**Basics of Java**

**Java why?**

**JRE, JVM, JDK**

Step1:

Install Eclipse.

Location:

<https://www.eclipse.org/downloads/packages/release/2025-06/r/eclipse-ide-java-developers>?

Click Download -> Select One time \_> eclipse will download

Extract the folder -> You can find eclipse ready

**(Optional)Run the installer** (eclipse-inst-jre-win64.exe) and select **Eclipse IDE for Java Developers** when prompted.

**(Optional)Install a 64-bit JDK**, if you haven't already, to ensure compatibility.

**Launch Eclipse**, choose or create a workspace, and you're ready to start coding!

**Class 3:**

**Basic Java Program Structure**

Here’s a simple program that prints "Hello World":

class HelloWorld {

public static void main(String[] args) {

System.out.println("Hello World");

}

}

**Explanation:**

* class HelloWorld → Defines a class named HelloWorld.
* public static void main(String[] args) → Starting point of the program.
* System.out.println() → Prints output to the screen.

### Program 1: Print "Hello World"

class HelloWorld {

public static void main(String[] args) {

System.out.println("Hello World");

}

}

### Program 2: Print your name

class PrintName {

public static void main(String[] args) {

System.out.println("My name is Suresh");

}

}

### Program 3: Print multiple lines

class PrintLines {

public static void main(String[] args) {

System.out.println("Java is powerful.");

System.out.println("It is platform independent.");

System.out.println("Let's start learning!");

}

}

**Java Data Types**

Java is **strongly typed**, meaning every variable must have a type.

**Primitive Data Types**

| **Data Type** | **Size** | **Example** |
| --- | --- | --- |
| byte | 1 byte | 127 |
| short | 2 bytes | 32767 |
| int | 4 bytes | 2147483647 |
| long | 8 bytes | 9223372036854775807 |
| float | 4 bytes | 3.14f |
| double | 8 bytes | 3.14159 |
| char | 2 bytes | 'A' |
| boolean | 1 bit | true/false |

**Non-Primitive Data Types**

* Strings
* Arrays
* Classes
* Interfaces

**Variables**

Variables store data.

### ****Types of Variables:****

1. **Local Variables** – Inside methods.
2. **Instance Variables** – Inside a class, but outside methods.
3. **Static Variables** – Shared among all objects.

**Example:**

int age = 25;

String name = "Suresh";

System.out.println("My name is " + name + " and I am " + age + " years old.");

### Program 1: Display different data types

class DataTypesDemo {

public static void main(String[] args) {

int age = 25;

float height = 5.9f;

char grade = 'A';

boolean isJavaFun = true;

String name = "Suresh";

System.out.println("Name: " + name);

System.out.println("Age: " + age);

System.out.println("Height: " + height);

System.out.println("Grade: " + grade);

System.out.println("Java Fun? " + isJavaFun);

}

}

### Program 2: Swap two numbers

class SwapNumbers {

public static void main(String[] args) {

int a = 10, b = 20;

System.out.println("Before swapping: a = " + a + ", b = " + b);

int temp = a;

a = b;

b = temp;

System.out.println("After swapping: a = " + a + ", b = " + b);

}

}

**Operators**

| **Type** | **Example** |
| --- | --- |
| Arithmetic | + - \* / % |
| Relational | > < >= <= == != |
| Logical | `&& |
| Assignment | = += -= \*= |
| Increment/Decrement | ++ -- |

**Example:**

int a = 5, b = 3;

System.out.println(a + b); // Output: 8

### Program 1: Arithmetic operations

class ArithmeticDemo {

public static void main(String[] args) {

int a = 15, b = 4;

System.out.println("Addition: " + (a + b));

System.out.println("Subtraction: " + (a - b));

System.out.println("Multiplication: " + (a \* b));

System.out.println("Division: " + (a / b));

System.out.println("Modulus: " + (a % b));

}

}

### Program 2: Relational operators

class RelationalDemo {

public static void main(String[] args) {

int a = 10, b = 20;

System.out.println(a == b); // false

System.out.println(a != b); // true

System.out.println(a > b); // false

System.out.println(a < b); // true

}

}

### Program 3: Logical operators

class LogicalDemo {

public static void main(String[] args) {

boolean x = true, y = false;

System.out.println("x && y: " + (x && y));

System.out.println("x || y: " + (x || y));

System.out.println("!x: " + (!x));

}

}

**Control Structures in Java**

Control structures in Java are used to control the **flow of execution** of a program. They allow you to make decisions, repeat tasks, and control how and when certain parts of the code run.

There are **three main types** of control structures in Java:

| **Control Structure Type** | **Examples** |
| --- | --- |
| Conditional Statements | if, if-else, if-else-if, switch |
| Looping Statements | for, while, do-while |
| Jump Statements | break, continue, return |

**1. Conditional (Decision-Making) Statements**

These are used to **make decisions** in the program based on conditions.

**a) if Statement**

Executes a block of code **only if** a given condition is true.

**Syntax:**

if (condition) {

// Code executes if condition is true

}

**Example:**

public class IfExample {

public static void main(String[] args) {

int age = 20;

if (age >= 18) {

System.out.println("You are eligible to vote.");

}

}

}

**b) if-else Statement**

Executes one block if the condition is true, otherwise executes another block.

**Syntax:**

if (condition) {

// Code if condition is true

// Code if condition is true

// Code if condition is true

}

else {

// Code if condition is false

}

**Example:**

public class IfElseExample {

public static void main(String[] args) {

int number = 5;

if (number % 2 == 0) {

System.out.println("Even number");

} else {

System.out.println("Odd number");

}

}

}

**c) if-else-if Ladder (Nested if)**

Used when there are **multiple conditions** to check.

**Syntax:**

if (condition1) {

// Code if condition1 is true

} else if (condition2) {

// Code if condition2 is true

} else {

// Code if none of the above is true

}

**Example:**

public class IfElseIfExample {

public static void main(String[] args) {

int marks = 85;

if (marks >= 90) {

System.out.println("Grade A+");

} else if (marks >= 75) {

System.out.println("Grade A");

} else {

System.out.println("Grade B");

}

int marks2 = 100;

if (marks2 >= 90) {

System.out.println("Grade A+");

} else if (marks2 >= 75) {

System.out.println("Grade A");

} else {

System.out.println("Grade B");

}

int marks3 = 70;

if (marks3 >= 90) {

System.out.println("Grade A+");

} else if (marks3 >= 75) {

System.out.println("Grade A");

} else {

System.out.println("Grade B");

}

}

}

**d) switch Statement**

Used to **replace multiple if-else statements** when comparing a single variable with multiple values.

**Syntax:**

switch (variable) {

case value1:

// Code block

break;

case value2:

// Code block

break;

default:

// Code if none match

}

**Example:**

public class SwitchExample {

public static void main(String[] args) {

int day = 3;

switch (day) {

case 1: System.out.println("Monday"); break;

case 2: System.out.println("Tuesday"); break;

case 3: System.out.println("Wednesday"); break;

default: System.out.println("Invalid day");

}

}

}

**2. Looping (Iteration) Statements**

Used to **repeat a block of code** multiple times.

**a) for Loop**

When the **number of iterations is known**.

**Syntax:**

for (initialization; condition; increment/decrement) {

// Code to be executed

}

**Example:**

public class ForLoopExample {

public static void main(String[] args) {

for (int i = 1; i <= 5; i++) {

System.out.println("Count: " + i);

}

}

}

Nested loop

Multiplication

public class ForLoopExample {

public static void main(String[] args) {

for (int i = 1; i <= 5; i++) {

for (int i = 1; i <= 5; i++) {

System.out.print(i\*j + “\t”);

}

System.out.print(“”);

}

}

Pyramid:

public class ForLoopExample {

public static void main(String[] args) {

for (int i = 1; i <= 5; i++) {

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

System.out.print(j + “\t”);

}

System.out.print(“”);

}

}

**b) while Loop**

Used when the **number of iterations is not known** in advance.

**Syntax:**

while (condition) {

// Code to be executed

}

**Example:**

public class WhileLoopExample {

public static void main(String[] args) {

int i = 1;

while (i <= 5) {

System.out.println("Count: " + i);

i++;

}

}

}

**c) do-while Loop**

Executes the code block **at least once**, and then repeats while the condition is true.

**Syntax:**

do {

// Code to be executed

} while (condition);

**Example:**

public class DoWhileExample {

public static void main(String[] args) {

int i = 1;

do {

System.out.println("Count: " + i);

i++;

} while (i <= 5);

}

}

**3. Jump Statements**

Used to **alter the normal flow of execution**.

**a) break**

* Exits the loop or switch immediately.

**Example:**

public class BreakExample {

public static void main(String[] args) {

for (int i = 1; i <= 5; i++) {

if (i == 3) {

break; // Exit loop when i is 3

}

System.out.println(i);

}

}

}

**b) continue**

* **Skips the current iteration** and moves to the next one.

**Example:**

public class ContinueExample {

public static void main(String[] args) {

for (int i = 1; i <= 5; i++) {

if (i == 3) {

continue; // Skip when i is 3

}

System.out.println(i);

}

}

}

**c) return**

* Exits from a method and optionally returns a value.

**Example:**

public class ReturnExample {

static int sum(int a, int b) {

return a + b;

}

public static void main(String[] args) {

System.out.println("Sum is: " + sum(5, 10));

}

}

**Arrays**

**What is Array?**

Array is the collection of similar data types

**1D:**

Example:

Int a[] = new int[5];

A[] -> reference of an array

Int[6] -> object

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 0 | 0 | 0 | 0 | 0 |

A 0 1 2 3 4

|  |
| --- |
|  |

Here we have to assign value,

A[0] = 1;

Every array has length(length is a property, not a method), to print the length,

S.o.p (a.length);

(Or)

Directly to mention the values,

Example:

Int a[] = {1,2,3,4,5,6}

|  |
| --- |
|  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 |

A

How to access?

s.o.p(a[0])

s.o.p(a[1])

**Example:**

public class arrayExample {

public static void main(String[] args) {

int a[] = {2,4,6,8,10}

for (int i = 0; i < a.length ; i++) {

System.out.println(a[i]);

}

}

}

public class arrayExample {

public static void main(String[] args) {

int a[] = {2,4,6,8,10}

for (int i = a.length -1; i >=0; i--) {

System.out.println(a[i]);

}

}

}

X -> x takes the value directly, a[i] means it traverse thr index’s.

Only forward direction

public class arrayExample {

public static void main(String[] args) {

int a[] = {2,4,6,8,10}

for (int x : a) {

System.out.println(x);

}

}

}

public class arrayPractise {

public static void main(String[] args) {

int a[] = new int[10];

int b[] = {1,2,3,4,5}

b[2] = 15;

int c[];

c= new int[10];

int[] d = {2,4,6,8,10}

int []e= {3,6,9,}

for (int i = 0; i <= a.length ; i++)

{

System.out.println(a[i]);🡪 default value will be o if not initialized

System.out.println(b[i]);

}

}

}

Program:

1. Find the sum of all the numbers
2. Searching element
3. Maximum element
4. Second largest element
5. copy array A to B

//program 1

public class arrayExample {

public static void main(String[] args) {

Int a[] = {3,9,7,8,12,6,15,5,4,10}

Int sum = 0;

For ( int i=0; i<=a.length; i++}

{

Sum = sum + a[i];

}

s.o.p(“sum is ”+ sum);

}

}

//program2

Int key = 12;

For ( int i=0; i<=a.length; i++}

{

If(key == a[i]}

{

s.o.p(“found the element in index number ”+ i);

System.exit(0);

}

}

s.o.p(“not found in array”);

//program3

Int max = a[0];

For ( int i=0; i<a.length; i++)

{

If (a[i] > max)

{

Max = a[i];

}

}

s.o.p( “max number is” +max)

program4:

Int a[] = {3,9,7,8,12,6,15,5,4,10}

Rough:

Max1 = 3,9,12,15 max2 = 3,3,7,8,9,12

Int max1, max2 ;

Max1=max2 = a[0];

For ( int i=0; i<a.length; i++)

{

If (a[i] > max1)

{

Max2 = max1;

Max1 = a[i];

}

Else if (a[i] > max2)

{

Max2 = a[i];

}

}

s.op.( “second max element is ” +max2)

}

Program5:

public static void main(String[] args)

{

int A[]={8,6,10,9,2,15,7,13,14,11};

int B[]=new int[10];

for(int i=0;i<A.length;i++)

{

B[i]=A[i];

}

for(int x:B)

{

System.out.print(x+",");

}

}

}

**2D**

Collection of arrays or array of arrays

Int a[][] = new int[3][4]

|  |  |  |  |
| --- | --- | --- | --- |
| 0 | 1 | 2 | 3 |

|  |
| --- |
| 0 |
| 1 |
| 2 |
|  |

a

|  |
| --- |
|  |

|  |  |  |  |
| --- | --- | --- | --- |
| 0 | 1 | 2 | 3 |

|  |  |  |  |
| --- | --- | --- | --- |
| 0 | 1 | 2 | 3 |

Int a[][]= {{1,2,3,4},{2,4,6,8},{3,5,7,9}}

Int a[][] = new int[3][4]

A[] – reference to an array of reference

(2nd)[] – reference to an array

|  |
| --- |
| 0 |
| 1 |
| 2 |
|  |

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | 2 | 3 | 4 |

a

|  |
| --- |
|  |

|  |  |  |  |
| --- | --- | --- | --- |
| 2 | 4 | 6 | 8 |

|  |  |  |  |
| --- | --- | --- | --- |
| 3 | 5 | 7 | 9 |

Can be also declared as,

Int a[][];= new int[5][5];

Int b[][] = {{1,2,3,4},{2,4,6,8},{3,5,7,9}}

Int c[][] ;

C= new int[5][5];

Int[] d[] = new int[5][5];

Int[] E,F[];

E 🡪 1D array

F 🡪 2Darray

**Program:**

**to print the values in 2D array**

|  |
| --- |
| No. of rows |

For (int i=0; i<a.length;i++) no of columns

{ for (int j= 0; j<a[0].length ;j++)

{

s.o.p(a[i][j]);

}

s.o.p(“\n”);

**to access each loop**

For (int x[] :a) 🡪 x[] reference to array

{ for (int y : x) 🡪 Y takes the element

{

s.o.p(y) }

s.o.p(“\n”);

**Program**:

public class arrayExample {

public static void main(String[] args) {

Int b[][] = {{1,2,3},{2,4,6},{1,3,5}};

For ( int i=0; i<b.length; i++}

{

For ( int j=0; j<b[0].length; j++}

{

s.o.print(b[i][j]+””);

} s.o.pln(“”);

} } }

(OR)

For(int x[]:B)

{

For(int y:x)

{

s.o.print(y);

}

s.o.pln(“”):

} } }

(OR)

**What will happen if I directly print B?**

**s.o.pn(B);**

**Guess the result ?**

**how to access the jagged array 🡪 means of different size**

0 1

|  |
| --- |
| 0 |
| 1 |
| 2 |
|  |

|  |  |  |  |
| --- | --- | --- | --- |
| 0 | 1 |  |  |

a

0 0 1 2 3

|  |
| --- |
|  |

|  |  |  |  |
| --- | --- | --- | --- |
| 2 | 4 | 6 | 8 |

0 1 2

|  |  |  |  |
| --- | --- | --- | --- |
| 3 | 5 | 7 | 9 |

Int a[][];

A = new int [3][];

A[0] = new int[2];

A[1]= new int[4];

A[2] = new int[3];

Example:

public class arrayExample {

public static void main(String[] args) {

Int A[][] = new int[3][];

A[0] = new int[5];

A[1]= new int[3];

A[2] = new int[8];

For ( int i=0; i<A.length; i++}

{

For ( int j=0; j<A[i].length; j++}

{

s.o.print(A[i][j]+””);

} s.o.pln(“”);

} } }

(OR)

public class arrayExample {

public static void main(String[] args) {

Int A[][] = new int[3][];

A[0] = new int[5];

A[1]= new int[3];

A[2] = new int[8];

For ( int x[] : A)

{

For ( int Y : x)

{

s.o.print(y +””);

} s.o.pln(“”);

} } }

Program : Addition of 2 arrays and store it in 3rd array.

public class arrayExample {

public static void main(String[] args) {

Int a[][] = {{3,5,9},{7,6,2},{4,3,5}}

Int b[][]= {{1,5,2},{6,8,4},{3,9,7}}

Int c[][]= new int[3][3]

For ( int i = 0; i<a.length; i++)

{

For ( int j=0; j<a[0].length; j++)

{

C[i][j] = a[i][j]+b[i][j];}

}

For ( x[] :c)

{

For ( y : x)

{

s.o.pln(y+””)

} } }}

Methods: **Methods** are **blocks of code that perform a specific task** and are executed when they are **called or invoked**

**In c, C++ - called as functions but in java we call as Method**

Data

Method 1 Method 2 Method 3 Method n

returnType methodName (Parameter list)

{

// body

//

//

}

returnType -> signature of the method / header of the method (In C or C++ 🡪 prototype)

Example: print the max number

class Test

{

static int max( int x, int y) 🡪 defining method / formal parameter

{

If( x > y)

Return x;

Else

Return y;

}

Public static void main (String args[])

{

Int a=10,b=15,c;

C = max(a,b); 🡪 calling method / actual parameter

s.o.pln(c);

}

}

Main method defining method

a b x y

10 15 10 15

X++ 🡪 value will change to 11 only in defining method

Program:

Static method:

public class MethodPractice {

static int max(int x,int y) //static method

{

if(x>y)

return x;

else

return y;

}

public static void main(String[] args) {

int a=10,b=15;

System.out.println(max(a,b)); 🡪 static method

}

}

Non static method:

public class MethodPractice {

int max(int x, inty) // non static method

{ if(x>y)

return x;

else

return y;

}

public static void main(String[] args) {

int a=10,b=15;

//non static method – create object for class then call the method

MethodPractice mp=new MethodPractice();

System.out.println(mp.max(a,b));

}

}

Difference between actual and formal parameter values:

public class MethodInc {

static void inc(int x)

{

X++;

s.o.pl(“formal parmeter value” +x)

}

public static void main(String[] args) {

int a=10;

inc(a)

s.o.pl(“actual parmeter value” +a)

}

}

**Passing object as Parameter:**

public class Test {

static void update(int a[])

{ a[1] = 25;

}

public static void main(String[] args) {

int a[]={2,4,6,8};

update(a);

System.out.println(a[0])

}

}

Array will be modified to {25,4,6,8} since the reference is passed to change the object, the object itself changing ( different from basic data types like int)

Program for object passing as parameter:

public class MethodPractice1 {

static void change(int A[],int index,int value)

{

A[index]=value;

}

static void change2(int x,int value)

{

x=value;

}

public static void main(String[] args) {

int A[]={2,4,6,8,10};

change(A,2,20);

for(int x:A)

{

System.out.println(x);

}

int x=10;

change2(x,20);

System.out.println("Value of "+x); 🡪 value of x remains as 10 because its not an array/ basic primitive data type.

}

}

**Parameter passing in Java**

Content of actual parameter is passed to formal parameter

Example:

1. A passed to X, B passed to Y -🡪 Z passed to C after addition

X Y Z

Int add (int x, inty) 10 15 25

{int z;

Z=x+y;

Return z; }

P.S.V.M(String args[]) A B C

{ int a=10,b=15,c; 10 15 25

C = add(int a,b)

s.o.pln(C);

} }

1. Name & N both methods will point to same **object** because string is object not primitive data type like int

Void welcome(String n) n

{ S.o.pln(“ Welcome to this “+ n);

}

P.S.V.M(String args[]) name

{ String name = “Victor”; Victor

welcome(name);

} }

Program:

Find prime number:

public class primeNumber

{

static boolean isPrime(int n)

{

for(int i=2;i<n/2;i++)

{

if(n%i==0)

return false;

}

return true;

}

public static void main(String[] args)

{

System.out.println(isPrime(19));

//check 91

} }

**Method Overloading :**

Having more than one method which allows to use same name but there should be difference in parameter list or data types.

1. Overlaod method to calculate areas
2. To reverse a int or array

**Program:**

import java.util.Arrays; // For printing arrays

public class SCMethod2 {

// Validate that the name contains only alphabets and spaces

static boolean validate(String name) {

return name.matches("[a-zA-Z\\s]+");

}

// Validate that the age is between 3 and 15

static boolean validate(int age) {

return age >= 3 && age <= 15;

}

// Reverse an integer

static int reverse(int n) {

int rev = 0;

while (n > 0) {

rev = rev \* 10 + n % 10;

n = n / 10;

}

return rev;

}

// Reverse an array

static int[] reverse(int A[]) {

int B[] = new int[A.length];

for (int i = A.length - 1, j = 0; i >= 0; i--, j++) {

B[j] = A[i];

}

return B;

}

// Calculate area of a circle

static double area(double radius) {

return Math.PI \* radius \* radius;

}

// Calculate area of a rectangle

static double area(double length, double breadth) {

return length \* breadth;

}

// Main method

public static void main(String[] args) {

// 1. Validate Name

String name = "John Doe";

System.out.println("Validating name: " + name);

if (validate(name)) {

System.out.println("Name is valid ✅");

} else {

System.out.println("Name is invalid ❌");

}

System.out.println();

// 2. Validate Age

int age = 10;

System.out.println("Validating age: " + age);

if (validate(age)) {

System.out.println("Age is valid ✅");

} else {

System.out.println("Age is invalid ❌");

}

System.out.println();

// 3. Reverse an Integer

int number = 12345;

int reversedNumber = reverse(number);

System.out.println("Original Number: " + number);

System.out.println("Reversed Number: " + reversedNumber);

System.out.println();

// 4. Reverse an Array

int[] originalArray = {1, 2, 3, 4, 5};

int[] reversedArray = reverse(originalArray);

System.out.println("Original Array: " + Arrays.toString(originalArray));

System.out.println("Reversed Array: " + Arrays.toString(reversedArray));

System.out.println();

// 5. Area of Circle

double radius = 7.0;

double circleArea = area(radius);

System.out.println("Area of Circle with radius " + radius + " = " + circleArea);

System.out.println();

// 6. Area of Rectangle

double length = 5.0, breadth = 3.0;

double rectangleArea = area(length, breadth);

System.out.println("Area of Rectangle with length " + length + " and breadth " + breadth + " = " + rectangleArea);

}

}

**Variable Arguments**

Use single method to handle multiple parameters.

Show()

Show(10)

Show(10,20)

Show(10,20,30)

Show(10,20,30,40)

Show(10,20,30,40,…….,n)

Void show(int …x) 🡪 similar to array (int x[]) but not same.

{

For (a:x)

s.o.pln(a);

}

Also,

Void show(int x, int …y)

Show 🡪 not valid, min one parameter is required because of X

Show(10) 🡪 x=10, y will be null

Show(10,20,30) 🡪 x=10, y = 20,30

Practice 1:

Public class varargsTest

{

Static void show(int …A)

{

For(int x : A)

{

s.o.pln(x);

} }

Public static void main(String[] args)

{

Show();

Show(10,20,30);

Show(new int[]{3,5,7,9,11,13,15});

} }

Practice 2:

If method is taking var parameter, that parameter must be last one.

Public class varargsString

{

Static void showList(int start, String …S)

{

For(int i=0; i<S.length; i++)

{

s.o.pln(i+1+”. “+S[i]);

start++;

} }

Public static void main(String[] args)

{

ShowList(1, “abc”, “def”,”ghi”,”klm”, “nop”);

} }

**Program:**

Find the max number using variable arguments:

public class SCMethod3

{

static int max(int ...A)

{

if(A.length==0)return Integer.MIN\_VALUE;

int max=A[0];

for(int i=1;i<A.length;i++)

if(A[i]>max)max=A[i];

return max;

}

public static void main(String[] args)

{

System.out.println(max());

System.out.println(max(10));

System.out.println(max(10,20));

System.out.println(max(10,20,30));

}

}

**Assignment:**

1. Sum of numbers:

static int sum(int ...A)

{

int s=0;

for(int i=0;i<A.length;i++)

s+=A[i];

return s;

}

1. Calculate Discounts

static double discount(double ...P)

{

double sum=0;

for(int i=0;i<P.length;i++)

sum+=P[i];

if(sum<500) return sum\*0.10;

else if(sum>=500 && sum<1000) return sum\*0.15;

else return sum\*0.20;

}

**Command Line Arguments**

**Recursion**