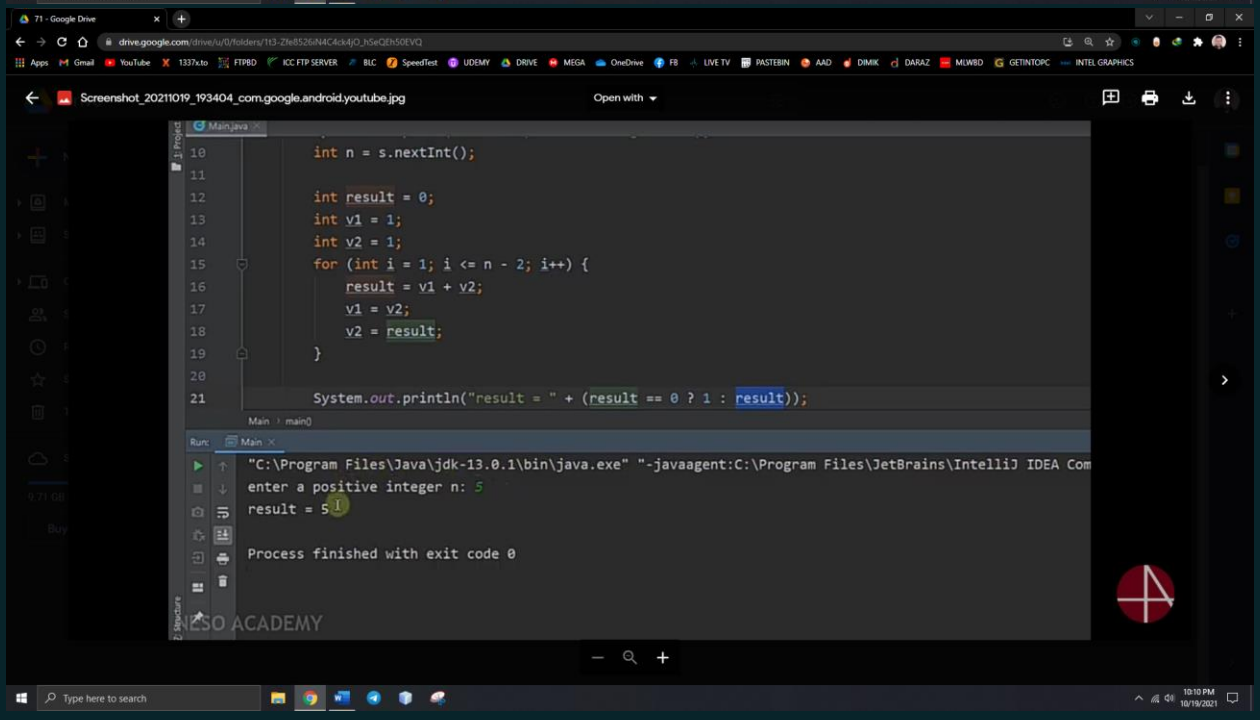
1123 → 1 + 1 + 2 + 3 = 7

12345 → 1 + 2 + 3 + 4 + 5 = 15

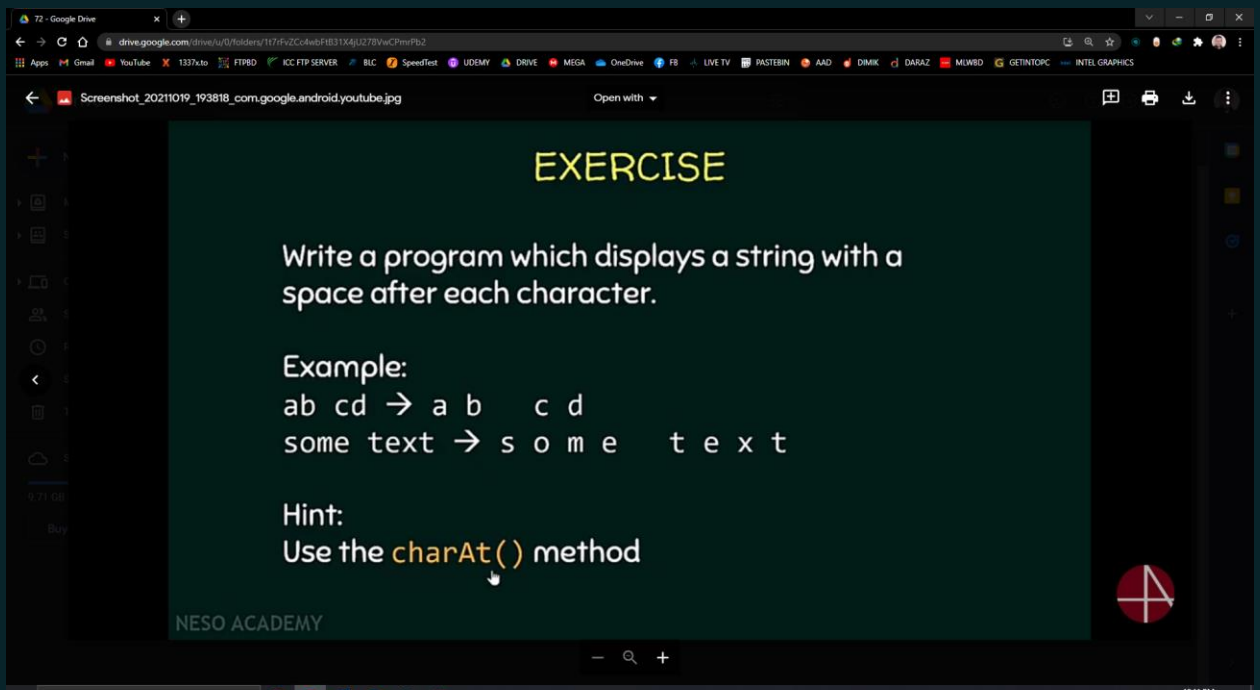
```java
package com.NesoAcademy;

import java.util.Scanner;

public class Main {
    public static void main(String[] args) {
        Scanner s = new Scanner(System.in);

        int n = s.nextInt();
        int sum = 0;
        while( n > 0 ) {
            sum += n % 10; // A
            n /= 10; // 0
        }

        System.out.println("sum= " + sum);
    }
}
```

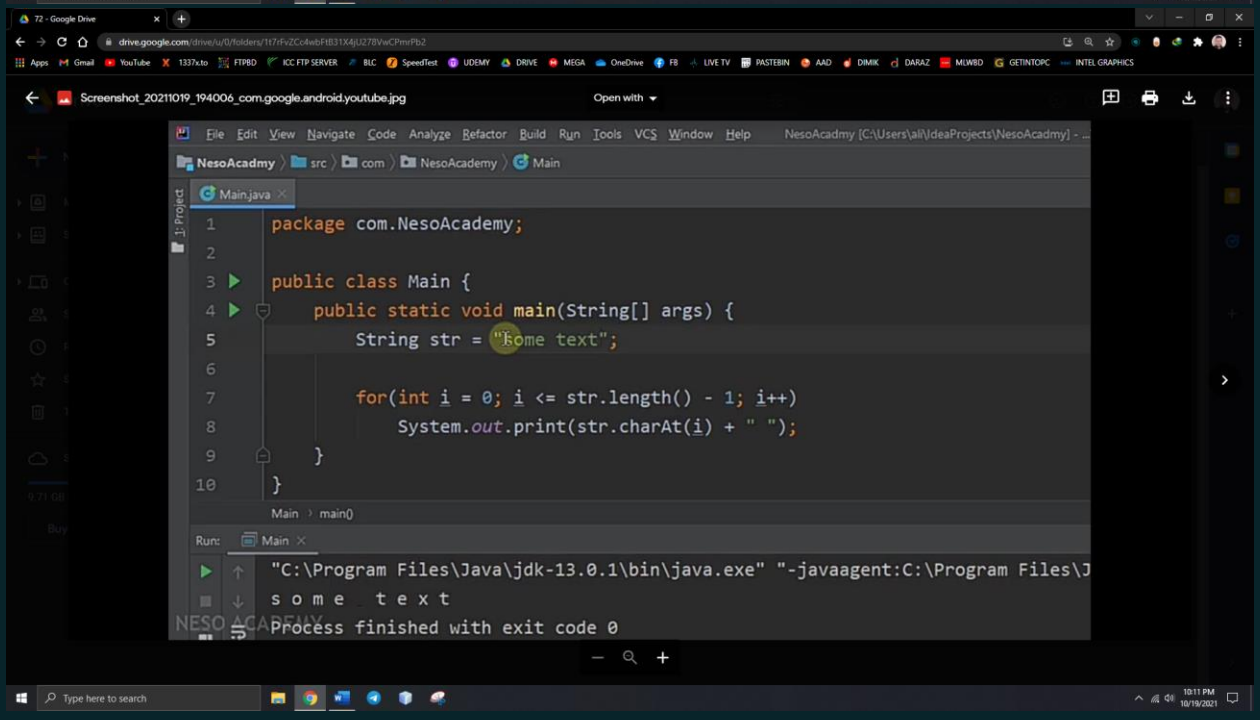
51. Fibonacci number



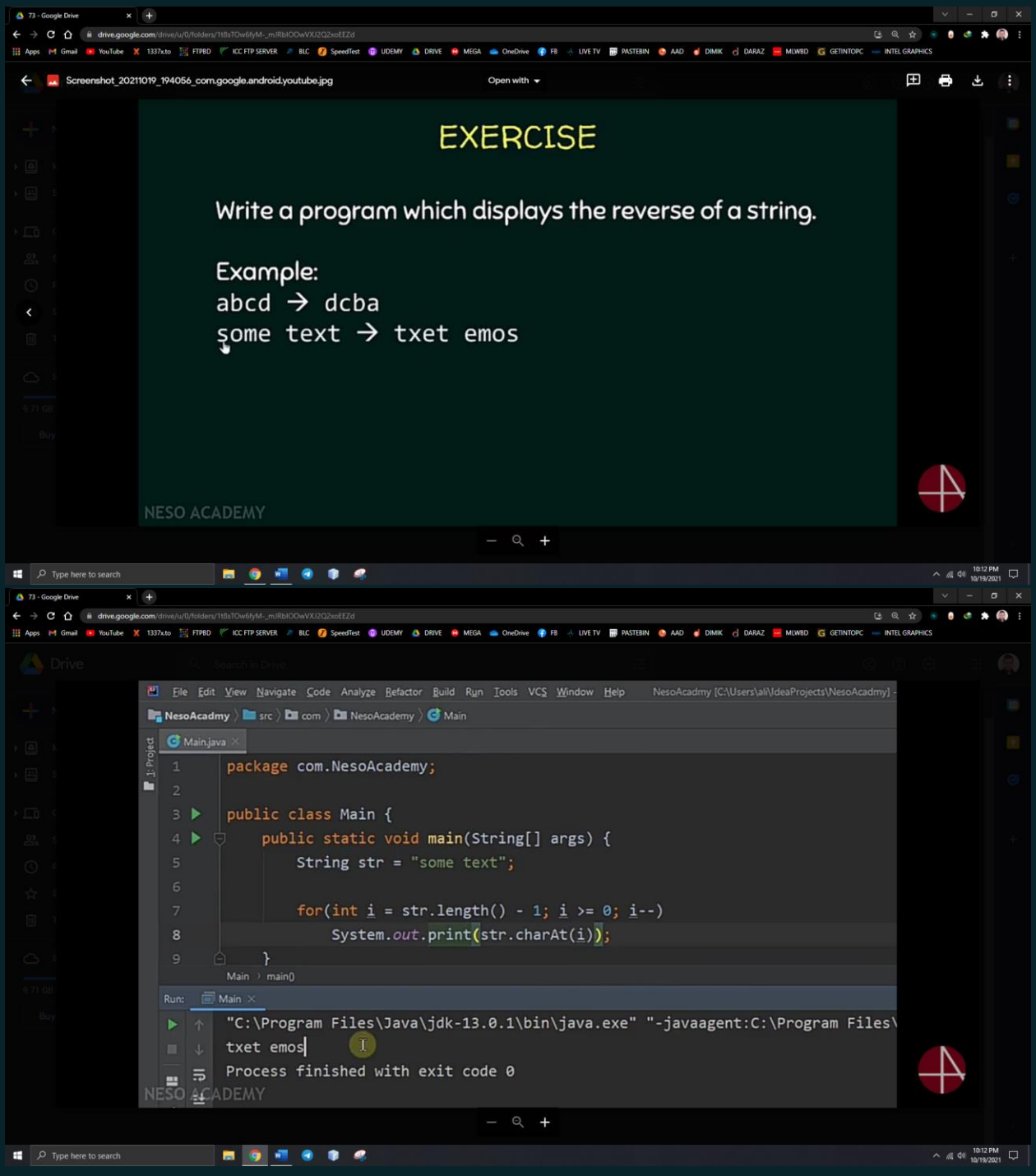


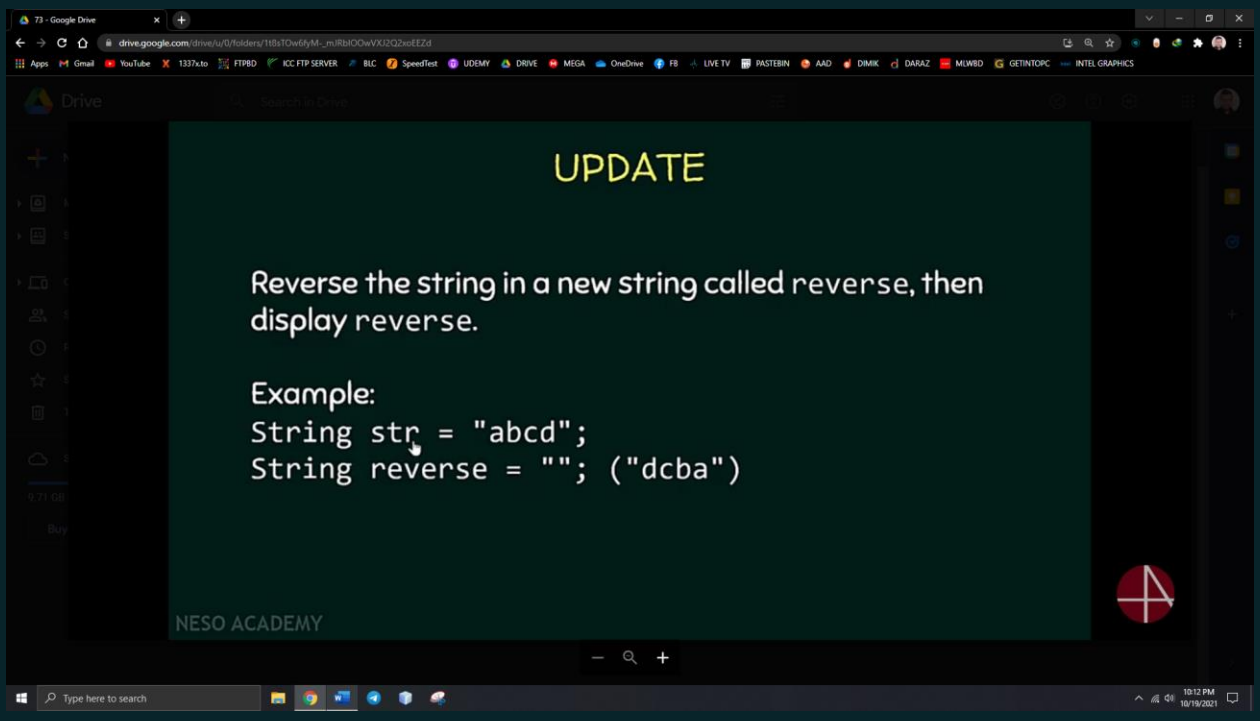
52. display string with a space

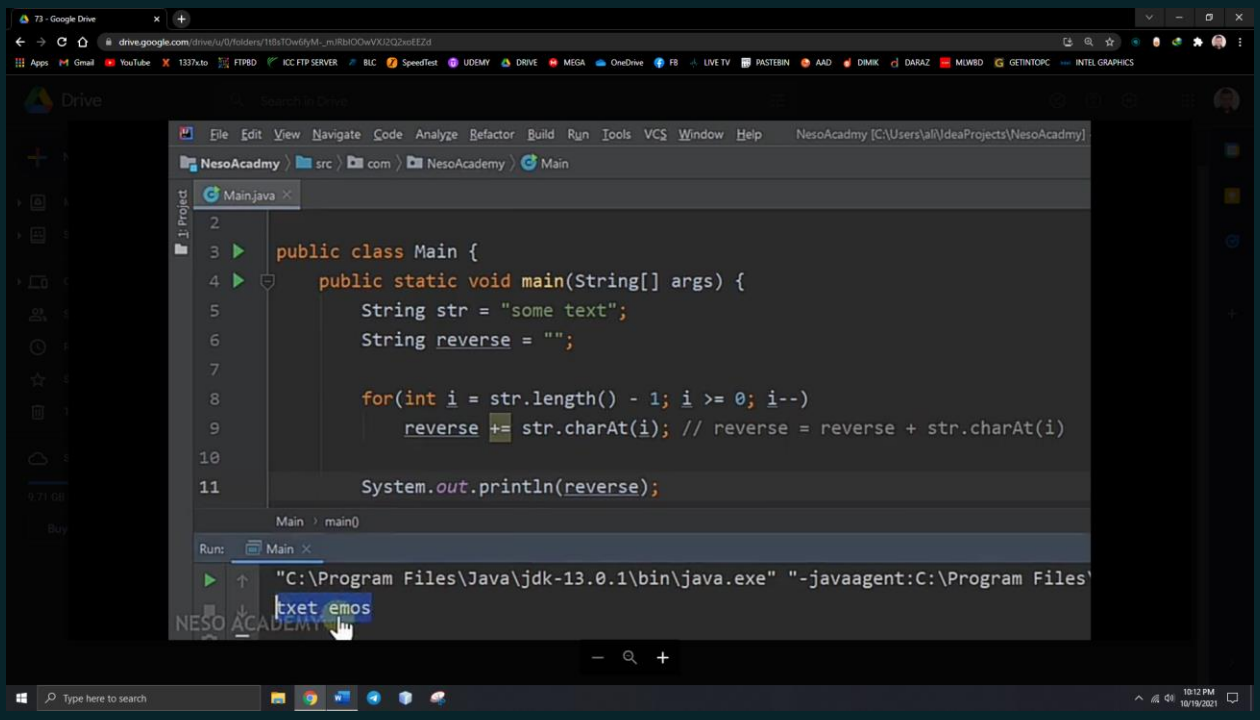




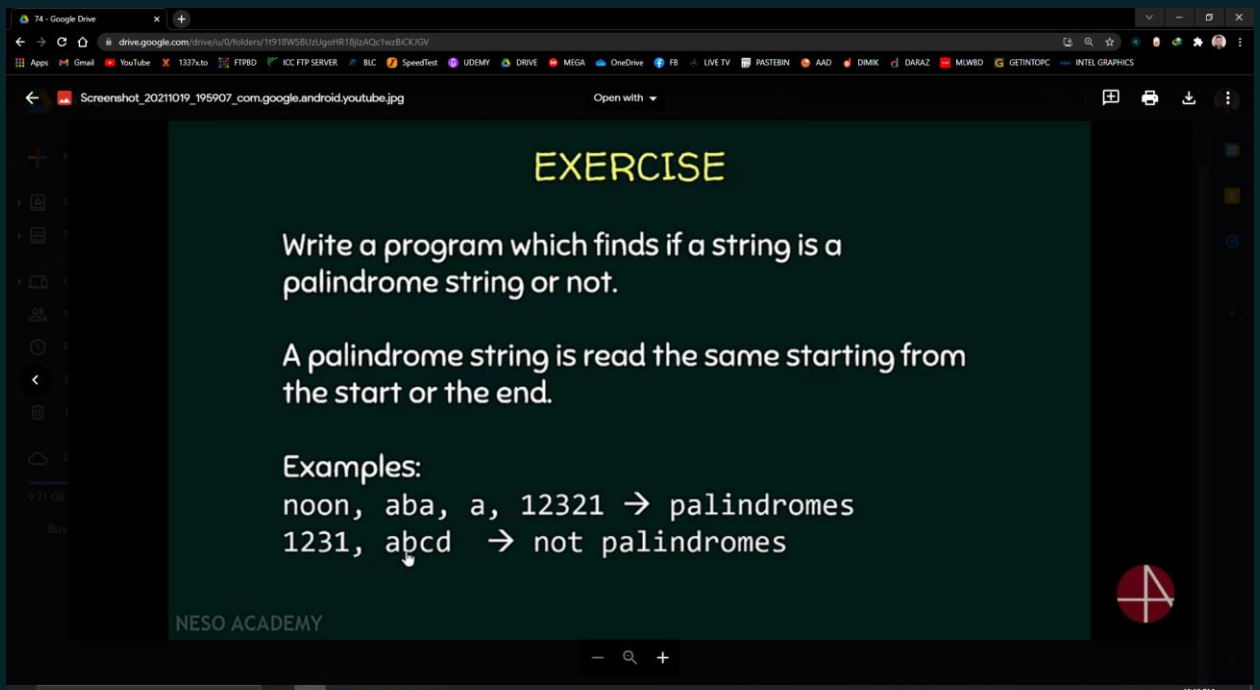
53. reverse string

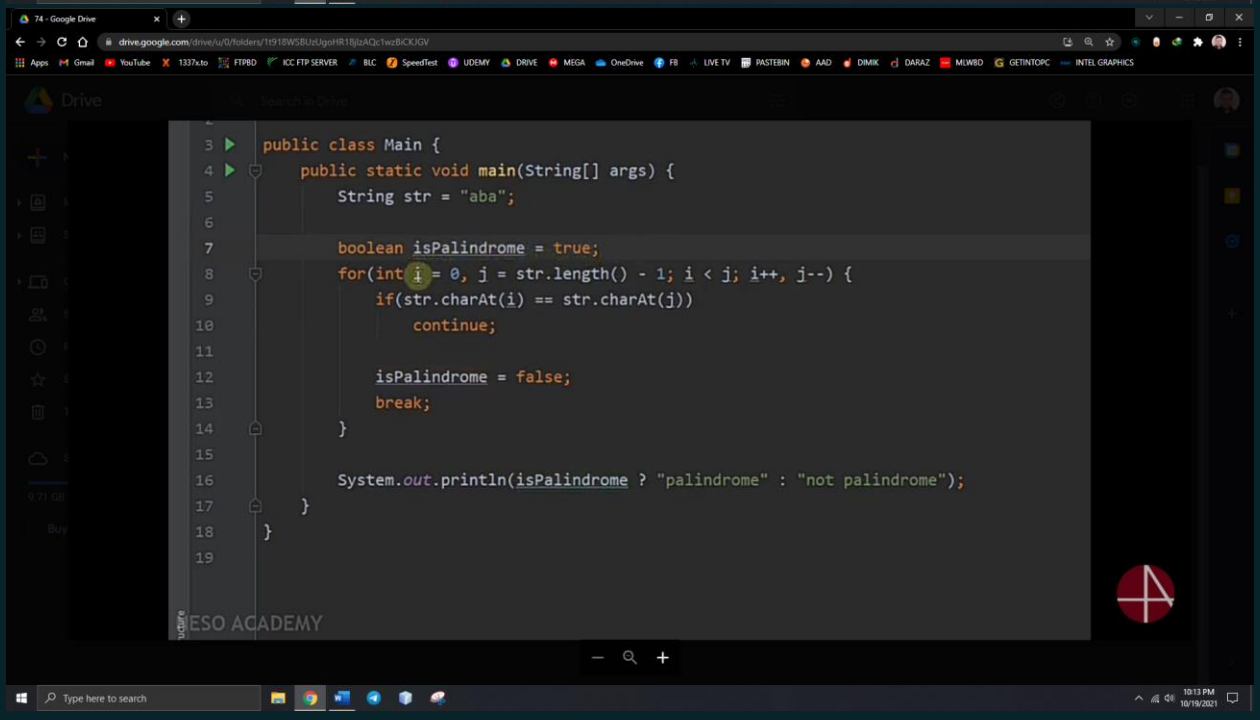



UPDATE
Reverse the string in a new string called reverse, then display reverse.
Example:
String str = "abcd";
String reverse = ""; ("dcba")
NESO ACADEMY


File Edit View Navigate Code Analyze Refactor Build Run Tools VCS Window Help
NesoAcadmy [C:\Users\ali\IdeaProjects\NesoAcadmy]
NesoAcadmy src com NesoAcademy Main
Main.java
public class Main {
public static void main(String[] args) {
String str = "some text";
String reverse = "";
for(int i = str.length() - 1; i >= 0; i--)
reverse += str.charAt(i); // reverse = reverse + str.charAt(i)
System.out.println(reverse);
Main main()
Run: Main
"C:\Program Files\Java\jdk-13.0.1\bin\java.exe" "-javaagent:C:\Program Files
txet emos
NESO ACADEMY

54. String palindrome or not





55. display the following

Write a program that reads a positive integer N from the user and displays the following:

1
22
333
4444
...
NNNNN...N

```java
package com.NesoAcademy;

import java.util.Scanner;

public class Main {
    public static void main(String[] args) {
        Scanner s = new Scanner(System.in);
        int n = s.nextInt();

        for(int i = 1; i <= n; i++) {
            for(int j = 1; j <= i; j++)
                System.out.print(i);

            System.out.println();
```

56.

Write a program that reads a positive integer N and displays the following:

Example for N = 6:

```
     *
    **
   ***
  ****
 *****
******
```

Example for N = 3:

```
  *
 **
***
```

```java
public class Main {
    public static void main(String[] args) {
        Scanner s = new Scanner(System.in);
        int n = s.nextInt();

        for(int i = 1; i <= n; i++) {

            for(int j = 1; j <= n - i; j++)
                System.out.print(" ");

            for(int k = 1; k <= i; k++)
                System.out.print("*");

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

Example for N = 6:

```
     *
    ***
   *****
  *******
 *********
***********
```

Example for N = 3:

```
  *
 ***
*****
```

`2*i - 1`

```java
public class Main {
    public static void main(String[] args) {
        Scanner s = new Scanner(System.in);
        int n = s.nextInt();

        for(int i = 1; i <= n; i++) {

            for(int j = 1; j <= n - i; j++)
                System.out.print(" ");

            for(int j = 1; j <= 2*i - 1; j++)
                System.out.print("*");

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

57.

Write a program that reads a positive integer N and displays the following:

Example for N = 6:

Example for N = 3:

```java
public class Main {
    public static void main(String[] args) {
        Scanner s = new Scanner(System.in);
        int n = s.nextInt();

        for(int i = 1; i <= n; i++) {

            for(int j = 1; j <= n - i; j++)
                System.out.print(" ");

            for(int j = 1; j <= 2*i - 1; j++)
                if(i == n)
                    System.out.print("*");
                else
                    if(j == 1 || j == 2*i -1)
                        System.out.print("*");
                    else
                        System.out.print(" ");

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

58.

Write a program that reads a positive integer N and displays the following:

Example for N = 5:

```
*****
*****
*****
*****
*****
```

Example for N = 3:

```
***
***
***
```

```java
public class Main {
    public static void main(String[] args) {
        Scanner s = new Scanner(System.in);
        int n = s.nextInt();

        for(int i = 1; i <= n; i++) {
            for(int j = 1; j <= n; j++)
                System.out.print("*");

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

Example for N = 5:

```
*****
*   *
*   *
*   *
*****
```

Example for N = 3:

```
***
* *
***
```

```java
public class Main {
    public static void main(String[] args) {
        Scanner s = new Scanner(System.in);
        int n = s.nextInt();

        for(int i = 1; i <= n; i++) {
            if(i == 1 || i == n)
                for(int j = 1; j <= n; j++)
                    System.out.print("*");
            else
                for(int j = 1; j <= n; j++)
                    if(j == 1 || j == n)
                        System.out.print("*");
                    else
                        System.out.print(" ");

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

Example for N = 5:

```
*****
  ***
  ***
  ***
*****
```

Example for N = 3:

```
***
 *
***
```

```
        for(int i = 1; i <= n; i++) {
            if(i == 1 || i == n)
                for(int j = 1; j <= n; j++)
                    System.out.print("*");
            else
                for(int j = 1; j <= n; j++)
                    if(j == 1 || j == n)
                        System.out.print(" ");
                    else
                        System.out.print("*");

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

59. Scope and local variable in java

- The scope of the variable is the part of the program where the variable can be used or referenced.
- A variable define inside a method is called a local variable.
- The scope of a local variable starts from its declaration and continues to the end of the block that contains the value.
- A local variable must be declared or assigned a value before it can be used.
- Parameters are also local variables; their scope is the whole method.

- ❖ args is the local variable for the main method.
- ❖ We can declare the same variable but in different block.

60. Method in java

VOID METHOD: A method that doesn't return a value

```
package neso;

public class Neso {

    public static void main(String[] args) {

        sayHi();

    }

    public static void sayHi() {

        System.out.println("Hi");

    }

}
```

Output: Hi

VALUE RETURNING METHOD:

```
package neso;

public class Neso {

    public static void main(String[] args) {

        int a = 5, b = 5;

        System.out.println("Sum is: "+sum(5, 5));

        // System.out.println(sum(3, 4) + sum(5, 6));

    }

    public static int sum(int x, int y){

        return x + y;

    }

}
```

Output: Sum is: 10

Public: This keyword is used in order to make the method public. Because a public method can access form outside the class.

Static: This is a keyword. We will be able to call the method from inside the main method.

61. Passing arguments by value.

```
package neso;

public class Neso {

    public static void main(String[] args) {

        int x = 1; //this x is local for main method

        increment(x);

        System.out.println(x);//1

        //Arguments are the actual value.

    }

    public static void increment(int x){

        x++;

        System.out.println(x);//2

    }

}
```

Output:

2

1

62. Passing arguments by reference

```
package neso;

import java.awt.Point;

public class Neso {

    public static void main(String[] args) {

        Point p1 = new Point();

        p1.x = 1;

        p1.y = 2;

        System.out.println("x = " + p1.x + ", y = " + p1.y);


        change(p1);

        System.out.println("x = " + p1.x + ", y = " + p1.y);

    }

    public static void change(Point p2) {

        p2.x = 2;

        p2.y = 1;

    }

}

/*

- Passing arguments by reference is apply to all objects.
- p1 is the reference type so it contains the address.
- p1 & p2 are refer to the same point that we created the main method.

*/
```

63. Method overloading

```
package neso;
public class Neso {
    public static void main(String[] args) {
        System.out.println(sum(2, 3));
        System.out.println(sum(2, 3, 4));
        sayHi();
        sayHi("Golam kibria");
    }
    public static int sum(int x, int y) {
        return x + y;
    }
    public static int sum(int x, int y, int z) {
        return x + y + z;
    }
    public static void sayHi() {
        System.out.println("Hi");
    }
    public static void sayHi(String args) {
        System.out.println("Hi " + args);
    }
}
```

Output:

5

9

Hi

Hi Golam Kibria

Overloading:

Writing the same method with different parameter.

Overloading method can have different return type.

Overloading method must have different parameters.

64. Write a method that gets a name and age from the user.

```
package neso;
import java.util.Scanner;
public class Neso {
    public static void main(String[] args) {
        System.out.print("Enter your name and age: ");
        System.out.println(getName() + " " + getAge());
    }
    public static String getName() {
        Scanner input = new Scanner(System.in);
        String name = input.nextLine();
        return name;
        //return new Scanner(System.in).nextLine();
    }
    public static int getAge() {
        Scanner input = new Scanner(System.in);
        int age = input.nextInt();

        return age;
    }
}
```

Output:

```
Enter your name and age: kibria

20

kibria 20
```

65. Prints the prime numbers between two numbers.

```
package neso;
public class Neso {
    public static void main(String[] args) {
        primePrintBetween(10, 50);
    }
    public static boolean isPrime(int n) {
        for (int i = 2; i <= n / 2; i++) {
            if (n % i == 0) {
                return false;
            }
        }
        return true;
    }
    public static void primePrintBetween(int start, int end) {
        for (int i = start; i <= end; i++) {
            if (isPrime(i)) {
                System.out.println(i + " ");
            }
        }
    }
}
```

Output:

11

13

17

19

23

29

31

37

41

43

47

66. Single dimension array-1

Arrays:

- A collection of variables of the same data type.
- An array in java is an object.
- An array variable references a group of data.
- The size of an array is fixed.

Default values:

When an array is created its element are assigned the following default values-

- 0 for the numeric data types.
- \u0000 for char types.
- False for Boolean types.
- Null for reference type.

Creating and printing an array

```java
package neso;

public class Neso {

    public static void main(String[] args) {

        /*
                creating array:
                datatype[] arrayName = new datatype[];
                int[] number = new int[];
        */
        double[] number = {1.2, 4.2, 4.5, 5, 6};

        /*This will print the address*/
        System.out.println(number);

        /*This will print the array*/
        for (int i = 0; i < number.length; i++) {
            System.out.println(number[i] + " ");
        }

        /*Alternative way to print an array*/
        System.out.println("\n");
        double[] num = new double[3];
        num[0] = 1.2;
        num[1] = 2.2;
        num[2] = 3.3;
        for (int i = 0; i < num.length; i++) {
            System.out.println(num[i] + " ");
        }
    }
}
```

```
OUTPUT:
[D@15db9742
1.2
4.2
4.5
5.0
6.0


1.2
2.2
3.3
```

67. Single dimention array-2

```java
package neso;

import java.awt.Point;

public class Neso {

    public static void main(String[] args) {

        char[] ch = {'a', 'b', 'c', 'd'};
        System.out.println(ch);
        /*The indicate must be between 0 and length-1
          ArrayIndexOutOfBoundsException*/


        /*Arrays are passed by reference*/
        int[] num = {1, 2};
        System.out.println("Before changing: ");
        for (int i = 0; i < num.length; i++) {
            System.out.println(num[i] + " ");
        }
        change(num);
        printArray(num);


        /*An object is destroyed when it is no longer referenced by a
variable. But this time the object is refered by variable thats why it will
not be destroyed*/
        Point p = getPoint();
        System.out.println(p);


        int[] n = getNumber();
        printArray(n);
    }

    /*num and num are refer to the same address. Thats why the value of the
variable must be change after execution the change method*/
    public static void change(int[] num) {
        num[0] = 2;
        num[1] = 1;
    }

    public static void printArray(int[] num) {
        System.out.println("After Changing: ");
        for (int i = 0; i < num.length; i++) {
            System.out.println(num[i] + " ");
        }
    }
```

```java
    public static Point getPoint(){
        return new Point(1, 2);
        /*1 is called absessa and 2 is  called ordinate*/
    }

    public static int[] getNumber(){
        int[] n = {1, 2, 3, 4, 5};
        return n;
        /*return new int[] {1, 2, 3, 4, 5};*/
    }
}


/*
    -Anonymous arrays: An array without a variable referencing it.
    -Array is passed by reference to a method.
    -If we want to return an array from a method the address of the
     array is returned.
    -As long as we have a variable that is referencing to the array,
     the array is still existing in the memory and it will not be destroyed.
*/


OUTPUT:
abcd
Before changing:
1
2
After Changing:
2
1
java.awt.Point[x=1,y=2]
After Changing:
1
2
3
4
5
```

68. Array class(sorting)

A class that contains some static methods that are used with arrays.

```java
package neso;

import java.util.Arrays;

public class Neso {

    public static void main(String[] args) {

        int[] numbers = {4, 3, 6, 1, 7, 8};
        Arrays.sort(numbers);
        for (int i = 0; i < numbers.length; i++) {
            System.out.print(numbers[i] + " ");
        }

        System.out.println("\n");
        char[] ch = {'e', 'a', 'A', 'f', 'D'};
        Arrays.sort(ch);
        for (int i = 0; i < ch.length; i++) {
            System.out.print(ch[i] + " ");
        }

        System.out.println("\n");
        int[] unicode = {'e', 'a', 'A', 'f', 'D'};
        Arrays.sort(unicode);
        for (int i = 0; i < unicode.length; i++) {
            System.out.print(unicode[i] + " ");
        }

        System.out.println("\n");
        int[] num = {4, 2, 6, 5, 7, 1}; //1, 4+1
        Arrays.sort(num, 1, 5);
        for (int i = 0; i < num.length; i++) {
            System.out.print(num[i] + " ");
        }

        System.out.println("\n");
        String[] str = {"hi", "hello", "kibria"};
        Arrays.sort(str);
        for (int i = 0; i < str.length; i++) {
            System.out.print(str[i] + " ");
        }
        System.out.println("\n");
    }
}
```

```
OUTPUT:
1 3 4 6 7 8

A D a e f

65 68 97 101 102

4 2 5 6 7 1

hello hi kibria
```

69. Array class(Searching)

```java
package neso;

import java.util.Arrays;

public class Neso {

    public static void main(String[] args) {

        int[] number = {5, 4, 3, 2, 1, 0, -1};
        Arrays.sort(number); //-1, 0, 1, 2, 3, 4, 5

        System.out.println(Arrays.binarySearch(number, 4));
        System.out.println(Arrays.binarySearch(number, 3));
        System.out.println(Arrays.binarySearch(number, -3));
        System.out.println(Arrays.binarySearch(number, 6));

        System.out.println("\n");
        String[] str = {"a", "b", "c"};
        System.out.println(Arrays.binarySearch(str, "a"));
        System.out.println(Arrays.binarySearch(str, "c"));
        System.out.println(Arrays.binarySearch(str, "A"));
        System.out.println(Arrays.binarySearch(str, "d"));
    }
}

OUTPUT:
5
4
-1
-8



0
2
-1
-4
```

70. Array class(equals)

```java
package neso;

import java.awt.Point;
import java.util.Arrays;

public class Neso {

    public static void main(String[] args) {

        int[] num1 = {1, 2, 3, 4, 5};
        int[] num2 = {1, 2, 3, 4, 5};
        int[] num3 = {7, 8, 9, 10};
        System.out.println(num1 == num2); //= compare the address.
        System.out.println(Arrays.equals(num1, num2));
        System.out.println(Arrays.equals(num1, num3));

        System.out.println("\n");
        //compare content to the string
        String[] str1 = {"a", "b", "c"};
        String[] str2 = {"a", "b", "c"};
        System.out.println(str1 == str2);
        System.out.println(Arrays.equals(str1, str2));

        System.out.println("\n");
        Point[] p1 = {new Point(1, 2), new Point(3, 4)};
        Point[] p2 = {new Point(1, 2), new Point(3, 4)};
        Point[] p3 = {new Point(6, 7), new Point(8, 9)};
        System.out.println(p1 == p2);
        System.out.println(Arrays.equals(p1, p2));
        System.out.println(Arrays.equals(p1, p3));

        System.out.println("\n");
        String s1 = new String("Hello");
        String s2 = new String("Hello");
        System.out.println(s1 == s2);
        System.out.println(s1.equals(s2));

        System.out.println("\n");
        Point point1 = new Point(1, 2);
        Point point2 = new Point(1, 2);
        System.out.println(point1 == point2);
        System.out.println(point1.equals(point2));

    }
}
```

```
OUTPUT:
false
true
false


false
true


false
true
false


false
true


false
true
```

71. Array class(filling and toString)

```java
package neso;

import java.awt.Point;
import java.util.Arrays;

public class Neso {

    public static void main(String[] args) {

        //fill(array, value)
        int[] num1 = new int[8];
        Arrays.fill(num1, 3);
        for (int i = 0; i < num1.length; i++) {
            System.out.print(num1[i] + " ");
        }


        System.out.println("\n");
        //fill(array, fromindex, toindex, value)
        int[] num2 = new int[8];
        Arrays.fill(num2, 3, 7, 4);
        for (int i = 0; i < num2.length; i++) {
            System.out.print(num2[i] + " ");
        }

        System.out.println("\n");
        String[] str = new String[3];
        Arrays.fill(str, "hi");
        for (int i = 0; i < str.length; i++) {
            System.out.print(str[i]+" ");
        }

        System.out.println("\n");
        Point[] p = new Point[3];
        Arrays.fill(p, 0, 2, new Point(1, 2));
        for (int i = 0; i < p.length; i++) {
            System.out.println(p[i]+" ");
        }
        System.out.println("\n");

        /*Alternative way to print array of string*/
        System.out.println(Arrays.toString(str));
        System.out.println(Arrays.toString(p));

        int[] x = {1, 2, 3, 4, 5};
        System.out.println(Arrays.toString(x));
    }
}
```

```
OUTPUT:
3 3 3 3 3 3 3 3

0 0 0 4 4 4 4 0

hi hi hi

java.awt.Point[x=1,y=2]
java.awt.Point[x=1,y=2]
null


[hi, hi, hi]
[java.awt.Point[x=1,y=2], java.awt.Point[x=1,y=2], null]
[1, 2, 3, 4, 5]
```

72. Variable length arguments

```
package neso;

public class Neso {

    public static void main(String[] args) {

        System.out.println(sum(1, 7));
        System.out.println(sum(1, 3, 4));
        System.out.println(sum(6, 7, 8, 9));

        int[] n = {1, 2, 3, 4};
        System.out.println(sum(n));
        /*Annonymus array*/
        System.out.println(sum(new int[]{1, 2, 3, 4}));
    }

    public static int sum(int... numbers) {
        int sum = 0;
        for (int i = 0; i < numbers.length; i++) {
            sum = sum + numbers[i];
        }
        return sum;
    }
}
/*
    Only one variable length parameter may be specidied in a method.
    It must be the last parameter.
    Any other parameter must precede it.
    We can pass an array or a variable length of arguments to a variable
length parameter.
    When invoking a method with a variable length of arguments, java created
an array and passes the argument to it.
*/


Output:
8
8
30
10
10
```

All the variable length argumetns must be put before the variable LA.

73. Write a program that fills an array with n integers entered by user. (at least 1 number and maximum 20 numbers)

```
package neso;

import java.util.Arrays;
import java.util.Scanner;

public class Neso {

    public static void main(String[] args) {

        Scanner input = new Scanner(System.in);
        int n;
        System.out.println("How many numbers? (max 20)");
        n = input.nextInt();

        while (n > 20 || n <= 0) {
            System.out.println("Invalid number....Please try
again!!");
            n = input.nextInt();
        }

        int[] numbers = new int[n];
        fillArrayOfInteger(numbers);
        printArrayOfInteger(numbers);
    }

    private static void fillArrayOfInteger(int[] numbers) {
        Scanner input = new Scanner(System.in);
        System.out.println("Enter elements one by one: ");
        for (int i = 0; i < numbers.length; i++) {
            numbers[i] = input.nextInt();
        }
    }

    private static void printArrayOfInteger(int[] numbers) {
        System.out.println("The elements are: ");
        System.out.println(Arrays.toString(numbers));
    }
}
```

```
OUTPUT:
How many numbers? (max 20)
33
Invalid number....Please try again!!
3
Enter elements one by one:
5
6
7
The elements are:
[5, 6, 7]
```

74. Fill an array with n integer using point.

```java
package neso;

import java.awt.Point;
import java.util.Scanner;

public class Neso {

    public static void main(String[] args) {

        Scanner input = new Scanner(System.in);
        int n;
        System.out.println("How many numbers? (max 20)");
        n = input.nextInt();

        while (n > 20 || n <= 0) {
            System.out.println("Invalid number....Please try again!!");
            n = input.nextInt();
        }

        Point[] p = new Point[n];
        fillArrayOfInteger(p);
        printArrayOfInteger(p);
    }

    private static void fillArrayOfInteger(Point[] p) {
        Scanner input = new Scanner(System.in);
        for (int i = 0; i < p.length; i++) {
            System.out.println("Enter x and y for point " + (i + 1) + ": ");
            p[i] = new Point(input.nextInt(), input.nextInt());
        }
    }

    private static void printArrayOfInteger(Point[] p) {
        System.out.println("The elements are: ");
        for (int i = 0; i < p.length; i++) {
            System.out.println("(" + p[i].x + ", " + p[i].y + ")");
        }
        //for(Point p1 : p) its alternative way.
    }
}
```

```
Output:
How many numbers? (max 20)
3
Enter x and y for point 1:
1 2
Enter x and y for point 2:
3 4
Enter x and y for point 3:
5 6
The elements are:
(1, 2)
(3, 4)
(5, 6)
```

75. Write a program that display the sum, product and average of an integer array.

```java
package neso;

import java.util.Scanner;

public class Neso {

    public static void main(String[] args) {

        //int[] num = {1, 2, 3, 4, 5};
        Scanner input = new Scanner(System.in);
        System.out.println("How many number? ");
        int n = input.nextInt();
        int[] num = new int[n];
        for (int i = 0; i < n; i++) {
            num[i] = input.nextInt();
        }
        int sum = 0;
        int product = 1;
        double average;

        for (int i = 0; i < num.length; i++) {
            sum = sum + num[i];
            product = product * num[i];
        }

        average = (double) sum / num.length;
        System.out.println("The sum is: " + sum);
        System.out.println("The product is: " + product);
        System.out.println("The average is: " + average);

    }
}
```

```
OUTPUT:
How many number?
3
1
2
3
The sum is: 6
The product is: 6
The average is: 2.0
```

76. Write a program that display the number of occurrences of an element in the array.

```
package neso;

public class Neso {

    public static void main(String[] args) {

        int[] numbers = {1, 3, 3, 4, 5, 7};
        int searchElement = 3;

        int f = find(numbers, searchElement);
        System.out.println(f + " times");
    }

    public static int find(int[] numbers, int s) {
        int occ = 0;
        for (int i = 0; i < numbers.length; i++) {
            if (numbers[i] == s) {
                occ++;
            }
        }
        return occ;
    }
}
/*
    Without using find method:
       int occ = 0;
        for (int i = 0; i < numbers.length; i++) {
            if(searchElement == numbers[i]){
                occ++;
            }
        }
        System.out.println(occ +" times");
*/

Output:
2 times
```

77. Display the maximum and minimum element of an array.

```java
package neso;

public class Neso {

    public static void main(String[] args) {

        int[] num = {1, 4, 2, 5, 6};

        int min = num[0];
        int max = num[0];

        for (int i = 1; i < num.length; i++) {
            min = (num[i] < min) ? num[i] : min;
            max = (num[i] > max) ? num[i] : max;
        }
        System.out.println("Minimum is: " + min + " & maximum is: " + max);
    }
}

Output:
Minimum is: 1 & maximum is: 6
```

78. Write a program that places the odd element of an array before the even element.

```java
package neso;

import java.util.Arrays;

public class Neso {

    public static void main(String[] args) {

        int[] n = {1, 4, 2, 5, 7, 8, 10};
        int[] temp = new int[n.length];

        int j = 0;
        int k = n.length - 1;

        for (int i = 0; i < n.length; i++) {
            if (n[i] % 2 != 0) {
                temp[j++] = n[i];
            } else {
                temp[k--] = n[i];
            }
        }

        for (int i = 0; i < temp.length; i++) {
            n[i] = temp[i];
        }
        System.out.println(Arrays.toString(n));
    }
}

/*
    USING ANOTHER METHOD:

    copyArray(temp, n);
    System.out.println(Arrays.toString(n));
    public static void copyArray(int[] temp, int[] n){
        for (int i = 0; i < temp.length; i++) {
            n[i] = temp[i];
        }
}
*/

OUTPUT:
[1, 5, 7, 10, 8, 2, 4]
```

79. 2D array

```
package student;

public class TwoArray {

    public static void main(String[] args) {

        int[][] num = new int[2][2];

        num[0][0] = 2;
        num[0][1] = 3;
        num[1][0] = 4;
        num[1][1] = 5;
        System.out.print(num[0][0] + " ");
        System.out.println(num[0][1]);
        System.out.print(num[1][0] + " ");
        System.out.println(num[1][1]);
    }
}
```

OUTPUT:

2 3

4 5

80. 2D array printing row by row

```java
package student;

public class TwoArray {

    public static void main(String[] args) {

        int[][] num = {{1, 2}, {3, 4}};

        //printing first row
        System.out.print(num[0][0] + " ");
        System.out.println(num[0][1]);

        //printing second row
        System.out.print(num[1][0] + " ");
        System.out.println(num[1][1]);

        System.out.println();

        for (int i = 0; i < 2; i++) {
            for (int j = 0; j < 2; j++) {
                System.out.print(num[i][j] + " ");
            }
            System.out.println();
        }
    }
}

OUTPTUT:
1 2
3 4

1 2
3 4
```

81. 2D array printing column by column

```java
package student;

public class TwoArray {

    public static void main(String[] args) {

        int[][] num = {
            {1, 2},
            {3, 4}
        };

        //printing first column
        System.out.print(num[0][0] + " ");
        System.out.println(num[1][0] + " ");

        //printing second column
        System.out.print(num[0][1] + " ");
        System.out.println(num[1][1] + " ");

        System.out.println();

        for (int i = 0; i < 2; i++) {
            for (int j = 0; j < 2; j++) {
                System.out.print(num[j][i] + " ");
            }
            System.out.println();
        }
    }
}
```

```
OUTPUT:
1 3
2 4

1 3
2 4
```

82. Printing arrays using toString method

```
package student;

import java.util.Arrays;

public class TwoArray {

    public static void main(String[] args) {

       int[][] num = {{1, 2}, {3, 4}};

        System.out.println(Arrays.toString(num));
        System.out.println(Arrays.deepToString(num));
    }
}
```

Output:

```
[[I@15db9742, [I@6d06d69c]
[[1, 2], [3, 4]]
```

83. Printing a 2D array using method.

```
package student;
public class TwoArray {
    public static void main(String[] args) {

        int[][] num = getArray();
        printArray(num);

    }

    public static int[][] getArray() {
        return new int[][]{{1, 2, 3}, {4, 5, 6}, {7, 8, 9}};
    }

    public static void printArray(int[][] num) {
        for (int i = 0; i < 3; i++) {
            for (int j = 0; j < 3; j++) {
                System.out.print(num[i][j] + " ");
            }
            System.out.println();
        }
    }
}
```

Output:

```
1 2 3
4 5 6
7 8 9
```

84. Ragged arrays

```
package student;
public class TwoArray {
    public static void main(String[] args) {

        int[][] num = {
            {1, 2, 3},
            {4, 5},
            {6, 7, 8}
        };
        printArray(num);
    }

    public static void printArray(int[][] num) {
        for (int i = 0; i < num.length; i++) {
            for (int j = 0; j < num[i].length; j++) {
                System.out.print(num[i][j] + " ");
            }
            System.out.println();
        }

    }
}
```

Output:

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

85. Print the sum of each row and each column of an 2D array.

```java
package student;

public class A {

    public static void main(String[] args) {
        int[][] num = {
            {1, 2, 3},
            {4, 5, 6},
            {7, 8, 9}
        };

        //printing row by row
        for (int i = 0; i < 3; i++) {
            int sum = 0;
            for (int j = 0; j < 3; j++) {
                sum = sum + num[i][j];
            }
            System.out.println("Sum of row " + (i + 1) + ": " + sum);
        }

        System.out.println();
        //printing column by column
        for (int i = 0; i < 3; i++) {
            int sum = 0;
            for (int j = 0; j < 3; j++) {
                sum = sum + num[j][i];
            }
            System.out.println("Sum of column " + (i + 1) + ": " + sum);
        }
    }
}
```

```
Output:
Sum of row 1: 6
Sum of row 2: 15
Sum of row 3: 24

Sum of column 1: 12
Sum of column 2: 15
Sum of column 3: 18
```

86. Prints the maximum of each row and each column in a 2D array.

```java
package student;

public class A {

    public static void main(String[] args) {
        int[][] num = {
            {1, 2, 3},
            {4, 5, 6},
            {7, 8, 9}
        };

        //printing row maximum
        for (int i = 0; i < 3; i++) {
            int max = num[i][0];
            for (int j = 1; j < 3; j++) {
                max = (num[i][j] > max) ? num[i][j] : max;
            }
            System.out.println("Maximum of row " + (i + 1) + ": " + max);
        }

        //printing column maximum
        System.out.println();
        for (int i = 0; i < 3; i++) {
            int max = num[i][0];
            for (int j = 1; j < 3; j++) {
                max = (num[j][i] > max) ? num[j][i] : max;
            }
            System.out.println("Maximum of column " + (i + 1) + ": " + max);
        }
    }
}
```

```
Output:
Maximum of row 1: 3
Maximum of row 2: 6
Maximum of row 3: 9

Maximum of column 1: 7
Maximum of column 2: 8
Maximum of column 3: 9
```

87. Print the maximum of each row using method.

```java
package student;

public class A {

    public static void main(String[] args) {
        int[][] num = {
            {1, 2, 3},
            {4, 5, 6},
            {7, 8, 9}
        };

        for (int i = 0; i < 3; i++) {
            System.out.println("Maximum of row " + (i + 1) + ": " +
getMax(num[i]));
        }
    }

    public static int getMax(int[] num) {
        int max = num[0];
        for (int i = 0; i < num.length; i++) {
            max = (max > num[i]) ? max : num[i];
        }
        return max;
    }
}
//Maximum of column ata try korlei parbo inshah-Allah
```

```
Output:
Maximum of row 1: 3
Maximum of row 2: 6
Maximum of row 3: 9
```

88. Using the add(), get(), set(), remove(), size() method.

```java
package student;

import java.util.ArrayList;

public class A {

    public static void main(String[] args) {

        ArrayList<Integer> num1 = new ArrayList<>();
        ArrayList<Double> num2 = new ArrayList<>();
        ArrayList<String> fruit = new ArrayList<>();

        System.out.println("Using the add() method: ");
        fruit.add("Apple");
        fruit.add("Banana");
        fruit.add("Orange");
        System.out.println(fruit);
        fruit.add(2, "Pepy");
        System.out.println(fruit);
        fruit.add(4, "Pineapple");
        System.out.println(fruit);

        System.out.println("\nUsing the get() method: ");
        System.out.println(fruit.get(1));
        System.out.println(fruit.get(3));

        System.out.println("\nUsing the set() method: ");
        fruit.set(1, "Kola");
        System.out.println(fruit);

        System.out.println("\nUsing the remove() & size() method: ");
        System.out.println("Before removing the size is: "+fruit.size());
        fruit.remove(1);
        System.out.println(fruit);
        System.out.println(fruit.size());
        fruit.remove("Orange");
        System.out.println(fruit);
        fruit.clear();
        System.out.println(fruit);
        System.out.println(fruit.size());
    }
}
/*
In an array list we can store object(String, Double, Integer, Boolean,
Character) but not a premitive type(string, double, int, double, char)
*/
```

```
OUTPUT:
Using the add() method:
[Apple, Banana, Orange]
[Apple, Banana, Pepy, Orange]
[Apple, Banana, Pepy, Orange, Pineapple]

Using the get() method:
Banana
Orange

Using the set() method:
[Apple, Kola, Pepy, Orange, Pineapple]

Using the remove() & size() method:
Before removing the size is: 5
[Apple, Pepy, Orange, Pineapple]
4
[Apple, Pepy, Pineapple]
[]
0
```

89. Printing an array list using for loop and using of sort method of collections classes

```java
package student;

import java.util.ArrayList;
import java.util.Collections;

public class A {

    public static void main(String[] args) {

        ArrayList<Integer> num1 = new ArrayList<>();
        ArrayList<Double> num2 = new ArrayList<>();
        ArrayList<String> fruit = new ArrayList<>();

        fruit.add("Apple");
        fruit.add("Banana");
        fruit.add("Orange");
        fruit.add("Pineapple");

        for (int i = 0; i < fruit.size(); i++) {
            System.out.println(" " + fruit.get(i));
        }
        System.out.println(fruit);
        Collections.sort(fruit); //alphabetical order.
        System.out.println(fruit);

        num1.add(5);
        num1.add(7);
        num1.add(10);
        num1.add(8);
        System.out.println(num1);
        Collections.sort(num1);
        System.out.println(num1);
    }
}
```

```
OUTPUT:
 Apple
 Banana
 Orange
 Pineapple
[Apple, Banana, Orange, Pineapple]
[Apple, Banana, Orange, Pineapple]
[5, 7, 10, 8]
[5, 7, 8, 10]
```

90. Using for each loop for printing an arraylist or array.

```java
package student;

import java.util.ArrayList;

public class A {

    public static void main(String[] args) {

        ArrayList<String> name = new ArrayList<>();
        name.add("Rahim");
        name.add("Karim");
        name.add("Kibria");
        name.add("Tausif");

        for (String x : name) {
            System.out.println(x);
        }

        System.out.println();
        String[] student = {"rahim", "kibria", "saim"};
        for (String y : student) {
            System.out.println(y);
        }

        System.out.println();
        int[] num = {1, 2, 3};
        int i = 0;
        for(int z : num){
            System.out.println(z +" is a element of index: "+i);
            i++;
        }
    }
}
/*
    In each iteration, the variable x hold the value of an element inside the
array list or array. Starting from the frist element.
    There is no index
    Safe(Boundaries)
*/
```

```
Output:
Rahim
Karim
Kibria
Tausif

rahim
kibria
saim

1 is a element of index: 0
2 is a element of index: 1
3 is a element of index: 2
```

91. Create a list of unique elements taken from the user. Sort and print this element. (Many same element thakly oitkahy akta element dory sort korby then print korby)

```java
package student;

import java.util.ArrayList;
import java.util.Collections;
import java.util.Scanner;

public class A {

    public static void main(String[] args) {

        ArrayList<Integer> integers = new ArrayList<>();

        System.out.println("Enter five integer: ");
        Scanner input = new Scanner(System.in);
        for (int i = 0; i < 5; i++) {
            int temp = input.nextInt();

            if (!integers.contains(temp)) {
                integers.add(temp);
            }
        }
        Collections.sort(integers);
        System.out.println(integers);
    }
}
```

```
Output:
Enter five integer:
2 4 1 2 4
[1, 2, 4]
```

92. Creating a menu program with this options(add, remove, display, exit). The program runs infinitely unitl the user press fourth options.

```java
package student;

import java.util.ArrayList;
import java.util.Scanner;

public class A {

    public static void main(String[] args) {

        ArrayList<Integer> num = new ArrayList<>();
        Scanner input = new Scanner(System.in);

        while (true) {
            displayMenu();
            int choice = input.nextInt();

            if (choice == 1) {
                //Add
                System.out.print("Enter an integer: ");
                int n = input.nextInt();
                num.add(n);
                System.out.println("Added");
            } else if (choice == 2) {
                //Remove
                System.out.print("Enter the value you want to remove: ");
                int removeElement = input.nextInt();
                if (num.contains(removeElement)) {
                    num.remove(Integer.valueOf(removeElement));
                    System.out.println("Removed");
                } else {
                    System.out.println("Elements not found");
                }
            } else if (choice == 3) {
                //Display
                System.out.println("Your list: " + num);
            } else if (choice == 4) {
                //Exit
                System.out.println("Good Bye");
                break;
            }
        }
    }
```

```java
public static void displayMenu() {
        System.out.println("1. Add");
        System.out.println("2. Remove");
        System.out.println("3. Display");
        System.out.println("4. Exit");
        System.out.println("Enter your choice: ");
    }
}
```

```
OUTPUT:
1. Add
2. Remove
3. Display
4. Exit
Enter your choice:
1
Enter an integer: 2
Added
1. Add
2. Remove
3. Display
4. Exit
Enter your choice:
1
Enter an integer: 3
Added
1. Add
2. Remove
3. Display
4. Exit
Enter your choice:
2
Enter the value you want to remove: 2
Removed
1. Add
2. Remove
3. Display
4. Exit
Enter your choice:
3
Your list: [3]
1. Add
2. Remove
3. Display
4. Exit
Enter your choice:
4
Good Bye
BUILD SUCCESSFUL (total time: 22 seconds)
```

93. Creating a class in JAVA(Circle class)

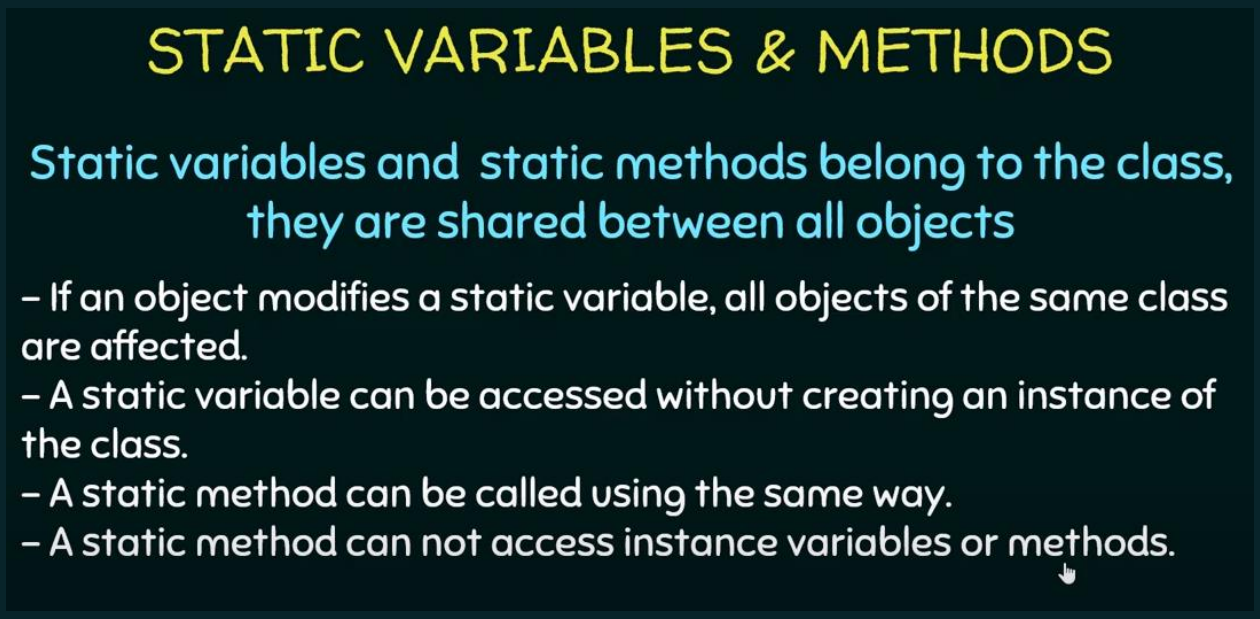
```java
package student;

import java.awt.Point;

public class Circle {

    Point center;
    double radius;

    Circle() {
    }

    Circle(Point center, double radius) {
        this.center = center;
        this.radius = radius;
    }

    double getParameter() {
        return 2 * Math.PI * this.radius;
    }

    double getArea() {
        return Math.PI * this.radius * this.radius;
    }

    void setCenter(Point center) {
        this.center = center;
    }

    void setRadius(double radius) {
        this.radius = radius;
       //this keyword help me to distinguished the parameter from the atribute.
    }
}

/*
    The attribute which is called center is equal to the parameter center.
*/
```

```java
package student;

import java.awt.*;

public class Test {

    public static void main(String[] args) {
        Circle c1 = new Circle(new Point(1, 2), 3);

        System.out.println(c1.getArea());
        System.out.println(c1.getParameter());
    }
}

OUTPUT:
28.274333882308138
18.84955592153876
```

যদি আমি টেষ্ট ক্লাসটা এইভাবে করি তাহলে নিচের মতো আউটপুট হবেঃ

```java
package student;

import java.awt.*;

public class Test {

    public static void main(String[] args) {
        Circle c1 = new Circle(new Point(1, 2), 3);
        Circle c2 = new Circle(new Point(3, 4), 5);

        System.out.println("c1 radius: " + c1.radius);
        System.out.println("c2 radius: " + c2.radius);

        c1.radius = 10;
        c2.radius = 20;
        System.out.println("c1 radius: " + c1.radius);
        System.out.println("c2 radius: " + c2.radius);
    }
}
/*
    Each object is independent from other object. Cause each circle c1
and c2 has its own memory.
*/
Output:
c1 radius: 3.0
c2 radius: 5.0
c1 radius: 10.0
c2 radius: 20.0
```

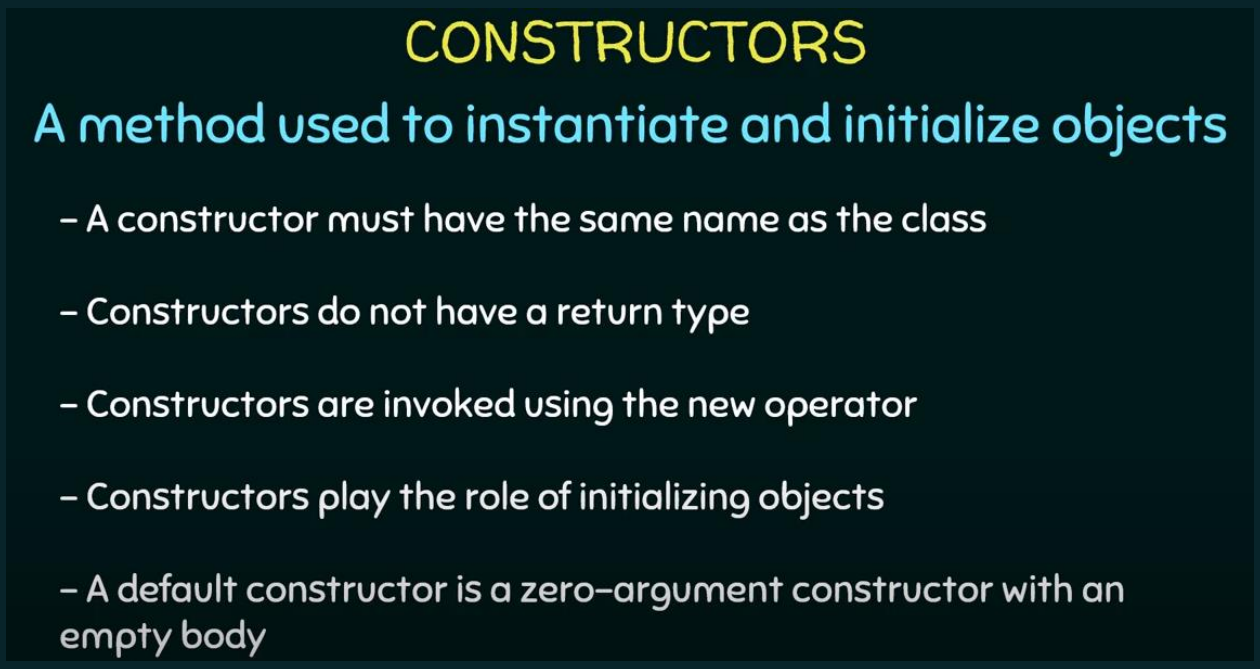
94. Static variable and method.



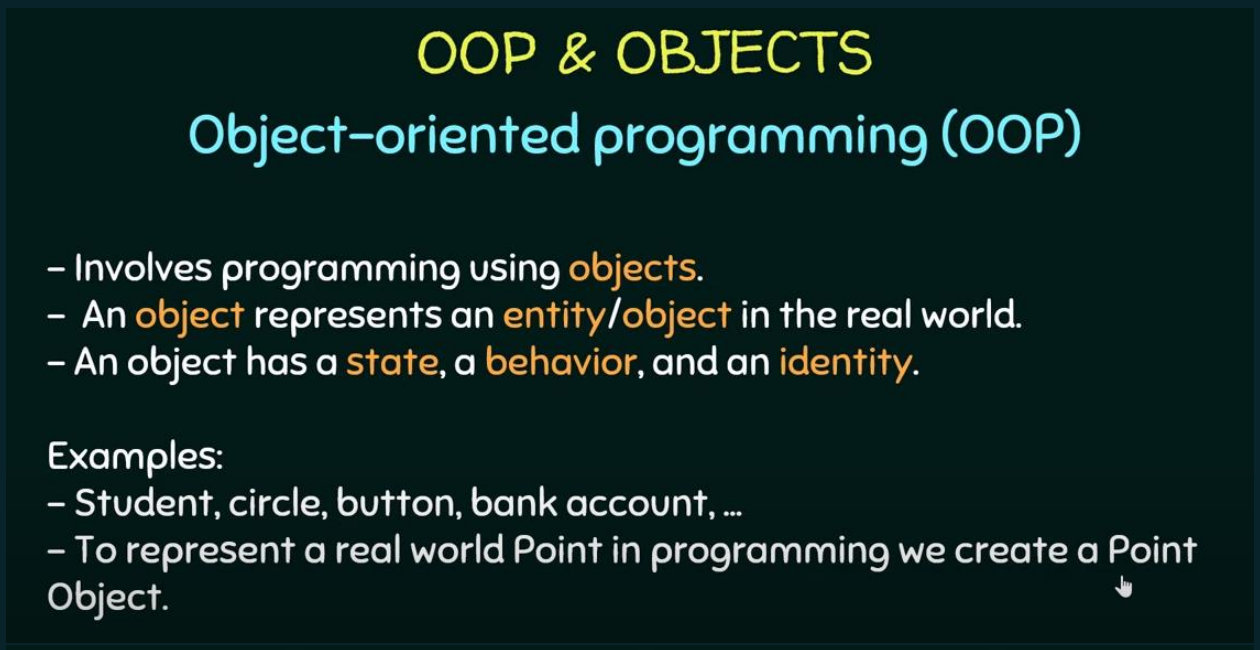
```java
package student;

import java.awt.Point;

public class Circle {

    Point center;
    double radius;
    static int numOfCircle;

    //Each time we use this constructore(Circle) to creater the circle
object we are incresing the number of objects(numberOfCircle)
    Circle() {
        numOfCircle++;
    }

    Circle(Point center, double radius) {
        numOfCircle++;
        this.center = center;
        this.radius = radius;
    }

    double getParameter() {
        return 2 * Math.PI * this.radius;
    }

    double getArea() {
        return Math.PI * this.radius * this.radius;
    }

    void setCenter(Point center) {
        this.center = center;
    }

    void setRadius(double radius) {
        this.radius = radius;
    }

    static int numOfCircle(){
        return numOfCircle;
    }
}
```

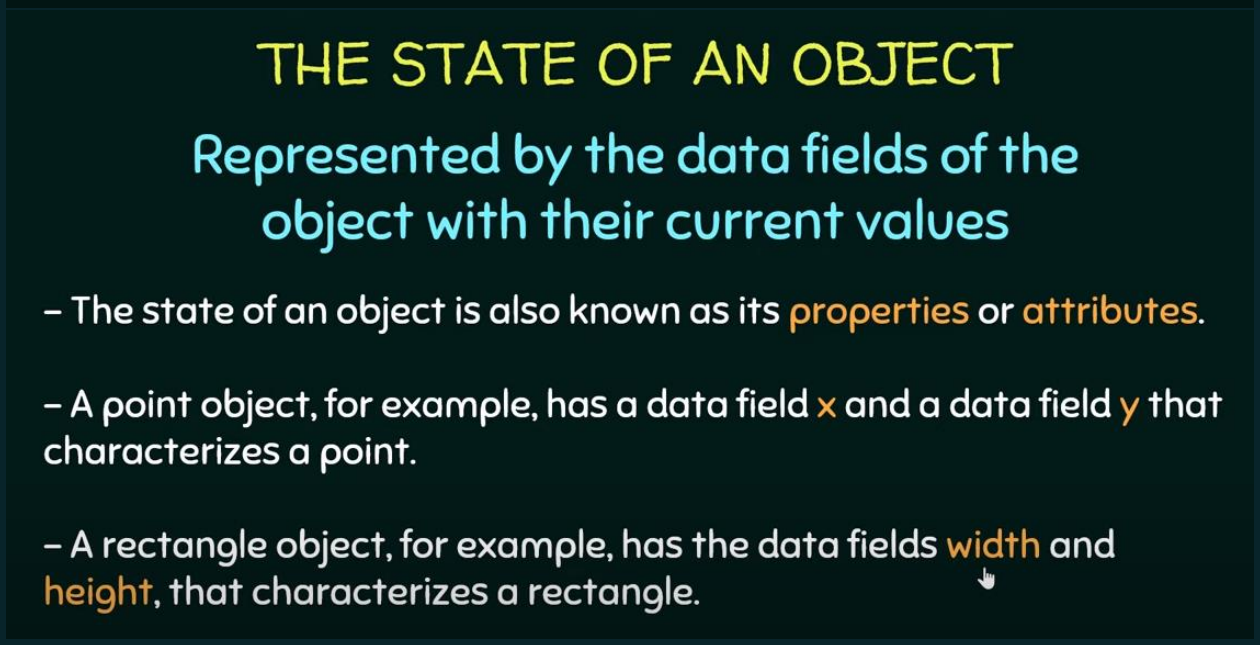
```java
package student;

import java.awt.*;

public class Test {

    public static void main(String[] args) {
        //We can access the static variable using the name of the
class or name of the object.
        System.out.println(Circle.numOfCircle);

        Circle c1 = new Circle(new Point(1, 2), 3);
        System.out.println(Circle.numOfCircle);
        //System.out.println(c1.numOfCircle);

        Circle c2 = new Circle(new Point(3, 4), 5);
        System.out.println(Circle.numOfCircle);
        //System.out.println(C2.numOfCircle);
    }
}

//we use the new keyword in order to called the constructor of a
class.
Output:
0
1
2
```

95. Constructor



96. Introduction to classes and object





CLASSES & OBJECTS

A Class defines the data fields and actions of an Object

– To create an Object we need a template/blueprint that defines the data fields and methods that this Object will have
→ Class
→ An object is an instance of a Class

– Objects of the same type are created/instantiated from the same class

– A Java class uses variables to define the data fields and methods to define actions. There are special methods Called Constructors.

CONSTRUCTORS

A method used to create Objects

– A constructor can do anything, it is simply a method, but it is designed to do initializing actions, such as initializing the data fields of an object.

```
Point p1 = new Point(0, 1);

public Point(int x, int y) {
    this.x = x;
    this.y = y;
}
```

DEFAULT CONSTRUCTORS

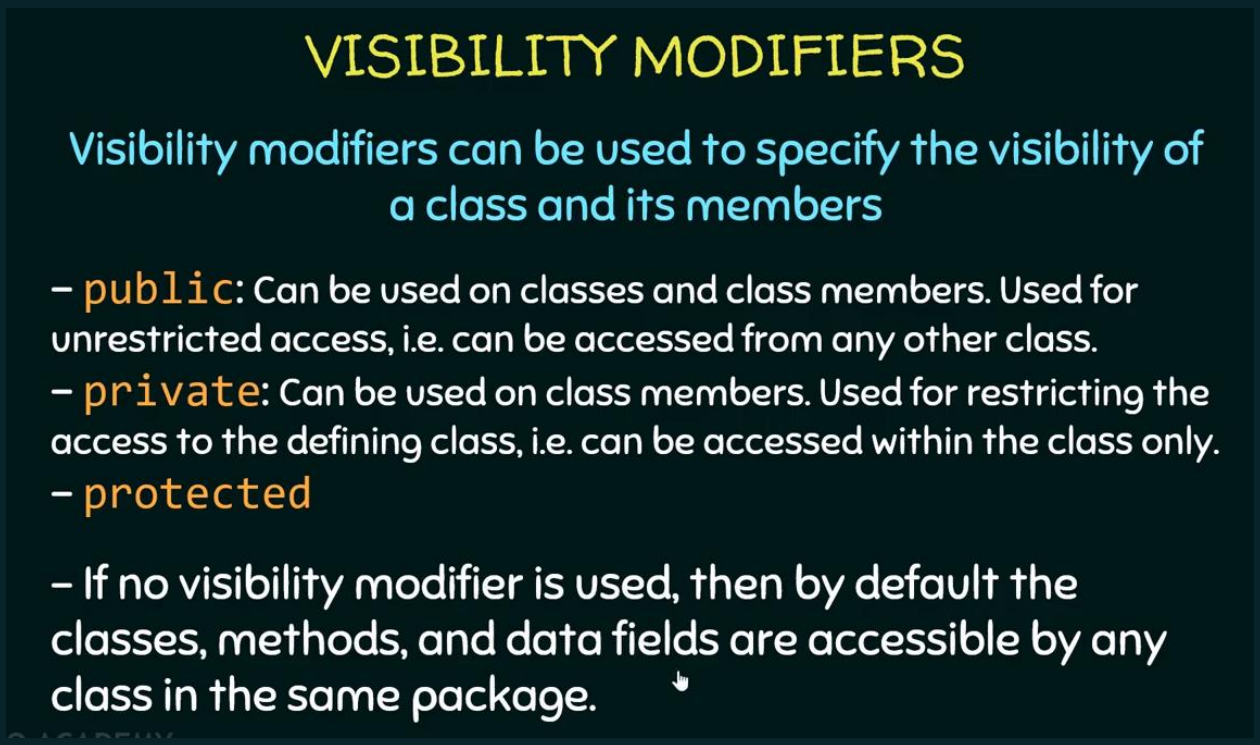
A constructor that takes no parameters

If we create a class without creating a constructor, Java automatically creates a default constructor that takes no parameters and we will be able to use it to create objects of this class.

DEFAULT VALUES

```
class DefaultValues {

    Point point; // null
    String str; // null
    double d; // 0.0
    int i; // 0
    char c; // '\u0000'
    boolean b; // false

}
```

97, Visibility modifiers




```java
package student;

public class Dhaka {

    public int x;
}

//public int x and just int x are the same thing.
```

```java
package student;

public class TestJava {

    public static void main(String[] args) {

        Dhaka d = new Dhaka();
        d.x = 10;
        System.out.println(d.x);
    }
}
```

```
OUTPUT: 10
```

```java
package student;

public class Dhaka {

    private int x;

    public void setX(int x) {
        this.x = x;
    }

    public int getX() {
        return x;
    }
}
```

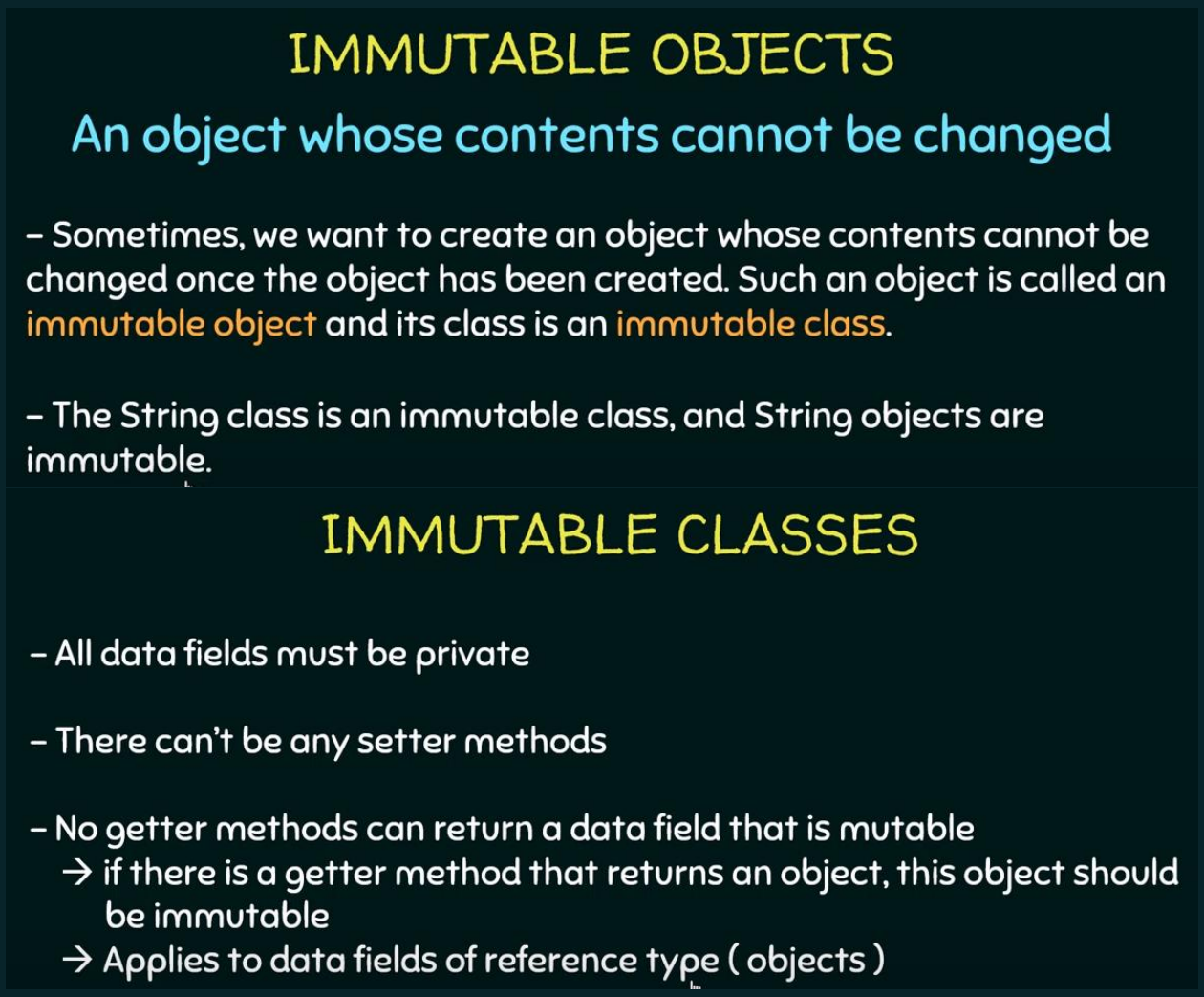
```java
package student;

public class TestJava {

    public static void main(String[] args) {

        Dhaka d = new Dhaka();
        d.setX(10);
        System.out.println(d.getX());
    }
}
```

```
OUTPUT: 10
```

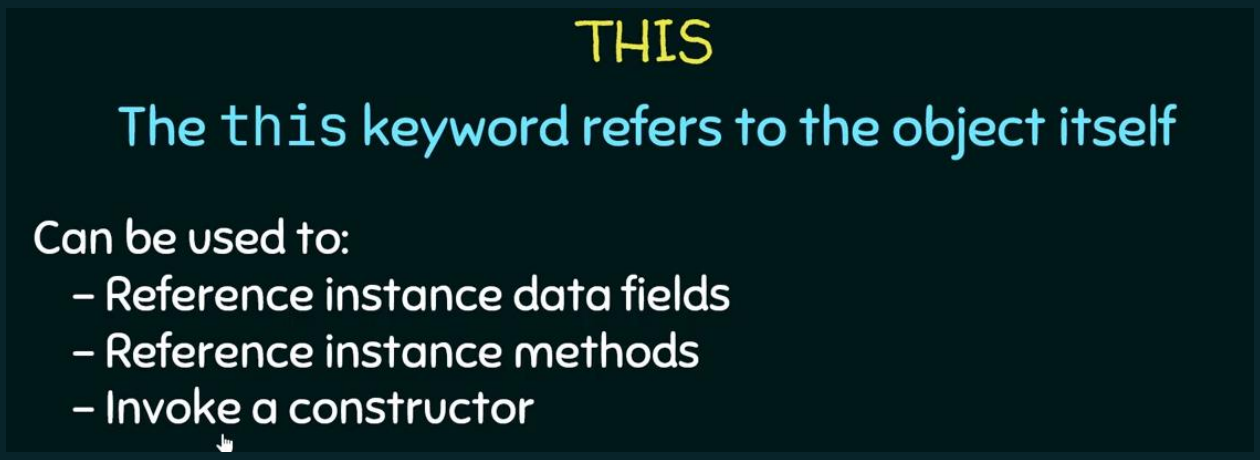
```java
package student;

public class TestJava {

    private int x;

    public static void main(String[] args) {

        TestJava d = new TestJava();
        d.setX(10);
        System.out.println(d.getX());
    }

    public void setX(int x) {
        this.x = x;
    }

    public int getX() {
        return x;
    }
}
```

OUTPUT: 10

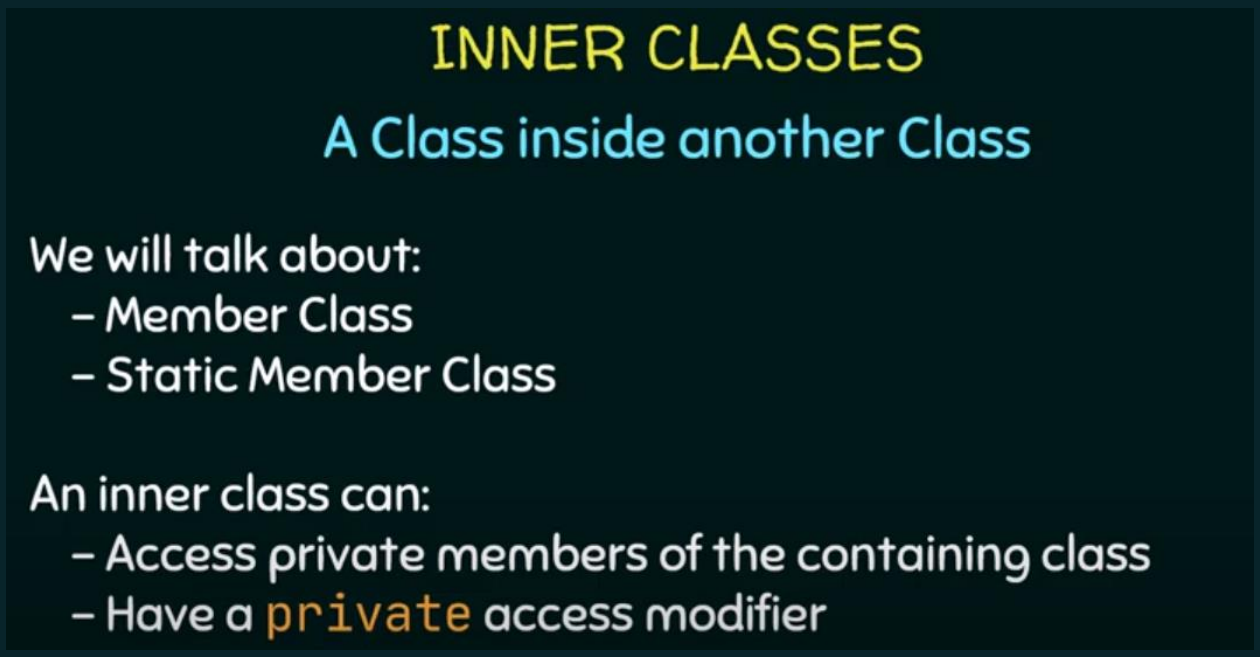
98. Immutable class and object



99. This keyword in java



100. Inner class in java

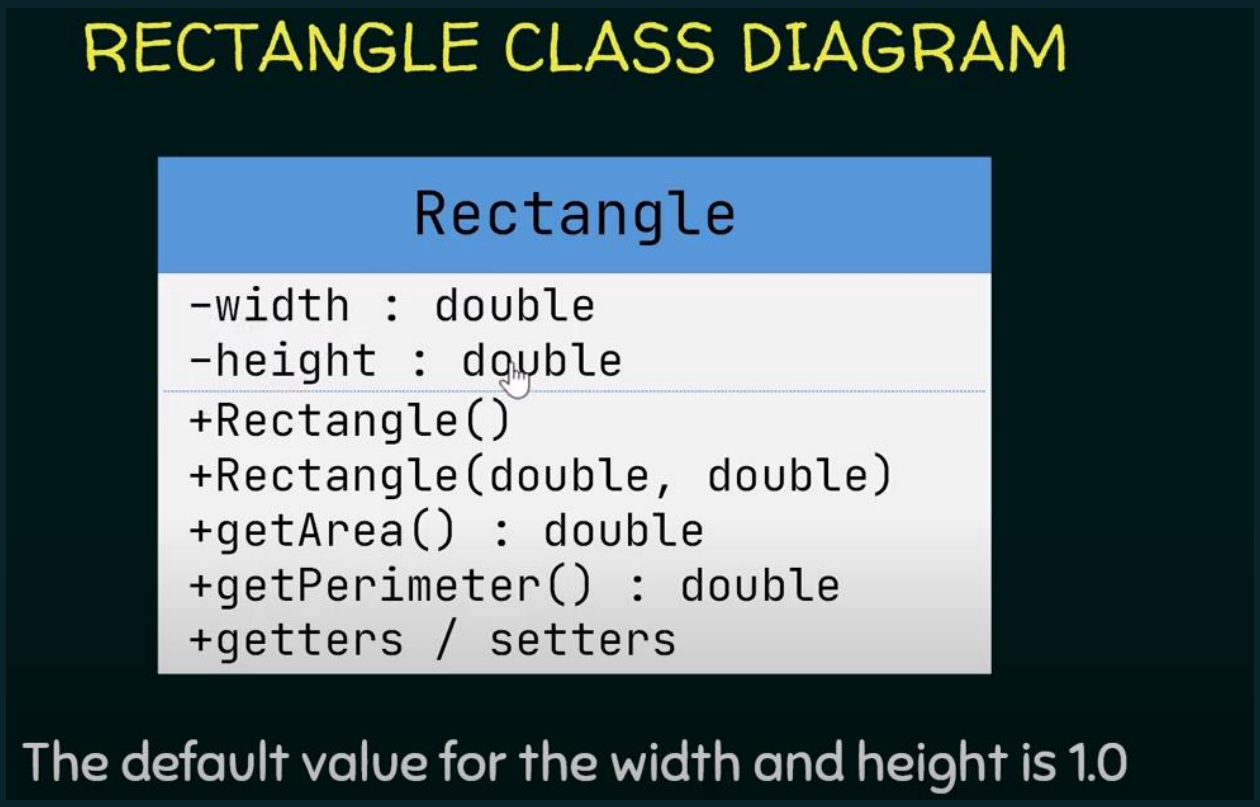


100. UML class in java

UML-unified modeling language. We use this language in order to create some diagram in computer science.

+ public -private ----------static

101. UML rectangle



```java
package student;

public class Rectangle {

    private double width;
    private double height;

    public Rectangle() {
        this(1.0, 1.0);
    }

    public Rectangle(double width, double height) {
        this.width = width;
        this.height = height;
    }

    public double getArea() {
        return this.width * this.height;
    }

    public double getPerameter() {
        return 2 * (this.width + this.height);
    }

    public double getWidth() {
        return width;
    }

    public void setWidth(double width) {
        this.width = width;
    }

    public double getHeight() {
        return height;
    }

    public void setHeight(double height) {
        this.height = height;
    }

}
```

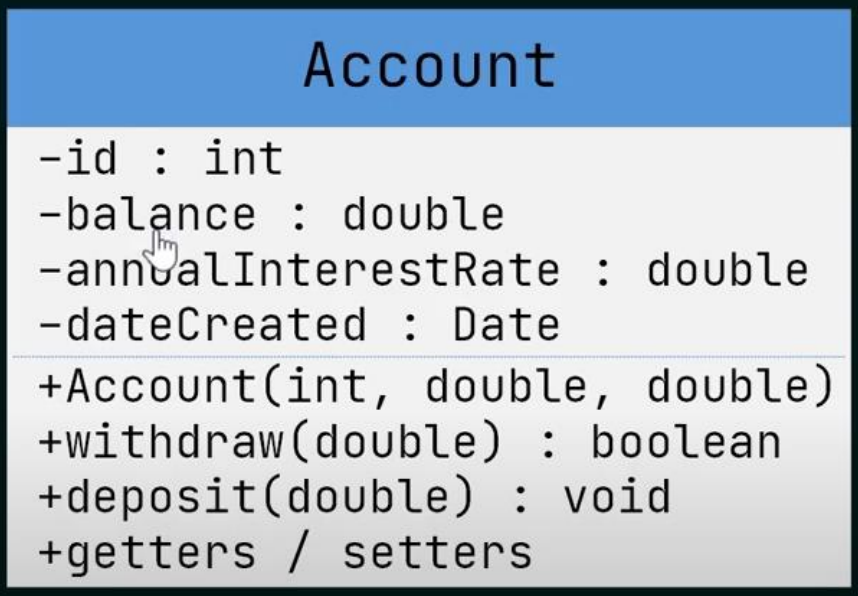
|---|

```java
package student;

import java.util.Scanner;

public class TestJava {

    public static void main(String[] args) {

        Rectangle[] r = new Rectangle[3];

        Scanner input = new Scanner(System.in);
        for (int i = 0; i < r.length; i++) {
            System.out.print("Do you want to enter the width and
height? (Y/N)");

            char choice = input.next().charAt(0);
            if (choice == 'y') {
                System.out.print("Please enter the width and height:
");
                r[i] = new Rectangle(input.nextDouble(),
input.nextDouble());
            } else {
                r[i] = new Rectangle();
            }

        }
        System.out.println("The rectangles are: ");
        for (int i = 0; i < r.length; i++) {
            System.out.println(
                    "Rectangle " + (i + 1)
                    + ": width: " + r[i].getWidth()
                    + ", height: " + r[i].getHeight());

            System.out.println(
                    "Rectangle " + (i + 1)
                    + ": area is: " + r[i].getArea());
            System.out.println();
        }
    }
}
|-----------------------------------------------------------|
```

```
OUTPUT:
Do you want to enter the width and height? (Y/N)n
Do you want to enter the width and height? (Y/N)n
Do you want to enter the width and height? (Y/N)y
Please enter the width and height: 2 3
The rectangles are:
Rectangle 1: width: 1.0, height: 1.0
Rectangle 1: area is: 1.0

Rectangle 2: width: 1.0, height: 1.0
Rectangle 2: area is: 1.0

Rectangle 3: width: 2.0, height: 3.0
Rectangle 3: area is: 6.0
```

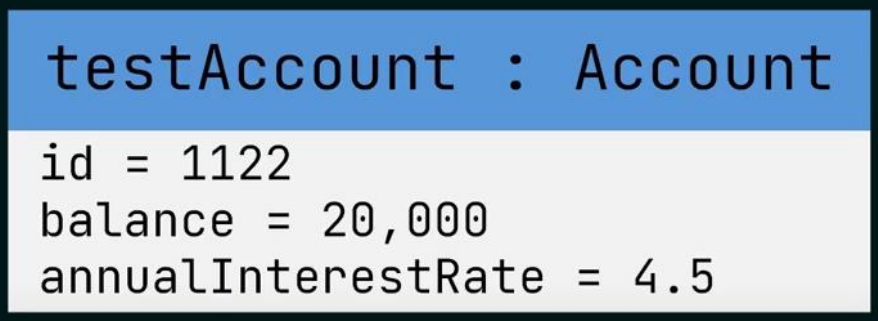
102. UML-2

ACCOUNT CLASS DIAGRAM



Do not create a setDateCreated() method.

1. Create the following Account object:



2. Withdraw 2500 from the account.
3. Deposit 3000 to the account.
4. Print the account's information.

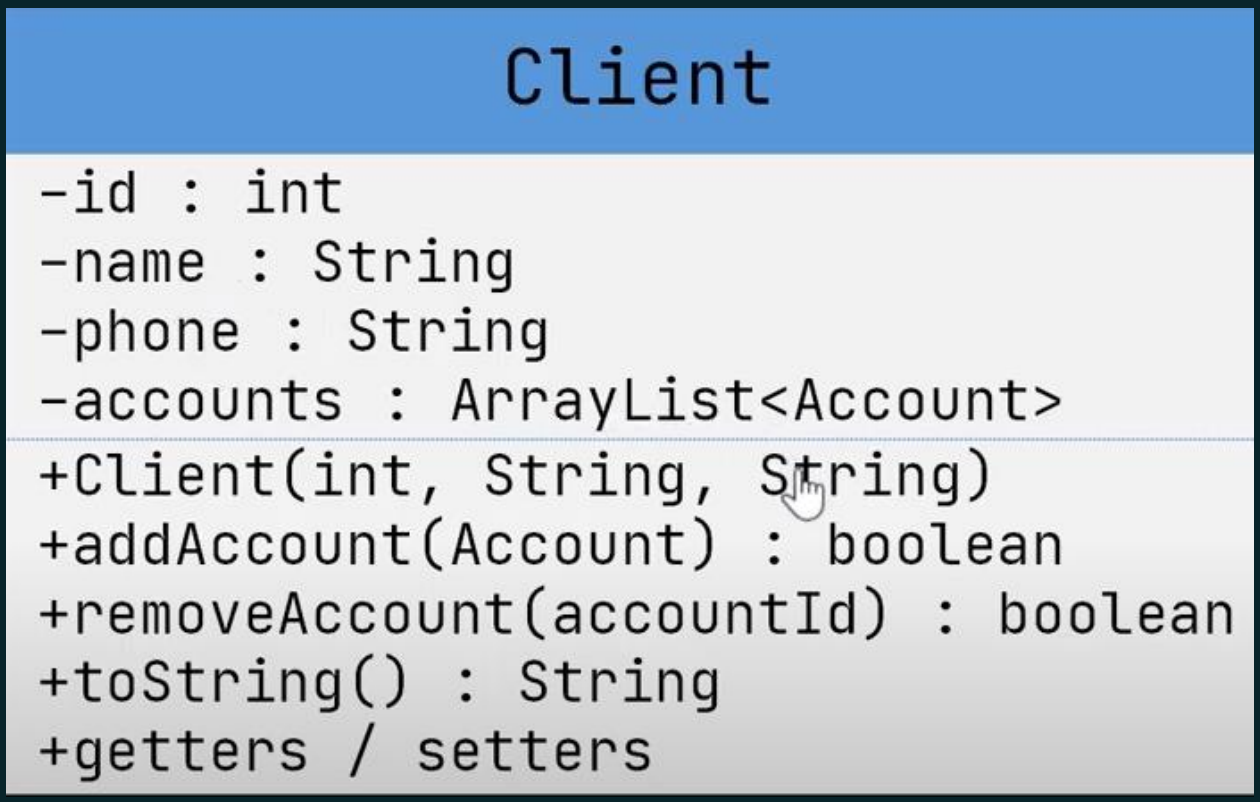
```java
package student;

import java.util.Date;

public class Account {

    private int id;
    private double balance;
    private double annualInterestRate;
    private Date dateCreated;

    public Account(int id, double balance, double annualInterestRate)
{
        this.id = id;
        this.balance = balance;
        this.annualInterestRate = annualInterestRate;

        dateCreated = new Date();
    }

    public boolean withdraw(double amount) {
        if (balance < amount) {
            return false;
        } else {
            balance = balance - amount;
            return true;
        }
    }

    public void deposit(double amount) {
        balance = balance + amount;
    }
```

```java
public int getId() {
        return id;
    }

    public void setId(int id) {
        this.id = id;
    }

    public double getBalance() {
        return balance;
    }

    public void setBalance(double balance) {
        this.balance = balance;
    }

    public double getAnnualInterestRate() {
        return annualInterestRate;
    }

    public void setAnnualInterestRate(double annualInterestRate) {
        this.annualInterestRate = annualInterestRate;
    }

    public Date getDateCreated() {
        return dateCreated;
    }
}
```

```java
package student;

public class TestAccount {

    public static void main(String[] args) {

        Account a = new Account(100, 20000, 4.5);

        if (a.withdraw(2500)) {
            System.out.println("Withdraw successful");
        } else {
            System.out.println("Withdram not successful");
        }

        a.deposit(3000);
        System.out.println(a.getId() + " "
                + a.getBalance() + " "
                + a.getAnnualInterestRate() + " "
                + a.getDateCreated().toLocaleString());
    }
}
```

```
OUTPUT:
Withdraw successful
100 20500.0 4.5 Oct 28, 2021 10:16:10 AM
```

103- UML-3



PROGRAM

1. Create an array of 2 clients
2. Add 2 accounts for the first client and 3 for the second one
3. Print the information of each client using toString()

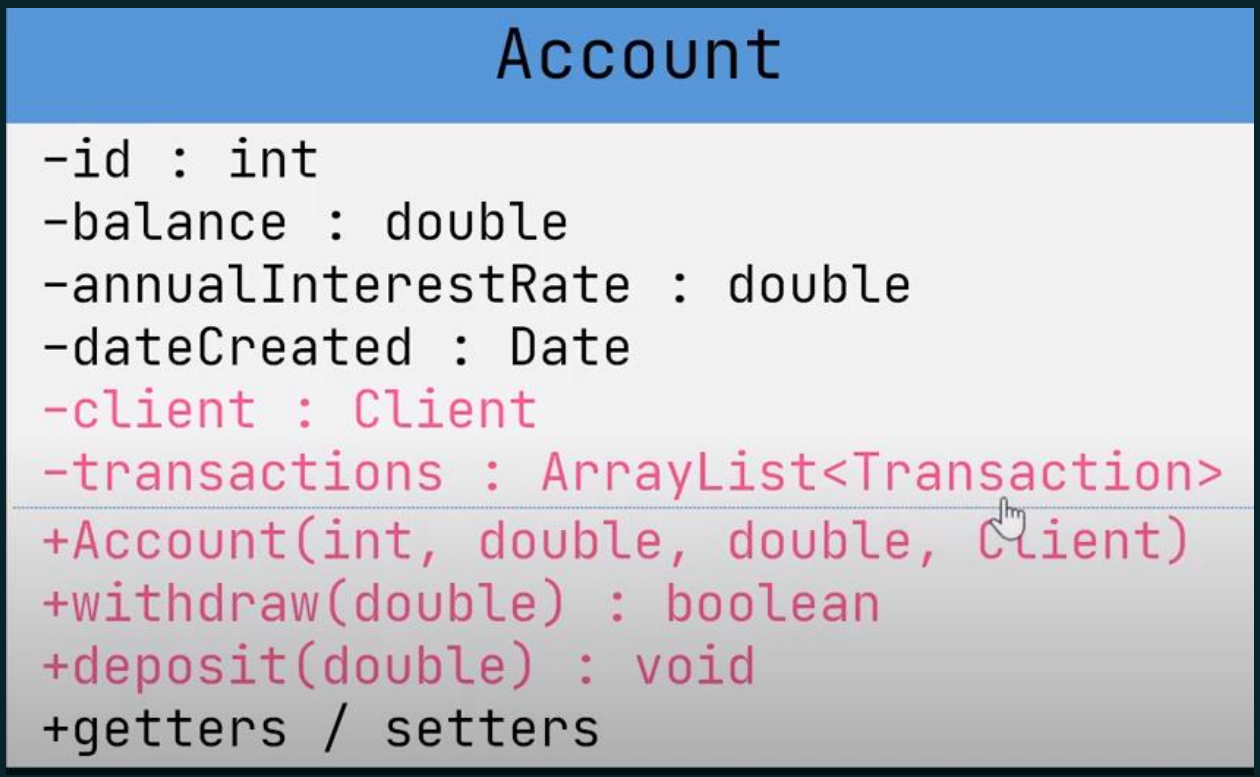
```java
package student;

import java.util.Date;

public class Account {

    private int id;
    private double balance;
    private double annualInterestRate;
    private Date dateCreated;

    public Account(int id, double balance, double annualInterestRate) {
        this.id = id;
        this.balance = balance;
        this.annualInterestRate = annualInterestRate;

        dateCreated = new Date();
    }

    public boolean withdraw(double amount) {
        if (balance < amount) {
            return false;
        } else {
            balance = balance - amount;
            return true;
        }
    }

    public void deposit(double amount) {
        balance = balance + amount;
    }

    public int getId() {
        return id;
    }

    public void setId(int id) {
        this.id = id;
    }

    public double getBalance() {
        return balance;
    }

    public void setBalance(double balance) {
        this.balance = balance;
    }

    public double getAnnualInterestRate() {
        return annualInterestRate;
```

```
    }

    public void setAnnualInterestRate(double annualInterestRate) {
        this.annualInterestRate = annualInterestRate;
    }

    public Date getDateCreated() {
        return dateCreated;
    }

    public String toString() {
        return this.id + " " + this.balance + " " + this.annualInterestRate +
" " + this.dateCreated.toLocaleString();
    }
}

/*-------------------------------------------------------------------------
-------------------------------------------------------------------------
-------------------------*/

package student;

import java.util.ArrayList;

public class Client {

    private int id;
    private String name;
    private String phoneNumber;
    private ArrayList<Account> a;

    public Client(int id, String name, String phoneNumber) {
        this.id = id;
        this.name = name;
        this.phoneNumber = phoneNumber;

        a = new ArrayList<>();
    }

    public boolean addAccount(Account acc) {
        a.add(acc);
        return true;
    }
```

```java
public boolean removeAccount(int accountId) {
        for (Account x : a) {
            if (x.getId() == accountId) {
                a.remove(x);
                return true;
            }
        }
        return false;

    }

    public String toString() {
        String s = this.id + " " + this.name + " " + this.phoneNumber + "\n";

        for (Account y : a) {
            s = s + y.toString() + "\n";
        }

        return s;

    }

    public int getId() {
        return id;
    }

    public void setId(int id) {
        this.id = id;
    }

    public String getName() {
        return name;
    }

    public void setName(String name) {
        this.name = name;
    }

    public String getPhoneNumber() {
        return phoneNumber;
    }

    public void setPhoneNumber(String phoneNumber) {
        this.phoneNumber = phoneNumber;
    }
}

/*--------------------------------------------------------------------------
--------------------------------------------------------------------------
-------------------------*/
```

```java
 package student;

public class TestAccount {

    public static void main(String[] args) {

        Client[] c = new Client[2];

        c[0] = new Client(100, "Kibria", "23144345234");
        c[0].addAccount(new Account(1, 100, 1.5));
        c[0].addAccount(new Account(2, 200, 2.0));

        c[1] = new Client(101, "Rahim", "564562435");
        c[1].addAccount(new Account(3, 300, 2.5));
        c[1].addAccount(new Account(4, 400, 3.0));
        c[1].addAccount(new Account(5, 500, 3.5));

        System.out.println(c[0].toString());
        System.out.println(c[1].toString());
    }
}

/*--------------------------------------------------------------------------
--------------------------------------------------------------------------
-------------------------*/

OUTPUT:
100 Kibria 23144345234
1 100.0 1.5 Oct 28, 2021 11:06:38 AM
2 200.0 2.0 Oct 28, 2021 11:06:38 AM

101 Rahim 564562435
3 300.0 2.5 Oct 28, 2021 11:06:38 AM
4 400.0 3.0 Oct 28, 2021 11:06:38 AM
5 500.0 3.5 Oct 28, 2021 11:06:38 AM
```

UML-4:



PROGRAM

1. Create an ArrayList of Accounts
2. Display the number of deposits and withdrawals of each account

```java
package student;

import java.util.ArrayList;
import java.util.Date;

public class Account {

    private int id;
    private double balance;
    private double annualInterestRate;
    private Date dateCreated;
    private Client c;
    private ArrayList<Transaction> t;

    public Account(int id, double balance, double annualInterestRate, Client
c) {
        this.id = id;
        this.balance = balance;
        this.annualInterestRate = annualInterestRate;
        this.c = c;

        this.t = new ArrayList<>();

        dateCreated = new Date();
    }

    public boolean withdraw(double amount) {
        if (balance < amount) {
            return false;
        } else {
            balance = balance - amount;
            this.t.add(new Transaction('W', amount, this.balance, "Withdram"
+ amount));
            return true;
        }
    }

    public void deposit(double amount) {
        balance = balance + amount;
        this.t.add(new Transaction('D', amount, this.balance, "Deposit" +
amount));

    }

    public int countTransaction(char type){
       int count = 0;
        for(Transaction z : t){
            if(z.getType()==type){
                count++;
            }
```

```
        }
        return count;
    }

    public int getId() {
        return id;
    }

    public void setId(int id) {
        this.id = id;
    }

    public double getBalance() {
        return balance;
    }

    public void setBalance(double balance) {
        this.balance = balance;
    }

    public double getAnnualInterestRate() {
        return annualInterestRate;
    }

    public void setAnnualInterestRate(double annualInterestRate) {
        this.annualInterestRate = annualInterestRate;
    }

    public Date getDateCreated() {
        return dateCreated;
    }

    public Client getC() {
        return c;
    }

    public void setC(Client c) {
        this.c = c;
    }

    public String toString() {
        return this.id + " " + this.balance + " " + this.annualInterestRate +
" " + this.dateCreated.toLocaleString();
    }
}

/*-------------------------------------------------------------------------
-------
-------------------------------------------------------------------------
-----*/
```

```java
package student;

import java.util.ArrayList;

public class Client {

    private int id;
    private String name;
    private String phoneNumber;
    private ArrayList<Account> a;

    public Client(int id, String name, String phoneNumber) {
        this.id = id;
        this.name = name;
        this.phoneNumber = phoneNumber;

        a = new ArrayList<>();
    }

    public boolean addAccount(Account acc) {
        a.add(acc);
        return true;
    }

    public boolean removeAccount(int accountId) {
        for (Account x : a) {
            if (x.getId() == accountId) {
                a.remove(x);
                return true;
            }
        }
        return false;

    }

    public String toString() {
        String s = this.id + " " + this.name + " " + this.phoneNumber + "\n";

        for (Account y : a) {
            s = s + y.toString() + "\n";
        }

        return s;

    }

    public int getId() {
        return id;
    }
```

```java
    public void setId(int id) {
        this.id = id;
    }

    public String getName() {
        return name;
    }

    public void setName(String name) {
        this.name = name;
    }

    public String getPhoneNumber() {
        return phoneNumber;
    }

    public void setPhoneNumber(String phoneNumber) {
        this.phoneNumber = phoneNumber;
    }
}

/*--------------------------------------------------------------------------
-------
--------------------------------------------------------------------------
-----*/

package student;

import java.util.Date;

public class Transaction {

    private char type;
    private double amount;
    private double balance;
    private Date date;
    private String description;

    public Transaction(char type, double amount, double balance, String
description) {
        this.type = type;
        this.amount = amount;
        this.balance = balance;
        this.description = description;

        date = new Date();
    }

    public char getType() {
```

```
        return type;
    }
}

/*--------------------------------------------------------------------------
-------
--------------------------------------------------------------------------
-----*/

package student;

import java.util.ArrayList;

public class TestAccount {

    public static void main(String[] args) {

        ArrayList<Account> a = new ArrayList<>();
        Client c = new Client(100, "kibria", "4582932");

        a.add(new Account(1, 1000, 1.5, c));
        a.add(new Account(2, 2000, 2.5, c));

        a.get(0).withdraw(2000);
        a.get(0).withdraw(1000);
        a.get(0).deposit(2000);
        a.get(0).withdraw(1000);

        a.get(1).deposit(100);
        a.get(1).deposit(200);

        for(Account account : a){
            System.out.println("Account: "+account.getId()+" : ");
            System.out.println("W:"+account.countTransaction('W'));
            System.out.println("D:"+account.countTransaction('D'));
        }
    }
}

/*--------------------------------------------------------------------------
-------
--------------------------------------------------------------------------
-----*/
```

```
OUTPUT:
Account: 1 :
W:2
D:1
Account: 2 :
W:0
D:
```