Java Overview

Java is1 an open-source, class-based, high-level, object-oriented programming language. Java is platform independent as the java programs are compiled into byte code that are platform independent.

History:

Java programming language was created by James Gosling in 1995. The original idea was to design a language for the television industry. Gosling worked along with his team also called the Green Team and the project they worked on was called Greentalk. This project was later named as OAK. The name OAK has its roots to the oak tree that stood outside Gosling's office. This name had to be dropped later as it was already a trademark by Oak Technologies.

So how was the name Java suggested?

Since the language could no longer be named OAK, Gosling and his team had to come up with new name. The team considered various names like DNA, RUBY, JAVA, jolt, dynamic, revolutionary, SILK.

But the name had to unique and quite easy to say. The name JAVA occurred in gosling's mind while having a cup of coffee at his office.

Types of Java applications:

A. Web Application:

Web applications are the applications that run on web browser using servlet, JSP, struts technologies. These technologies create java web applications and deploy them on server.

B. Mobile Application:

These are mobile applications created using java.

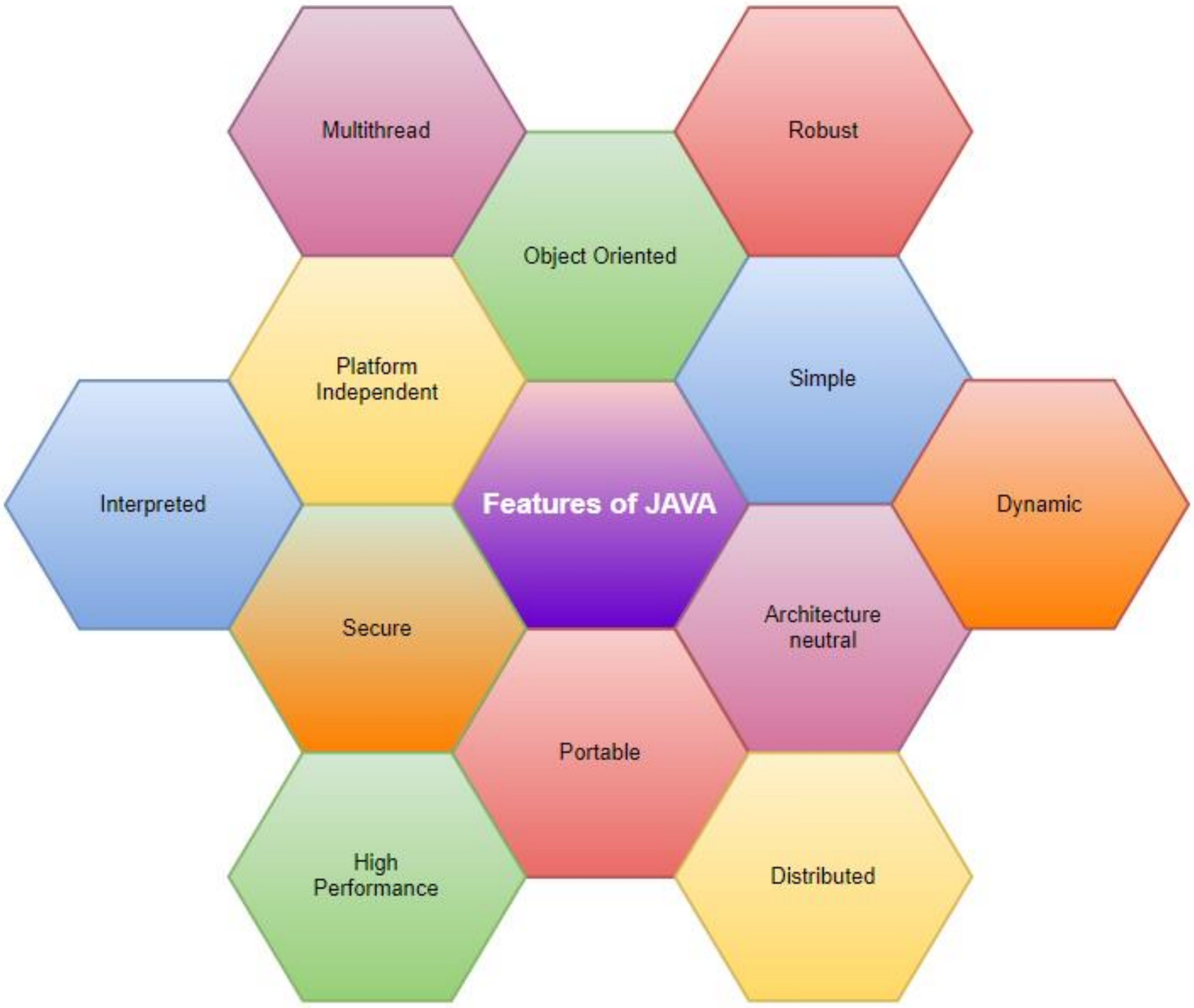
C. Standalone Application:

Standalone applications are executed by themselves without the need of other programs and files. Example of such an application is antivirus.

D. Enterprise Application:

Some applications are designed for corporate organizations with the intent to control major process in real time. Such applications are called enterprise applications.

Features



- Object Oriented: In object oriented programming everything is an object rather that function and logic.
- Simple: Java is simple to understand, easy to learn and implement.
- Secured: It is possible to design secured software systems using Java.
- Platform Independent: Java is write once and run anywhere language, meaning once the code is written, it can be executed on any software and hardware systems.
- Portable: Java is not necessarily fixated to a single hardware machine. Once created, java code can be used on any platform.
- Architecture Neutral: Java is architecture neutral meaning the size of primitive type is fixed and does not vary depending upon the type of architecture.
- Robust: Java emphasizes a lot on error handling, type checking, memory management, etc. This makes it a robust language.
- Interpreted: Java converts high-level program statement into Assembly Level Language, thus making it interpreted.
- Distributed: Java lets us create distributed applications that can run on multiple computers simultaneously.
- Dynamic: Java is designed to adapt to ever evolving systems thus making it dynamic.
- Multi-thread: multi-threading is an important feature provided by java for creating web applications.
- High-performance: Java uses Just-In-Time compiler thus giving us a high performance.

Basic Java Syntax

It is particularly important to follow the appropriate syntax while writing java code, as we might get errors for the slightest mistake in our code.

The class name should be the same as that of the name of the java file. And each line of code must be written inside a class.

Example: program where file name and class name is different.

```
public class Details {
   public static void main(String[] args) {
      System.out.println("Java program with same file name and class 
name");
     }
}
```

Copy

Output:

Java Comments

Comments in any programming language are ignored by the compiler or the interpreter. A comment is a part of the coding file that the programmer does not want to execute, rather the programmer uses it to either explain a block of code or to avoid the execution of a specific part of code while testing.

There are two types of coments:

- Single-line comment
- Multi-line comment

A. Single Line Comments:

To write a single-line comment just add a '//' at the start of the line.

Example:

```
package syntax1;
public class Details {
   public static void main(String[] args) {
        //This is a single line comment
        System.out.println("Hello World!!!");
    }
}
```

```
Output:

Hello World!!!
```

B. Multi Line Comments:
To write a multi-line comment just add a '/*…….*/' at the start of the line.

Example:

```
package syntax1;

public class Details {
    public static void main(String[] args) {
        /*This
         * is
         * a
         * Multiline
         * Comment
         */
        System.out.println("Hello World!!!");
    }
}
```

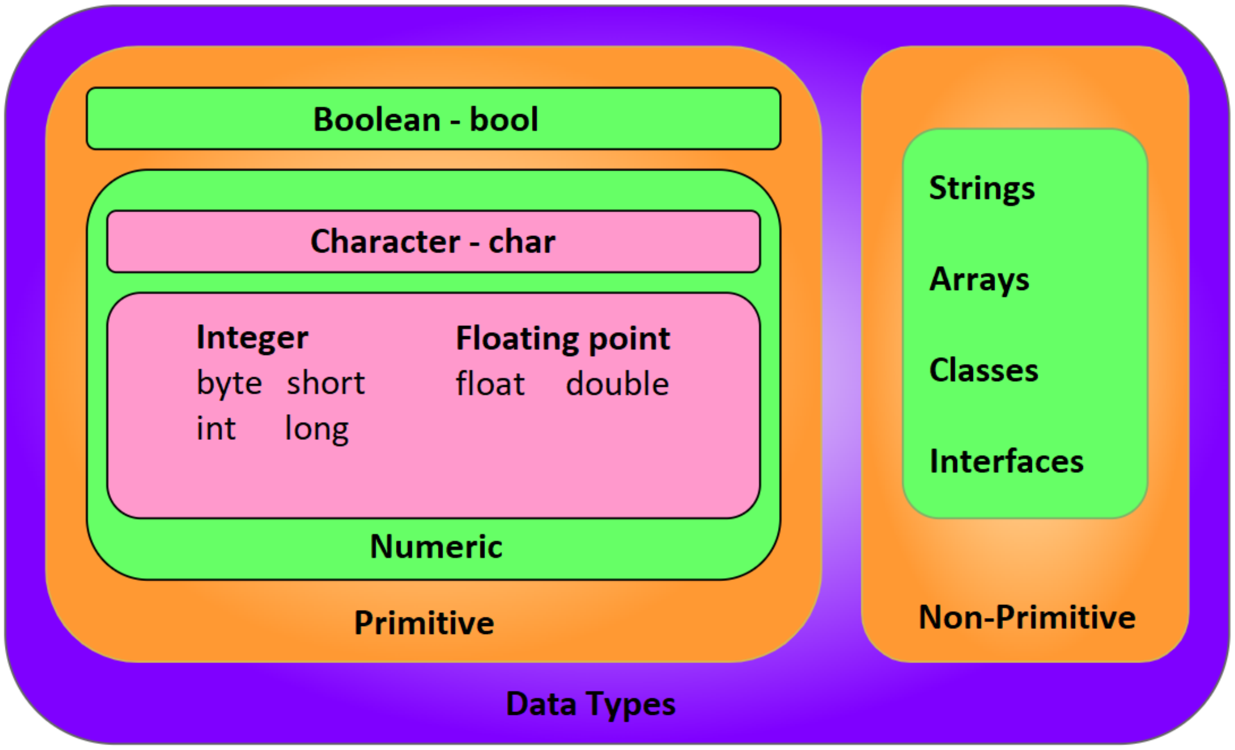
```
Output:

Hello World!!!
```

Java Data Types

There are two forms of datatypes in Java:

- Primitive data type
- Non-Primitive data type



- **bool:** Boolean data type consists of true and false values.
- **char:** char datatype is used to store characters.
- **byte:** The main purpose of byte is used to save memory and consists values in the range -128 to 127.
- **short:** consists values in the range -32768 to 32767.
- **int:** consists values in the range -2,147,483,648 to 2,147,483,647.
- **long:** consists values in the range -9,223,372,036,854,775,808 to 9,223,372,036,854,775,807

- **float:** can be used to deal with decimal numbers. Always recommended to use float rather than double because float saves memory.
- **double:** can be used to deal with decimal numbers.

Data Type	Size	Range	
bool	1 bit	true, false	
char	2 byte	a….z, A….Z	
byte	1 byte	-2^7 to 2^7-1	-128 to 128
short	2 byte	-2^{15} to 2^{15}-1	-32768 to 32767
int	4 byte	-2^{31} to 2^{31}-1	-2,147,483,648 to 2,147,483,647
long	8 byte	-2^{63} to 2^{63}-1	-9,223,372,036,854,775,808 to 9,223,372,036,854,775,807
float	4 byte	6.022f	
double	8 byte	3.142	

Java Variables

Variables are containers that store information that can be manipulated and referenced later by the programmer within the code. Java variables have a data type associated with them which can tell us about the size and layout of the variable's memory.

Syntax:

datatype variable = value

There are three types of variables in java:

- Local variable
- Instance variable

- Class/Static variable

A. Local Variables:
A variable that is declared inside the body of the method or constructor is called a local variable. It is called so because the extent of a local variable lies only within the method or constructor within which it is created and other methods in the class cannot access it.

Inside the method body, local variable is declared using the static keyword.

Example:

```
public class variableType {
    public void localVariable() {
        String name = "Ben";
        int marks = 95;
        System.out.println(name + " Scored " + marks + "%.");
    }

    public static void main(String[] args) {
        variableType vt = new variableType();
        vt.localVariable();
    }
}
```

Copy

Output:

```
Ben Scored 95%.
```

If it is accessed outside the method or constructor within which it is creaed, then it give an error.

Example:

```
public class variableType {
    public void localVariable() {
        String name = "Ben";
        int marks = 95;
    }
    public void notLocalVariable() {
        System.out.println(name + " Scored " + marks + "%.");
    }

    public static void main(String[] args) {
        variableType vt = new variableType();
        vt.notLocalVariable();
    }
}
```

Copy

Output:

```
name cannot be resolved to a variable
marks cannot be resolved to a variable
```

B. Instance Variables:

An instance variable is declared inside the class but outside a method or a constructor. It is similar to a static variable except that it is declared without using the keyword static. These variables are accessible by all methods or constructors that are inside the class.

Example:

```
public class variableType {

    public String name = "Ben";
    public int marks = 95;

    public void instanceVariable() {
        System.out.println(name + " Scored " + marks + "%.");
    }

    public static void main(String[] args) {
        variableType vt = new variableType();
        vt.instanceVariable();
    }
}
```

Copy

Output:

```
Ben Scored 95%.
```

C. Class/Static Variables:
An static variable is declared inside the class but outside a method or a constructor. It is like an instance variable except that it is declared using the keyword static. These variables are accessible by all methods or constructors that are inside the class.

Example:

```
public class variableType {

    public static String name;
    public static int marks;
    public static void main(String[] args) {
        name = "Ben";
        marks = 95;
        System.out.println(name + " Scored " + marks + "%.");
    }
}
```

Copy

Output:

```
Ben Scored 95%.
```

If variable is not declared static the it gives an error.

Example:

```
public class variableType {
    public String name;
    public int marks;

    public static void main(String[] args) {
        name = "Ben";
        marks = 95;
        System.out.println(name + " Scored " + marks + "%.");
    }
}
```

Output:

```
Cannot make a static refrence to a non-static field
```

Java Operators

Java has different types of operators for different operations. They are as follows:

Arithmetic operators:

Arithmetic operators are used to perform arithmetic/mathematical operations.

Name	Operator	Example
Addition	+	a+b
Subtraction	-	a-b
Multiplication	*	a*b
Division	/	a/b
Modulus	%	a%b
Increment	++	a++ or b++
Decrement	--	a-- or b--

Assignment operators:

These operators are used to assign values to variables.

Name	Operator	Evaluated As
Assignment	=	a=b
Addition assignment	+=	a+=b or a=a+b
Subtraction assignment	-=	a-=b or a=a-b
Multiplication assignment	*=	a*=b or a=a*b
Division assignment	/=	a//=b or a=a//b
Modulus assignment	%=	a%=b or a=a%b
Bitwise AND assignment	&=	a&=b or a=a&b
Bitwise inclusive OR assignment	|=	a|=b or a=a|b
Bitwise exclusive OR assignment	^=	a^=b or a=a^b

Right Shift assignment	>>=	a>>=b or a=a>>b
Left Shift assignment	<<=	a<<=b or a=a<<b

Bitwise operators:
Bitwise operators are used to deal with binary operations.

Name	Operator	Example
Bitwise AND	&	a & b
Bitwise OR	|	a | b
Bitwise NOT	~	~a
Bitwise XOR	^	a ^ b
Bitwise right shift	>>	a>>
Bitwise left shift	<<	b<<
Unsigned right shift	>>>	a>>>

Comparison operators:
These operators are used to compare values.

Name	Operator	Example
Equal	==	a==b
Not Equal	!=	a!=b
Less Than	<	a>b
Greater Than	>	a<b
Less Than or Equal to	<=	a>=b
Greater Than or Equal to	>=	a<=b

Logical operators:
These operators are used to deal with logical operations.

Name	Operator	Example
AND	&&	a && b
OR	||	a || b
NOT	!	! (a=2 or b=3)

Other operators:

A. instance of operator:

This operator checks if an object is an instance of class.

Example:

```
class Main {
    public static void main(String[] args) {

        Integer number = 5;
        boolean res;

        if (res = number instanceof Integer){
            System.out.println("number is an object of Integer. Hence: " +
res);
        } else {
            System.out.println("number is not an object of Integer.Hence: " +
res);
        }
    }
}
```

Copy

Output:

```
number is an object of Integer. Hence: true
```

B. Conditional operator:
It is used in a single line if-else statement.

Example:

```
class Main {
    public static void main(String[] args) {

        Integer number = 3;
        String res;

        res = (number > 5) ? "number greater than five" : "number lesser
than five";
        System.out.println(res);
    }
}
```

Output:

```
number lesser than five
```

User Input/Output

Taking Input:
To use the Scanner class, we need to import the java.util.Scanner package.

```
import java.util.Scanner;
```

Now the Scanner class has been imported. We create an object of the Scanner class to use the methods within it.

```
Scanner sc = new Scanner(System.in)
```

The System.in is passed as a parameter and is used to take input.

Note: Your object can be named anything, there is no specific convention to follow. But we normally name our object sc for easy use and implementation.

There are four ways to create an object of the scanner class. Let us see how we can create Scanner objects:

A. Reading keyboard input:

```
Scanner sc = new Scanner(System.in)
```

B. Reading String input:

```
Scanner sc = new Scanner(String str)
```

C. Reading input stream:

```
Scanner sc = new Scanner(InputStream input)
```

D. Reading File input:

```
Scanner sc = new Scanner(File file)
```

So how does a Scanner class work?

The scanner object reads the entered inputs and divides the string into tokens. The tokens are usually divided based upon whitespaces and newline.

Example:

```
Susan
19
```

```
78.95
O
```

The above input will be divided as “Susan”, “19”, “78.95” and “O”. Then the Scanner object will iterate over each token and then it will read each token depending upon the type of Scanner object created.

Now, we have seen how Scanner object is created, different ways to create it, how it reads input, and how it works. **Let us see different methods to take inputs.**

Below are the methods that belong to the scanner class:

Method	Description
nextLine()	Accepts string value
next()	Accept string till whitespace
nextInt()	Accepts int value
nextFloat()	Accepts float value
nextDouble()	Accepts double value
nextLong()	Accepts long value
nextShort()	Accepts short value
nextBoolean()	Accepts Boolean value
nextByte()	Accepts Byte value

Example:

```
import java.util.Scanner;

public class ScannerExample {
        public static void main(String[] args) {

       Scanner sc = new Scanner(System.in);
```

```
        System.out.println("Enter Name, RollNo, Marks, Grade");

        String name = sc.nextLine();              //used to read line
        int RollNo = sc.nextInt();                //used to read int
        double Marks = sc.nextDouble();           //used to read double
        char Grade = sc.next().charAt(0);  //used to read till space

        System.out.println("Name: "+name);
        System.out.println("Gender: "+RollNo);
        System.out.println("Marks: "+Marks);
        System.out.println("Grade: "+Grade);

        sc.close();
         }
}
```

Copy

Output:

```
Enter Name, RollNo, Marks, Grade
Mohit
19
87.25
A
Name: Mohit
Gender: 19
Marks: 87.25
Grade: A
```

Entering the wrong type of input, or just messing up with the order of inputs in the above example will give an error.

For same example when we change the order of inputs it gives the following output:

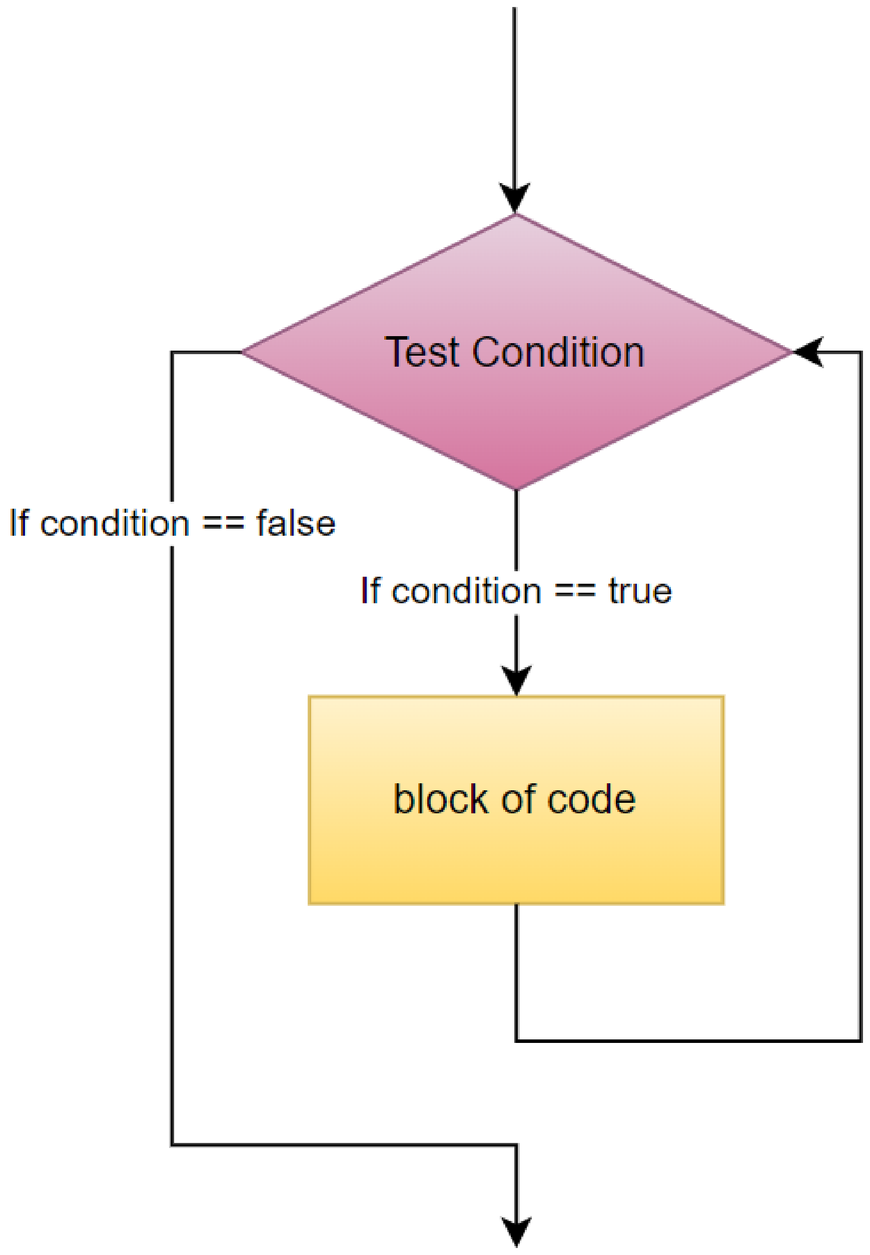
```
Enter Name, RollNo, Marks, Grade
Rajesh
Joshi
Exception in thread "main" java.util.InputMismatchException
	at java.base/java.util.Scanner.throwFor(Scanner.java:939)
	at java.base/java.util.Scanner.next(Scanner.java:1594)
	at java.base/java.util.Scanner.nextInt(Scanner.java:2258)
	at java.base/java.util.Scanner.nextInt(Scanner.java:2212)
	at
javaFiles/FileHandling.ScannerExample.main(ScannerExample.java:14)
```

if Statement

Decision-making involves evaluating a condition to a Boolean value and making a decision based on it. The basic idea revolves around executing the block of code whose condition evaluates to true. Below are the types of decision-making statements:

- if statement
- if…..else statement
- if…..else if statement
- nested if statements
- switch statement

if statement:



In a simple if statement, a block of code inside the if statement is only executed if the condition evaluates to true.

Syntax:

```
if (condition) {
    //block of code
}
public class JavaIf {
    public static void main(String[] args) {
        String name = "Mohan";
        int Roll = 25;
        if (name == "Mohan" && Roll == 25) {
            System.out.println("Details of Mohan.");
        }
    }
}
```

Output:

```
Details of Mohan.
```

Example:

```
public class JavaIf {
    public static void main(String[] args) {
        String name = "Mohan";
        int Roll = 25;
        if (name == "Mohan" && Roll == 26) {
            System.out.println("Details of Mohan.");
        }
    }
}
```

Output:

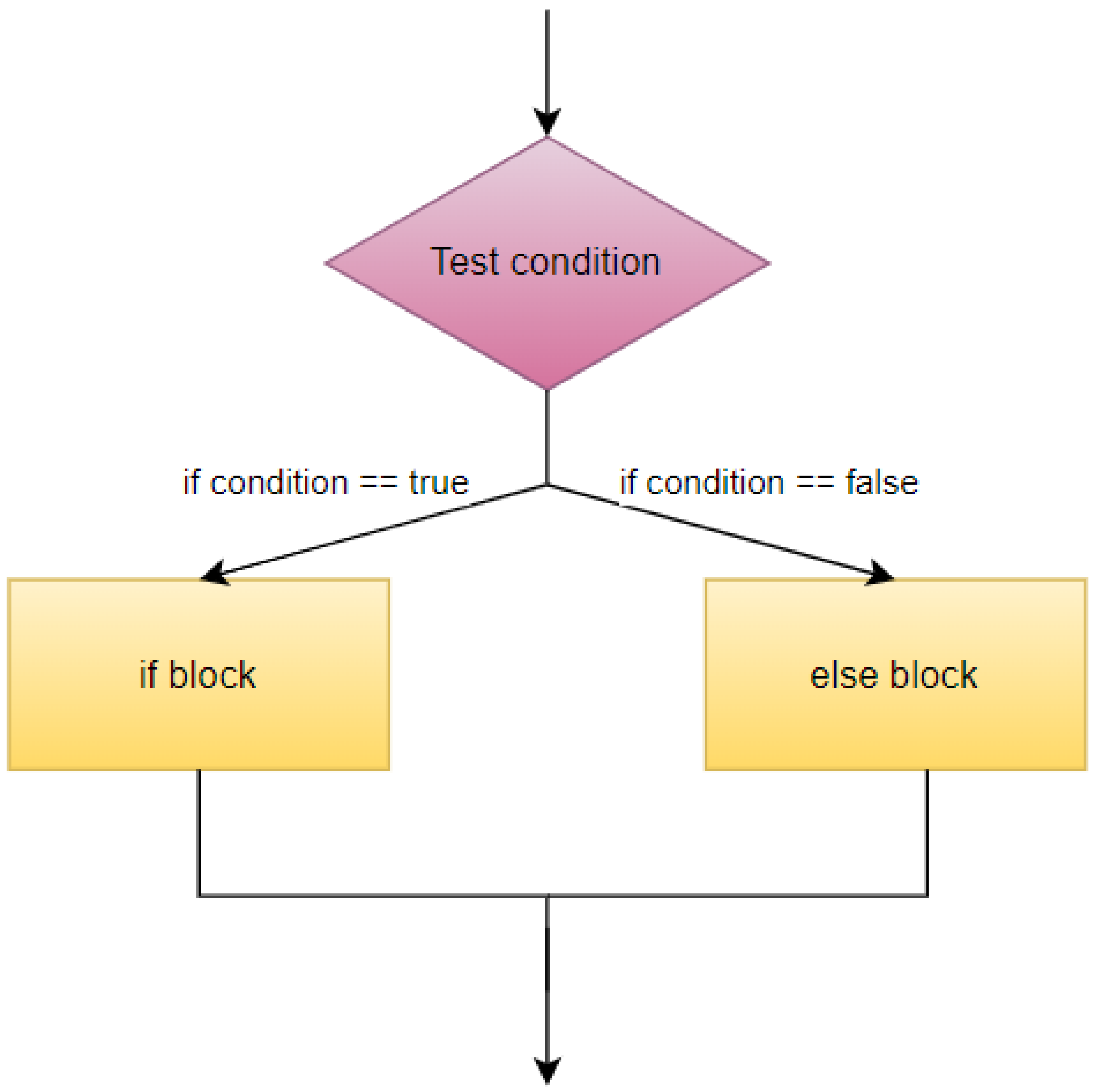
Above code won’t give an output.

<u>if…..else Statement</u>

In an if…..else statement we have two blocks of code, wherein the former block of code (code inside if statement) is executed if condition evaluates to true and the later block of code (code inside else statement) is executed if the condition is false.

Syntax:

```
if (condition) {
        //block of code
} else {
        //block of code
}
```



Example:

```
public class JavaIf {
    public static void main(String[] args) {
        String name = "Mohan";
        int Roll = 25;
        if (name == "Mohan" && Roll == 26) {
            System.out.println("Details of Mohan.");
        } else {
            System.out.println("Invalid details.");
        }
    }
}
```

Copy

Output:

```
Invalid details.
```

if…..else if Statement

But what if we have more than two blocks of code? And what if we need to check which block of code evaluates to true? Well here we use an if…..else if statement.

if……else if statements allows us to check multiple expressions and enter the block of code where the condition evaluates to true.

Syntax:

```
if (condition 1) {
    //block of code
} else if (condition 2) {
    //block of code
} else if (condition 3) {
    //block of code
} else if (condition 4) {
    //block of code
} else {
    //if no condition matches
    //block of code
}
```

Example:

```
public class JavaIf {
    public static void main(String[] args) {
        String name[] = {"Mohan", "Rohan", "Soham"};
        int Roll[] = {25, 36, 71};
        if (name[0] == "Mohan" && Roll[1] == 25) {
            System.out.println("Details of Mohan.");
        } else if (name[2] == "Rohan" && Roll[1] == 36) {
            System.out.println("Details of Rohan.");
        } else if (name[2] == "Soham" && Roll[2] == 71) {
            System.out.println("Details of Soham.");
        } else {
            System.out.println("Invalid details.");
        }
    }
}
```

Output:

```
Details of Soham.
```

Nested if Statements

if statements inside other if statements are called nested if statements.

Example:

```
public class Nested {
    public static void main(String[] args) {
        String name = "Mohan";
        int Roll = 25;
        int marks = 85;
        if (name == "Mohan" && Roll == 25) {
            if (marks > 35) {
                System.out.println("Mohan has been promoted to next class.");
            } else {
                System.out.println("Mohan needs to give re-exam.");
            }
        }
    }
}
```

Copy

Output:

```
Mohan has been promoted to next class.
```

<u>switch case Statements</u>

In a switch statement, a block of code is executed from many based on switch case.

Syntax:

```
switch (expression) {
  case value1:
    // code
    break;
  case value2:
    // code
    break;
  ...
  ...
  default:
    // default statements
  }
```

Example:

```
public class JavaSwitch {
    public static void main(String[] args) {
        String day = "Wednesday";
        switch (day) {
          case "Sunday":
            System.out.println("Today is Sunday");
            break;
          case "Monday":
            System.out.println("Today is Monday");
            break;
          case "Tuesday":
            System.out.println("Today is Tuesday");
            break;
          case "Wednesday":
            System.out.println("Today is Wednesday");
            break;
          case "Thursday":
            System.out.println("Today is Thursday");
            break;
          case "Friday":
            System.out.println("Today is Friday");
            break;
          case "Saturday":
            System.out.println("Today is Saturday");
            break;
        }
    }
}
```

Output:

```
Today is Wednesday
```

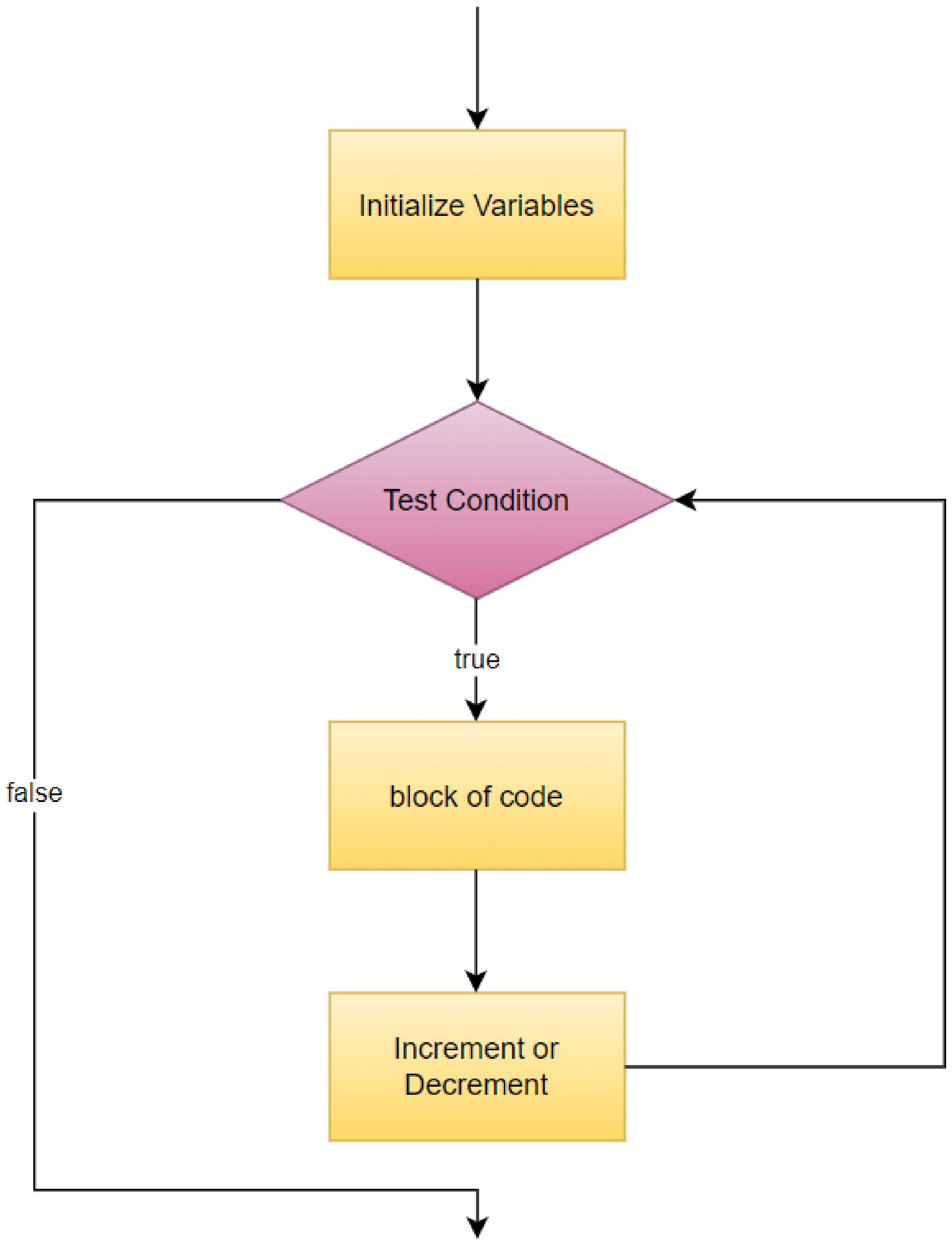
for Loop

Loops in any programming language are used to execute a block of code again and again until a base condition is achieved. As soon as a base condition is satisfied the loop is terminated and the control is returned to the main body of the program.

There are three types of loops in java:

- for loop
- while loop
- do……while loop

for loop:



Whenever a loop needs to be run a specific number of times, we use a for loop.

Syntax:

```
for (initializeVariable, testCondition, increment/decrement){
//block of code
}
```

- initializeVariable: initialize a new variable or use an already existing one.
- testCondition: It checks the testing condition of the loop after each iteration and returns a Boolean value, which determines if the loop should be terminated or not.
- Increment/decrement: It is used to increment or decrement the variable after each iteraton.

Example:

```
public class ForLoop1 {
    public static void main(String[] args) {
        for(int i=1; i<=10; i++) {
            System.out.println("2 * "+ i+ " = "+ 2*i);
        }
    }
}
```

Output:

```
2 * 1 = 2
2 * 2 = 4
2 * 3 = 6
2 * 4 = 8
2 * 5 = 10
2 * 6 = 12
2 * 7 = 14
2 * 8 = 16
2 * 9 = 18
2 * 10 = 20
```

We also have a special syntax for iterating through arrays and other collection objects, also called as a for-each loop.

Syntax:

```
for (type variable : collectionObject){
    //block of code
}
```

Example:

```
public class ForEach1 {
    public static void main(String[] args) {
        int[] prime = {1,3,5,7,11,13,17,19};
        System.out.println("Prime numbers are:");
        for(int i : prime) {
            System.out.println(i);
        }
    }
}
```

Copy

Output:

```
Prime numbers are:
1
3
5
7
11
13
17
19
```

And lastly we have an infinite for loop, wherein the expression always evaluates to true, hence running indefinitely.

Example:

```
public class ForLoop1 {
    public static void main(String[] args) {
        for(int i=1; i<=10; i--) {
            System.out.println(i);
        }
    }
}
```

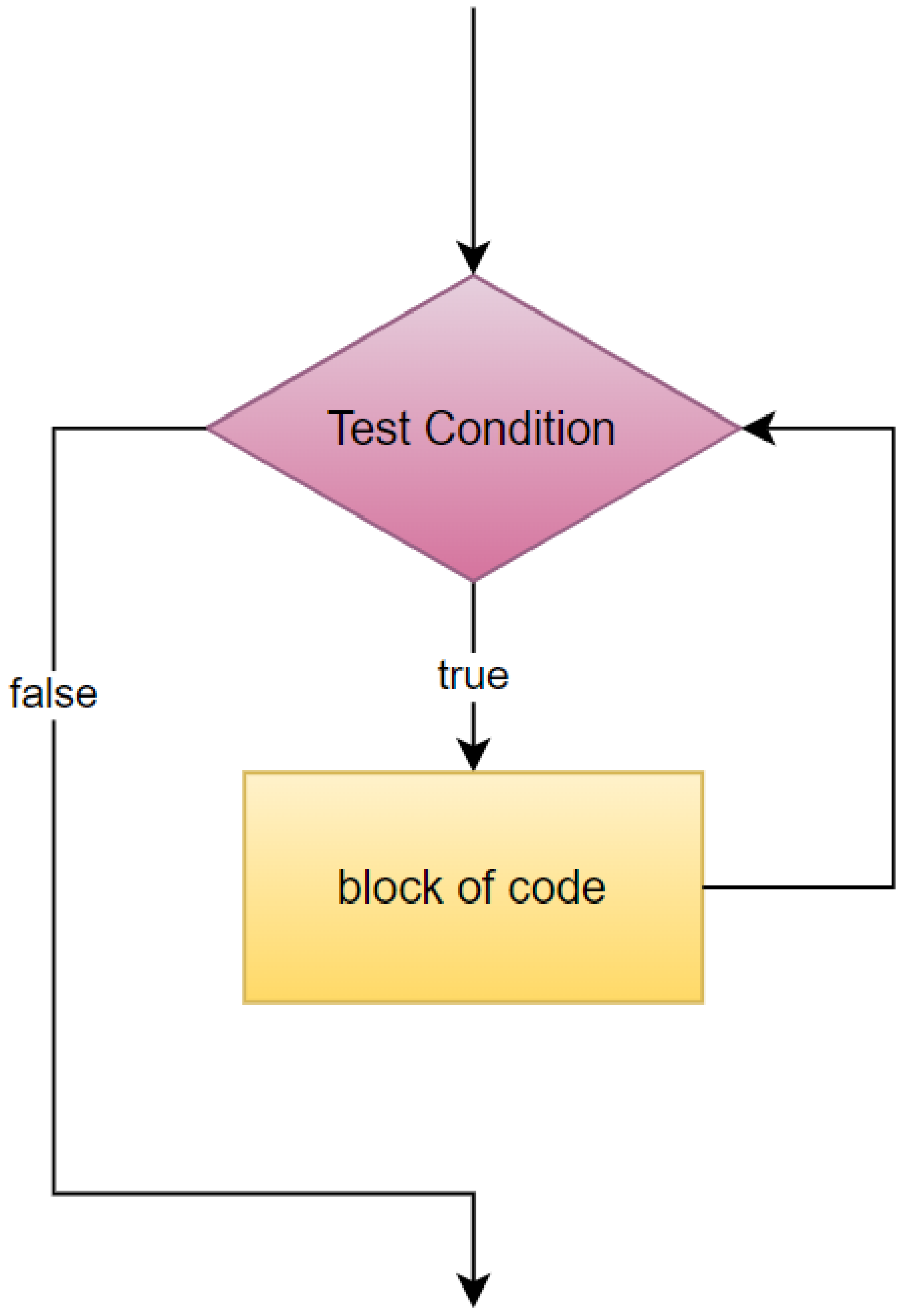
Copy

Output:

```
-3832975
-3832976
-3832977
-3832978
-3832979
-3832980
-3832981
-3832982
-3832983
-3832984
-3832985
.
.
.
.
```

The loop will keep on running until you halt the program.

while Loop



Whenever we are not sure about the number of times the loop needs to be run, we use a while loop. A while loop keeps on running till the condition is true, as soon as the condition is false, control is returned to the main body of the program.

Syntax:

```
while (baseBooleanCondition) {
    //block of code
}
```

baseBooleanCondition: it checks if the condition is true or false after each iteration. If true, run block of code. If false, terminate the loop.

Example:

```
public class WhileLoop {
    public static void main(String[] args) {
        int i = 10;
        while (i>0) {
            System.out.println(i);
            i--;
        }
    }
}
```

Output:

```
10
9
8
7
6
5
4
3
2
1
```

do-while Loop

A do…..while loop is a special kind of loop that runs the loop at least once even if the base condition is false. This is because the base condition in this loop is checked after executing the block of code. As such, even if the condition is false, the loop is bound to run atleast once. Hence, do…..while loop is also called as an Exit Control Loop.

Syntax:

```
do {
    //block of code
} while (baseBooleanCondition);
```

Example 1:

```
public class WhileLoop {
    public static void main(String[] args) {
        int i = 10;
        do {
            System.out.println(i);
            i--;
        } while (i>0);
    }
}
```

Copy

Output:

```
10
9
8
7
6
```

```
5
4
3
2
1
```

Example 2:

```
public class WhileLoop {
    public static void main(String[] args) {
        int i = 10;
        do {
            System.out.println(i);
            i--;
        } while (i>10);
    }
}
```

Copy

Output:

```
10
```

As we can see, even if condition is false, the loop runs at least once.

Nested Loops

Loops inside other loops are called nested loops.

Example:

```
public class Nested {
    public static void main(String[] args) {
        for (int i=1; i<5; i++) {
            for (int j=1; j<5; j++) {
                System.out.println(i+" * "+j+" = "+i*j);
            }
            System.out.println();
        }
    }
}
```

Output:

```
1 * 1 = 1
1 * 2 = 2
1 * 3 = 3
1 * 4 = 4

2 * 1 = 2
2 * 2 = 4
2 * 3 = 6
2 * 4 = 8

3 * 1 = 3
3 * 2 = 6
3 * 3 = 9
3 * 4 = 12

4 * 1 = 4
4 * 2 = 8
4 * 3 = 12
4 * 4 = 16
```

break/continue Statement

break statement
In java, break statement is used when working with any kind of a loop or a switch statement. It breaks out of the loop or a switch statement and returns the control to the main body of the program. In the case of nested loops, it breaks the inner loop and control is returned to the outer loop.

Example:

```
public class JavaBreak {
    public static void main(String[] args) {
        for(int n=1; n<=20; n++) {
            if(n%2 == 0) {
                System.out.println(n);
                if (n == 12) {
                    break;
                }
            }
        }
    }
}
```

Copy

Output:

```
2
4
```

```
6
8
10
12
```

continue statement

The continue statement breaks the current iteration in the loop, if a specified condition occurs, moves to the end of the loop, and continues with the next iteration in the loop.

Example:

```
public class JavaContinue {
    public static void main(String[] args) {
        for(int n=1; n<=20; n++) {
            if(n%2 == 0) {
                if (n == 12) {
                    continue;
                }
                System.out.println(n);
            }
        }
    }
}
```

Output:

```
2
4
6
8
10
14
16
```

```
18
20
```

String Basics

Strings in java is a sequence of characters that Is enclosed in double quotes. Whenever java comes across a String literal in the code, it creates a string literal with the value of string.

Example:

```
public class string {
    public static void main(String[] args) {
        String name;
        name = "Diablo";
        System.out.println("My name is " + name);
    }
}
```

Output:

```
My name is Diablo
```

The same can be done using an array of characters.

Example:

```
public class string {
    public static void main(String[] args) {
        char[] name = {'D', 'i', 'a', 'b', 'l', 'o'};
        String welcomeMsg = new String(name);
        System.out.println("Welcome " + welcomeMsg);
    }
}
```

Output:

```
Welcome Diablo
```

Concatenate Strings:

Concatenation between two strings in java is done using the + operator.

Example:

```
public class string {
   public static void main(String[] args) {
      String fname, lname;
      fname = "Diablo";
      lname = "Ramirez";
      System.out.println(fname + " " + lname);
   }
}
```

Output:

```
Diablo Ramirez
```

Alternatively, we can use the concat() method to concatenate two strings.

Example:

```
public class string {
   public static void main(String[] args) {
      String fname, lname;
      fname = "Diablo";
      lname = " Ramirez";
      System.out.println(fname.concat(lname));
   }
}
```

Output:

```
Diablo Ramirez
```

What if we concatenate string with an integer?

Well concatenating a string and an integer will give us a string.

Example:

```
public class string {
    public static void main(String[] args) {
        String name;
        int quantity;
        quantity = 12;
        name = " Apples";
        System.out.println(quantity + name);
    }
}
```

Output:

```
12 Apples
```

Escape Characters

Try running the code given below in your java compiler.

```
public class string {
    public static void main(String[] args) {
        System.out.println("He said, "I believe that the Earth is Flat".");
    }
}
```

As we can see that the code gives an error. This is because the compiler assumes that the string ends after the 2nd quotation mark.

This can be solved by using ‘\’ (backslash). Backslash acts as an escape character allowing us to use quotation marks in strings.

Example:

```
public class string {
    public static void main(String[] args) {
        System.out.println("He said, \"I believe that the Earth is Flat\".");
        System.out.println("she said, \'But the Earth is spherical\'.");
    }
}
```

Output:

```
He said, "I believe that the Earth is Flat".
she said, 'But the Earth is spherical'.
```

Similarly to use a backslash in the string we must escape it with another backslash.

Example:

```
public class string {
    public static void main(String[] args) {
        System.out.println("The path is D:\\Docs\\Java\\Strings");
    }
}
```

Output:

```
The path is D:\Docs\Java\Strings
```

We also have an escape character for printing on a new line(\n), inserting a tab(\t), backspacing(\b), etc.

Example:

```
public class string {
    public static void main(String[] args) {
        System.out.println("My name is Anthony. \nI'm an Artist.");
        System.out.println();
        System.out.println("Age:\t18");
        System.out.println("Addresss\b: Washington DC");
    }
}
```

Output:

```
My name is Anthony.
I'm an Artist.

Age:    18
Address: Washington DC
```

String Methods

Here we will see some of the popular methods we can use with strings.

length(): This method is used to find the length of a string.

Example:

```
public class string {
    public static void main(String[] args) {
        String quote = "To be or not to be";
        System.out.println(quote.length());
    }
}
```

Output:

```
18
```

indexOf(): This method returns the first occurrence of a specified character or text in a string.

Example:

```
public class string {
    public static void main(String[] args) {
        String quote = "To be or not to be";
        System.out.println(quote.indexOf("be"));    //index of text
        System.out.println(quote.indexOf("r"));     //index of character
    }
}
```

Output:

```
3
7
```

toLowerCase(): Converts string to lower case characters.

Example:

```
public class string {
    public static void main(String[] args) {
        String quote = "THOR: Love and Thunder";
        System.out.println(quote.toLowerCase());
    }
}
```

Output:

```
thor: love and thunder
```

toUpperCase(): Converts string to upper case characters.

Example:

```
public class string {
    public static void main(String[] args) {
        String quote = "THOR: Love and Thunder"
        System.out.println(quote.toUpperCase());
    }
}
```

Output:

```
THOR: LOVE AND THUNDER
```

Array Basics

An array is a container object that holds a fixed number of values of a single type. We do not need to create different variables to store many values, instead we store them in different indices of the same objects and refer them by these indices whenever we need to call them.

Syntax:

```
Datatype[] arrayName = {val1, val2, val3,……. valN}
```

Note: array indexing in java starts from [0].

There are two types of array in java:

- Single Dimensional Array
- Multi-Dimensional Array

We will see how to perform different operations on both the type of arrays,

A. Length of an array:

Finding out the length of an array is very crucial when performing major operations. This is done using the .length property:

Example:

```
public class ArrayExample {
    public static void main(String[] args) {
        //creating array objects
        String[] cities = {"Delhi", "Mumbai", "Lucknow", "Pune",
"Chennai"};
        int[] numbers = {25,93,48,95,74,63,87,11,36};

        System.out.println("Number of Cities: " + cities.length);
        System.out.println("Length of Num List: " + numbers.length);
    }
}
```

Output:

```
Number of Cities: 5
Length of Num List: 9
```

B. Accessing array elements:

Array elements can be accessed using indexing. In java, indexing starts from 0 rather than 1.

Example:

```
public class ArrayExample {
    public static void main(String[] args) {
        //creating array objects
        String[] cities = {"Delhi", "Mumbai", "Lucknow", "Pune",
"Chennai"};
        int[] numbers = {25,93,48,95,74,63,87,11,36};

        //accessing array elements using indexing
        System.out.println(cities[3]);
        System.out.println(numbers[2]);
    }
}
```

Output:

```
Pune
48
```

C. Change array elements:
The value of any element within the array can be changed by referring to its index number.

Example:

```
public class ArrayExample {
    public static void main(String[] args) {
        //creating array objects
        String[] cities = {"Delhi", "Mumbai", "Lucknow", "Pune",
"Chennai"};

        cities[2] = "Bangalore";
        System.out.println(cities[2]);
    }
}
```

```
Output:

Bangalore
```

Multidimensional Arrays

We can even create multidimensional arrays i.e. arrays within arrays. We access values by providing an index for the array and another one for the value inside it.

Example:

```
public class ArrayExample {
    public static void main(String[] args) {
        //creating array objects
        String[][] objects = {{"Spoon", "Fork", "Bowl"}, {"Salt",
"Pepper"}};

        //accessing array elements using indexing
        System.out.println(objects[0][2]);
        System.out.println(objects[1][1]);
    }
}
```

```
Output:

Bowl
Pepper
```

We can also print the multi-dimensional array.

Example:

```
public class ArrayExample {
    public static void main(String[] args) {
        //creating array objects
        int[][] objects = {{1,2,3}, {4,5,6}};

        for (int i = 0; i < objects.length; i++) {
            for (int j = 0; j < objects[i].length; j++) {
                  System.out.print(objects[i][j] + "\t");
            }
            System.out.println();
        }
    }
}
```

Output:

```
1	2	3
4	5	6
```

Use loops with arrays:
The simplest way of looping through an array is to use a simple for-each loop.

Example:

```
public class ArrayExample {
    public static void main(String[] args) {
        //creating array objects
        String[] objects = {"Spoon", "Fork", "Bowl", "Salt", "Pepper"};

        for (String i : objects) {
              System.out.println(i);
        }
    }
}
```

Output:

```
Spoon
Fork
Bowl
Salt
Pepper
```

Alternatively, you can also use a simple for loop to do the same.

Example:

```
public class ArrayExample {
    public static void main(String[] args) {
        //creating array objects
        String[] objects = {"Spoon", "Fork", "Bowl", "Salt", "Pepper"};

        for (int i = 0; i < objects.length; i++) {
              System.out.println(objects[i]);
        }
    }
}
```

Output:

```
Spoon
Fork
Bowl
```

```
Salt
Pepper
```

Java Methods

Methods or Functions are a block of code that accept certain parameters and perform actions whenever they are called. Methods are always written inside a java class and can be called by simply referring to the method name.

Passing Parameters:

Parameters are nothing but the variables that are passed inside the parenthesis of a method. We can pass a single or more than one parameter of different datatypes inside our method.

Example 1: Passing single parameter

```
public class MethodExample {

    static void Details(String name) {
        System.out.println("Welcome " + name);
    }

    public static void main(String[] args) {
        Details("Mitali");
    }
}
```

Output:

```
Welcome Mitali
```

Example 2: Passing multiple parameters

```
public class MethodExample {

    static void Details(String name, int roll) {
        System.out.println("Welcome " + name);
        System.out.println("Your roll number is "+ roll);
    }

    public static void main(String[] args) {
        Details("Mitali", 37);
    }
}
```

Output:

```
Welcome Mitali
Your roll number is 37
```

Example 3: Method with loop

```
public class MethodIf {
    static int Details(int num) {
        int fact = 1;
        for (int i=2; i<=num; i++) {
            fact = fact * i;
        }
        return fact;
    }

    public static void main(String[] args) {
        System.out.println(Details(3));
        System.out.println(Details(4));
        System.out.println(Details(5));
    }
}
```

Output:

```
6
24
120
```

Example 4: Method with control statements

```
public class Methodloop {
    static void Details(int marks) {
        if (marks < 35) {
            System.out.println("Fail");
        } else if (marks >= 35 && marks < 65) {
            System.out.println("B grade");
        } else if (marks >= 65 && marks < 75) {
            System.out.println("A grade");
        } else if (marks >= 75 && marks < 100) {
            System.out.println("O grade");
        } else {
            System.out.println("Invalid marks entered");
        }
    }

    public static void main(String[] args) {
        Details(25);
        Details(90);
        Details(60);
    }
}
```

Output:

```
Fail
O grade
B grade
```

So what can we make out from e.g.3 and e.g.4? In e.g.3, we have created a method without using the void keyword, this lets us return the value inside the method. Whereas in e.g.4, we have created a method using void keyword, this means that our method wont return a value.

Method Overloading

Method Overloading is when we create multiple methods with the same name but pass different types of parameters inside it. This allows us to load the same methods many times. We only either need to pass a different type or a different number of parameters inside it.

Example:

```java
public class MethodOverloadEx {
    static void Details(String name, int marks) {
        System.out.println("Welcome " + name);
        System.out.println("Your got "+ marks + " marks in exam.");
    }

    static void Details(String name, double marks) {
        System.out.println("Welcome " + name);
        System.out.println("Your got "+ marks + " marks in exam.");
    }

    public static void main(String[] args) {
        Details("Ridhi", 89);
        Details("Ritesh", 93.5);
    }
}
```

Output:

```
Welcome Ridhi
Your got 89 marks in exam.
Welcome Ritesh
Your got 93.5 marks in exam.
```

Recursive Functions

Java allows us to recursively call a method many times, which helps us solve different type of problems.

Example:

```java
public class RecursiveMethod {

    static int fact(int num) {
        if (num != 0)
            return num * fact(num-1);
        else
            return 1;
    }

    public static void main(String[] args) {
        int num1 = 6, res;
        res = fact(num1);
        System.out.println("Factorial of " + num1 + " is " + res);
    }
}
```

Output:

```
Factorial of 6 is 720
```

<u>Object & Class</u>

OOP's stands for Object Oriented Programming. It is a concept of using objects in programming to implement real-world entities. OOP provides a clear syntax for our code making it easier to execute the code.

The key concepts in OOP include:

- Object & Class
- Inheritance
- Polymorphism
- Abstraction
- Encapsulation

Object & Class

An object can be any real-world entity such as a book, cupboard, pen, paper, fan, etc. While a class is a group of objects with similar properties.

An object is an instance of a class while a class is a blueprint from which we create objects.

i. Different ways to create objects:

Let's how we can create a class and from it, create an object.

Syntax to create object from class:

```
className objectName = new className();
```

Example:

```
public class Example1 {

    String name = "Rajesh";
    int age = 20;

    public static void main(String[] args) {
        Example1 ex = new Example1();
        System.out.println("Name: " + ex.name);
        System.out.println("Age: " + ex.age);
    }
}
```

Copy

Output:

```
Name: Rajesh
Age: 20
```

In the above example, first we create a class using the class keyword. We have named our class Example1. Now in order to create an object from Example1 class we will use the new keyword. new keyword allocates heap memory to object at run time.

We can even create multiple instances of the same class.

Example:

```
public class Example2 {

    String name = "Rajesh";
    int age = 20;

    public static void main(String[] args) {
        Example1 ex1 = new Example1();
        Example2 ex2 = new Example2();
        System.out.println("Name: " + ex1.name);
        System.out.println("Age: " + ex2.age);
    }
}
```

Copy

Output:

```
Name: Rajesh
Age: 20
```

This example is similar to the previous example, i.e. we get same output. But the difference is that, in this example, we have created two instances of the same class while in the previous example only one single instance was created.

Finally, we can program our code in one class and call it as an object in the main() method of another class. This helps us organize our code thus making it easy to use, detect errors, modify, etc.

Example3.java:

```
public class Example3 {
    String name = "Rajesh";
    int age = 20;
}
```

Example4.java:

```
public class Example4 {

    public static void main(String[] args) {
        Example3 ex3 = new Example3();
        System.out.println("Name: " + ex3.name);
        System.out.println("Age: " + ex3.age);
    }
}
```

Copy

Output:

```
Name: Rajesh
Age: 20
```

ii. Class attributes/fields:
Class attributes are the variables created inside a class.

Example:

```
public class Example3 {
    String name = "Rajesh";
    int age = 20;
}
```

Here name and age are attributes or fields of class Example3.

We have already seen how to access these attributes in previous examples, i.e. we create object and access the attribute of that object.

Example:

```
public class Example1 {

    String name = "Rajesh";
    int age = 20;
    public static void main(String[] args) {
        Example1 ex = new Example1();
        System.out.println("Name: " + ex.name);
        System.out.println("Age: " + ex.age);
    }
}
```

But the attributes declared in the class can be overridden in the main method().

Example:

```
public class Example1 {

    String name = "Rajesh";
    int age = 20;

    public static void main(String[] args) {
        Example1 ex = new Example1();
        ex.age = 25;
        System.out.println("Name: " + ex.name);
        System.out.println("Age: " + ex.age);
    }
}
```

Copy

Output:

```
Name: Rajesh
Age: 25
```

As we can see, we changed the value of age attribute in the main method and the output was affected by it. But what if we don't want the main method to override any declared value?

This can be done using the final keyword. Essentially what final keyword does is that, once the attribute holds certain value, then it cannot be overridden.

Example:

```
public class Example1 {

    final String name = "Rajesh";
    final int age = 20;

    public static void main(String[] args) {
        Example1 ex = new Example1();
        ex.name = "Sanjay";
        ex.age = 25;
        System.out.println("Name: " + ex.name);
        System.out.println("Age: " + ex.age);
    }
}
```

Copy

Output:

```
Exception in thread "main" java.lang.Error: Unresolved compilation problems:
    The final field Example1.name cannot be assigned
    The final field Example1.age cannot be assigned
    at javaFiles/ObjectNClass.Example1.main(Example1.java:10)
```

iii. Class Methods:

Methods are a block of code that accept certain parameters and perform actions whenever they are called. Methods are always written inside a java class and can be called by simply referring to the method name.

In java we have public and static methods. So what is the difference between?

public methods are accessed by making objects of the class whereas static methods do not need objects to be accessed, we can directly accessed static methods.

Example:

```
public class Example5 {
    //public method
    public void fruits() {
        String fruits[] = {"Apple", "Banana", "Mango", "Strawberry"};
        System.out.println("Fruits:");
        for (int i=0; i<fruits.length; i++) {
            System.out.println(fruits[i]);
        }
    }

    //static method
    static void vegetables() {
        String vegies[] = {"Onion", "Potato", "Carrot", "Raddish"};
        System.out.println("Vegetables:");
        for (int i=0; i<vegies.length; i++) {
            System.out.println(vegies[i]);
        }
    }

    public static void main(String[] args) {
        Example5 ex5 = new Example5();        //need to create object
        ex5.fruits();
        System.out.println();

        vegetables();                         // no need to create object
    }
}
```

Copy

Output:

```
Fruits:
Apple
Banana
Mango
Strawberry

Vegetables:
Onion
Potato
Carrot
Raddish
```

As we can see, we have created two methods, inside which each of the method has array and for loop to print them. But public method needs an object to be declared in the main() method while we can directly use the static method inside the main() method.

Inheritance

Inheritance is the mechanism by which one class acquires the properties and features of another class. The class that inherits the properties is called as a sub-class (child class) while the class from which the property is inherited is called as the super-class (parent class).

A child class inherits properties of parent class with the help of extends keyword.

Syntax:

```
class childClass extends parentClass {
    //any code
}
```

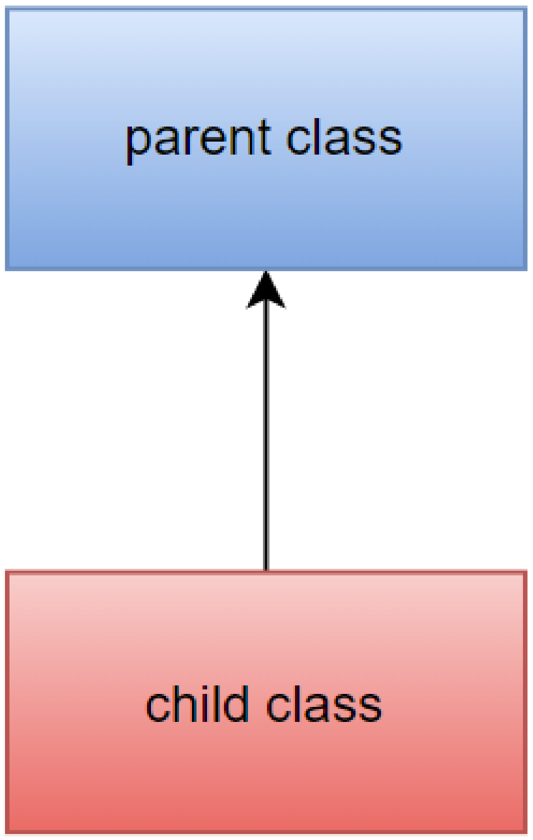
Inheritance can be further divided into the following types:

- Single level
- Multi-level
- Hierarchical
- Multiple
- Hybrid

Multiple and hybrid inheritance is not directly supported in java, instead it is achieved through the use of interfaces in java.

i. Single Inheritance

When a single class inherits the attributes and methods of another class, it is known as single inheritance.



Example:

```
class FundamentalForce {
    void Force() {
        System.out.println("There are four fundamental forces.");
    }
}

class Gravitational extends FundamentalForce {
    void Gravity() {
        System.out.println("Fruits fall to the ground due to gravitational
Force.");
    }
}
```

```
class SingleInheritance {
    public static void main(String[] args) {
        Gravitational G = new Gravitational();
        G.Force();
        G.Gravity();
    }
}
```

Copy

Output:

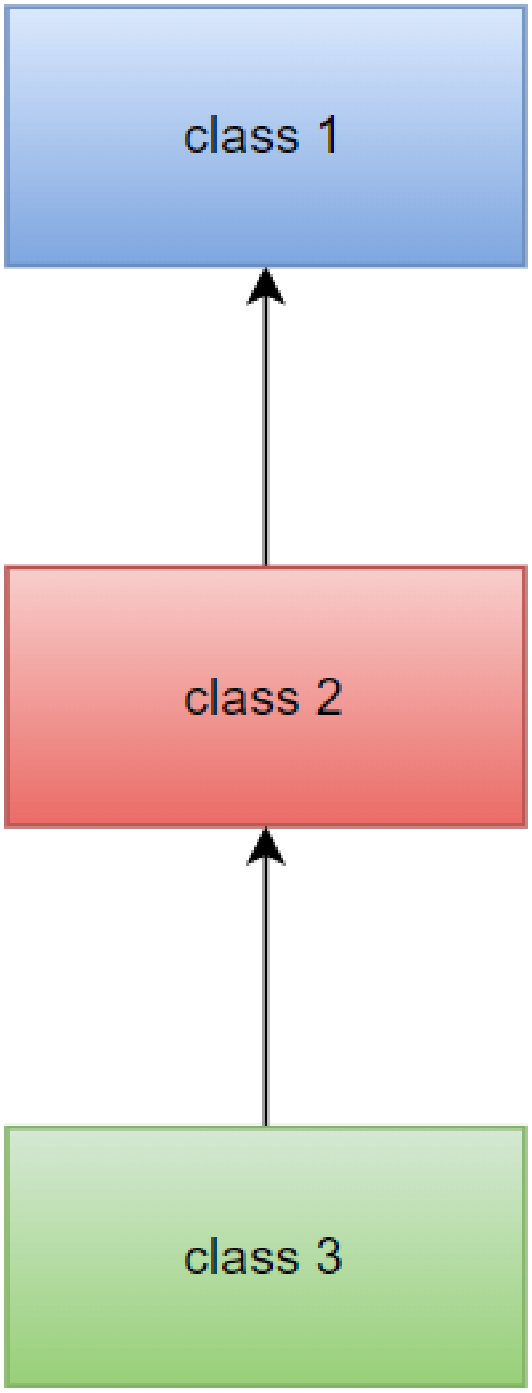
```
There are four fundamental forces.
Fruits fall to the ground due to gravitational Force.
```

In this example, we see how class Gravitational can inherit the method of Its parent class (FundamentalForce). This is an perfect example of parent-child relationship.

ii. Multi-level Inheritance

When a class 3 inherits attributes and methods from class 2 which in turn inherits its attributes and methods from class 1, it is called a multi-level inheritance.

It forms a child-parent-grandparent (or a parent-child-grandchild) relationship. Meaning that child inherits from the parent while the parent inherits from the grandparent.



Example:

```
class NuclearForce extends FundamentalForce {
    void Nuclear() {
        System.out.println("Nuclear Forces are of two types;");
        System.out.println("Strong Nuclear Force");
        System.out.println("Weak Nuclear Force");
    }
}

class StrongNuclearForce extends NuclearForce {
    void Strong() {
        System.out.println("Strong Nuclear Force is responsible for the
underlying stability of matter.");
    }
}

class MultilevelInheritance {
    public static void main(String[] args) {
        StrongNuclearForce st = new StrongNuclearForce();
        st.Force();
        st.Nuclear();
        st.Strong();
    }
}
```

Copy

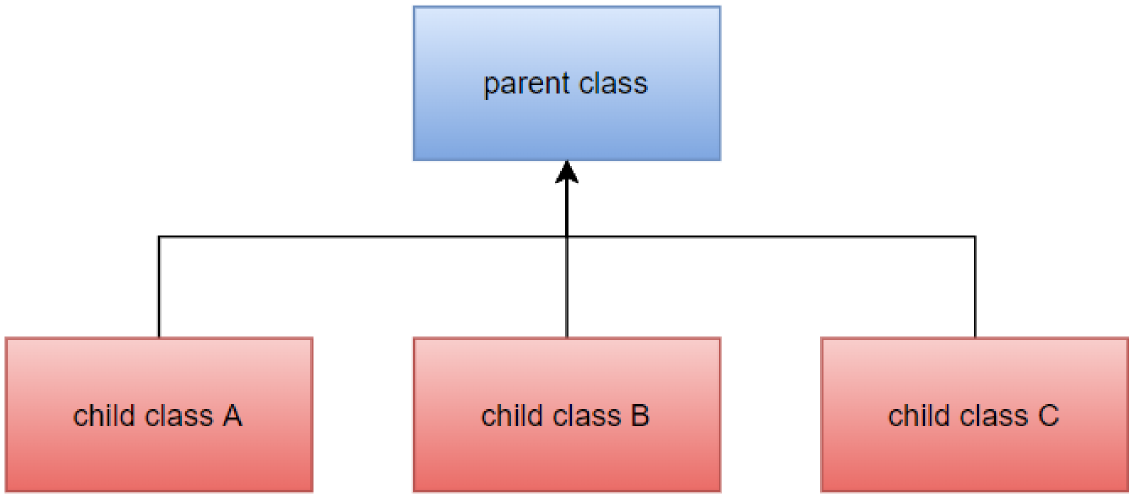
Output:

```
There are four fundamental forces.
Nuclear Forces are of two types;
Strong Nuclear Force
Weak Nuclear Force
Strong Nuclear Force is responsible for the underlying stability of
matter.
```

In this example, we see how class StrongNuclearForce inherits the method of NuclearForce which in turn inherits the method of FundamentalForce. This is a classic example of a child-parent-grandparent relationship.

iii. Hierarchical Inheritance

Hierarchical inheritance is when two or more classes inherit from a single class. This can be easily visualized as a parent with more than one child. Here each child can inherit the properties of a parent.



Example:

```
class FundamentalForce {
   void Force() {
      System.out.println("There are four fundamental forces.");
   }
}

class Gravitational extends FundamentalForce {
   void Gravity() {
        System.out.println("Fruits fall to the ground due to gravitational
Force.");
    }
}

class Electromagnetic extends FundamentalForce {
    void Particles() {
        System.out.println("The electromagnetic force acts between
charged particles");
    }
}

class HierarchicalInheritance {
    public static void main(String[] args) {
        System.out.println("Child 1:");
        Gravitational G = new Gravitational();
        G.Force();
        G.Gravity();

        System.out.println();
        System.out.println("Child 2");
        Electromagnetic em = new Electromagnetic();
        em.Force();
        em.Particles();
    }
}
```

Copy

Output:

```
Child 1:
There are four fundamental forces.
```

```
Fruits fall to the ground due to gravitational Force.

Child 2
There are four fundamental forces.
The electromagnetic force acts between charged particles
```

As we can see, both the children can access the method of the parent class.

Polymorphism

The word polymorphism is derived from the Greek words poly(meaning many), and morph(meaning form). Thus, polymorphism is the ability of an object to take more than one form.

Polymorphism is of two types:

- Compile time polymorphism
- Run time polymorphism

i. Compile-time polymorphism:

Java doesn't support operator overloading and hence compile-time polymorphism is not possible in java.

But we can overload multiple functions with same name and different parameters or different type of parameters.

Example:

```
class AddMethods {
    static int AddNums(int a, int b) {
        return (a+b);
    }

    static int AddNums(int a, int b, int c) {
        return (a+b+c);
    }

    static double AddNums(double a, double b) {
        return (a+b);
    }
}

public class Example1 {

    public static void main(String[] args) {
        System.out.println("Addition of two integers: "+
AddMethods.AddNums(6, 11));
        System.out.println("Addition of three integers: "+
AddMethods.AddNums(6, 11, 5));
        System.out.println("Addition of two decimal numbers: "+
AddMethods.AddNums(6.3, 2.8));
    }
}
```

Copy

Output:

```
Addition of two integers: 17
Addition of three integers: 22
Addition of two decimal numbers: 9.1
```

Here we have defined three methods with same name, but the parameters passed inside each differ by either the data type or the number of arguments passed. And we get output from each of these methods based on the input provided.

ii. Run-time polymorphism:

Run-time polymorphism or dynamic method dispatch involves overriding a method at run-time instead of compile-time.

Example:

```
class Color {
   void paint() {
      System.out.println("I'm Painting.");
   }
}

class RedPaint extends Color {
   void paint() {
      System.out.println("I'm Painting with Red color.");
   }
}

class BluePaint extends Color {
   void paint() {
      System.out.println("I'm Painting with Blue color.");
   }
}


public class Example2 {

   public static void main(String[] args) {
      Color c;
      c = new RedPaint();
      c.paint();
      c = new BluePaint();
      c.paint();
   }
}
```

Copy

Output:

```
I'm Painting with Red color.
I'm Painting with Blue color.
```

Child classes have overridden the method of attribute parent class. Hence, when we create object of child class, then the method inside the child class is executed because it has more priority.

Abstraction

Data abstraction refers to the process of hiding low level details and only displaying important information. The abstract keyword is used to declare abstract classes. Abstract classes can have abstract and non-abstract methods.

Abstraction is achieved with the help of abstract classes and interfaces:

i. Abstract Classes and Abstract Methods:

Abstraction can be implemented only if we inherit the class from another class.

Inside the abstract class, when we create an abstract method, we use a semicolon (;) instead of curly brackets ({}).

Example:

```
abstract class Fruits {
    public abstract void taste();
    public void eat() {
        System.out.println("Let's eat Fruits.");
    }
}

class Mango extends Fruits {
    public void taste() {
        System.out.println("Mango is sweet.");
    }
}


public class Example3 {
    public static void main(String[] args) {
        Mango m = new Mango();
        m.eat();
        m.taste();
    }
}
```

Copy

Output:

```
Let's eat Fruits.
Mango is sweet.
```

We have an abstract class Fruits that has an abstract method taste() and a regular method eat(). We cannot directly create object of fruit class.

First, we inherit methods of the fruit class into the Mango class and access the abstract method through it.

Lastly, we create an object of the inherited class to use the abstract methods.

Thus we can see that the implementation of the class can be kept hidden from the end user.

ii. Interfaces

Interface in java is mainly used to achieve abstraction. We use the implements keyword to implement an interface.

Example:

```
interface Fruits {
    public abstract void taste();
    public void eat();
}

class Mango extends Fruits {

    public void taste() {
        System.out.println("Mango is sweet.");
    }

    public void eat() {
        System.out.println("Let's eat Fruits.");
    }
}

public class Example4 {
    public static void main(String[] args) {
        Mango m = new Mango();
        m.eat();
        m.taste();
    }
}
```

Copy

Output:

```
Let's eat Fruits.
Mango is sweet.
```

As we can see, implementing an interface is not that different from creating and abstract class and method. **So what is the main difference between an abstract class and an interface?**

<u>Encapsulation</u>

To encapsulate something is to enclose something, in our case, we encapsulate or wrap data into a single unit essentially binding the data and code together.

i. Get and set methods:

We use set method to set value of variable and get method to get the value of variable.

Example:

```
// filename: Example6.java

public class Example6 {
    private String name;
    private int age;

      // Getter Methods
    public String getName() {
        return name;
    }
    public int getAge() {
        return age;
    }

      // Setter Methods
    public void setName(String newName) {
        this.name = newName;
    }
    public void setAge(int newAge) {
        this.age = newAge;
    }
}
```

Here we have get method that takes values of variables and set method that assigns arguments as values to these variables.

```
//Filename: Example5.java

public class Example5 {

    public static void main(String[] args) {
        Example6 ex6 = new Example6();
        ex6.setName("Pranav");
        ex6.setAge(21);
        System.out.println("Name: " + ex6.getName());
        System.out.println("Age: " + ex6.getAge());
    }
}
```

Here, we make object of class Example6. Let’s run this file.

Output:

```
Name: Pranav
Age: 21
```

Advantages of Encapsulating data:

- We can hide our data more efficiently. Hence, after implementation, user will not have any idea about the inner working of the class. To the user, only setting and initializing values is visible.
- It makes our data reusable.
- Encapsulated data is easy to test.

Disadvantages of Encapsulating data:

- Size of the code increases exponentially.
- As the size of the code increases, we need to provide additional implementation for each method.
- We provide additional methods, this increases code execution.

Abstract Class	Interface
abstract keyword is used to create abstract class.	**Interface** keyword is used to create an interface.
Abstract class is implemented using extends keyword.	Interface is implemented using **implements** keyword.
Can extend another class or interface.	Can only extend an interface.

Can provide implementation of interface.	Cannot provide implementation of interface.
Does not support multiple inheritance.	Supports multiple inheritance.
Has abstract and non-abstract methods.	Has default, static and abstract methods.

File Creation

Java allows us to handle files and perform operations like create, read, write, update, and delete. This is known as File Handling in java. The java.io package has all the classes you will require to perform input and output (I/O) in Java. For this tutorial we will be using File class from the java.io package.

A. Create a File:

The createNewFile() method is used to create new files in java. This method throws an IOException if any error occurs. Hence it is important to write it in a try…….catch block.

Example:

```
import java.io.File;
import java.io.IOException;

public class CreateFile {
    public static void main(String[] args) {
        try {
            File myObj = new File("students.txt");
            if (myObj.createNewFile()) {
                System.out.println("Created Successfully: " +
myObj.getName());
            } else {
                System.out.println("Sorry, File Exists.");
            }
        } catch (IOException e) {
            System.out.println("Error.....");
            e.printStackTrace();
        }
    }
}
```

Copy

Output:

```
Created Successfully: students.txt
```

If we re-run the same code again, we get the following message:

```
Sorry, File Exists.
```

Files Read/Write

Read a File:

We can also read the contents of a file in java. This is done using the scanner class. This method throws an FileNotFoundException if any error occurs. Hence it is important to write it in a try…….catch block.

Example:

```
import java.io.File;
import java.io.FileNotFoundException;
import java.util.Scanner;

public class ReadFile {
    public static void main(String[] args) {
        try {
            File file = new File("students.txt");
            Scanner myReader = new Scanner(file);
            while (myReader.hasNextLine()) {
                String data = myReader.nextLine();
                System.out.println(data);
            }
            myReader.close();
        } catch (FileNotFoundException e) {
            System.out.println("Error.....");
            e.printStackTrace();
        }
    }
}
```

Output:

Here we do not see an output, because the stundents.txt file created has no content. Let's read a file which has some content in it.

Example:

```
import java.io.File;
import java.io.FileNotFoundException;
import java.util.Scanner;

public class ReadFile {
    public static void main(String[] args) {
        try {
            File file = new File("Teachers.txt");
            Scanner myReader = new Scanner(file);
            while (myReader.hasNextLine()) {
                String data = myReader.nextLine();
                System.out.println(data);
            }
            myReader.close();
        } catch (FileNotFoundException e) {
            System.out.println("Error.....");
            e.printStackTrace();
        }
    }
}
```

Copy

Output:

```
This file has information of TeachersName: Rosy Fernandes, Age:
36Name: Isha Mheta, Age: 29
```

Write a File:
We use the FileWriter class to write into a file in java.

Example:

```
import java.io.FileWriter;
import java.io.IOException;

public class WriteFile {
    public static void main(String[] args) {
        try {
            FileWriter file = new FileWriter("Teachers.txt");
            file.write("This file has information of Teachers");
            file.write("Name: Rosy Fernandes, Age: 36");
            file.write("Name: Isha Mheta, Age: 29");
            file.close();
            System.out.println("File has been written into.");
        } catch (IOException e) {
            System.out.println("Error......");
            e.printStackTrace();
        }
    }
}
```

Output:

```
File has been written into.
```

File Deletion

Deleting files is easy in java, just write an if…..else block and use the delete() method inside it.

Example:

```
import java.io.File;

public class DeleteFile {
    public static void main(String[] args) {
        File file = new File("students.txt");
        if (file.delete()) {
            System.out.println("Deleted Sccessfully: " + file.getName());
        } else {
            System.out.println("Error......");
        }
    }
}
```

Output:

```
Deleted Sccessfully: students.txt
```

Exception Handling
Sometimes, while executing programs, we get errors that influence the normal working of the program. Such errors are called exceptions and the method used to deal with these exceptions is known as exception handling.

Exceptions are of two types:

- Built-in exception
- User-defined exception

Built-in exceptions are available in Java libraries. These predefined exceptions can be used to explain certain error situations.

Users can also create their own exception class and throw that exception using throw keyword. These exceptions are known as user-defined or custom exceptions.

A. Exception Keywords:

Exception handling is done with the help of these keywords:

- try: the try block is always accompanied by a catch or finally block. Try block is where the exception is generated.
- catch: catch block handles the exception that is generated in the try block.
- finally: finally is always executed whether there is an exception or not.
- throw: it is used to throw an single exception.
- throws: it declares which type of exception might occur.

B. Examples:

a. try…..catch:

```
public class TryCatch {
    public static void main(String[] args) {
        try {
            int result = 36/0;
        } catch(ArithmeticException e) {
            System.out.println("Error: " + e.getMessage());
        }
    }
}
```

Copy

Output:

```
Error: / by zero
```

b. multiple catch:

```
public class MultipleCatch {
    public static void main(String[] args) {
        try {
            int result = 36/0;
        } catch(NullPointerException e1) {
            System.out.println("Error: " + e1.getMessage());
        } catch(ArithmeticException e2) {
            System.out.println("Error: " + e2.getMessage());
        }
    }
}
```

Copy

Output:

```
Error: / by zero
```

c. try…..finally:

```
public class TryFinally {
    public static void main(String[] args) {
        try {
            int result = 36/0;
        } finally {
            int result = 36/6;
            System.out.println("Finally block result:" + result);
        }
    }
}
```

Copy

Output:

```
Finally block result:6
Exception in thread "main" java.lang.ArithmeticException: / by zero
    at javaFiles/ExceptionHandling.TryFinally.main(TryFinally.java:6)
```

d. try……catch…..finally:

```
public class TryCatchFinally {
    public static void main(String[] args) {
        try {
            int result = 36/0;
        } catch(ArithmeticException e) {
            System.out.println("Error: " + e.getMessage());
        } finally {
            int result = 36/6;
            System.out.println("Finally block result:" + result);
        }
    }
}
```

Copy

Output:

```
Error: / by zero
Finally block result:6
```

e. throws:

```
public class Throws {
    public static void example() throws ArithmeticException {
        int result = 36/0;
    }
    public static void main(String[] args) {
        try {
            example();
        } catch (ArithmeticException e) {
            System.out.println(e);
        }
    }
}
```

Copy

Output:

```
java.lang.ArithmeticException: / by zero
```

f. throw keyword:

```
public class Throw {
    public static void example() {
        throw new ArithmeticException("divide by 0");
      }
      public static void main(String[] args) {
        example();
      }
}
```

Copy

Output:

```
Exception in thread "main" java.lang.ArithmeticException: divide by 0
    at javaFiles/ExceptionHandling.Throw.example(Throw.java:5)
    at javaFiles/ExceptionHandling.Throw.main(Throw.java:9)
```