What is the difference between JDK and JRE?

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| The **JDK (Java Development Kit)** and **JRE (Java Runtime Environment)** are both essential components of Java, but they serve different purposes:  **1. JDK (Java Development Kit)**   * **Purpose:** Used for developing, compiling, and running Java applications. * **Includes:**   + JRE (Java Runtime Environment)   + Java Compiler (javac)   + Development tools (debugger, Javadoc, etc.) * **Who Needs It?** Developers who write and compile Java programs.   **2. JRE (Java Runtime Environment)**   * **Purpose:** Used only for running Java applications. * **Includes:**   + JVM (Java Virtual Machine)   + Java class libraries * **Who Needs It?** End-users who just want to run Java applications but don’t need to develop them.   **Key Difference:**   |  |  |  | | --- | --- | --- | | **Feature** | **JDK (Java Development Kit)** | **JRE (Java Runtime Environment)** | | **Includes JVM?** | ✅ Yes | ✅ Yes | | **Includes JRE?** | ✅ Yes | ❌ No (JRE is a standalone package) | | **Includes Compiler?** | ✅ Yes (javac) | ❌ No | | **Usage** | Development & Execution | Execution only |   **In short:**   * If you want to **develop Java applications**, install the **JDK**. * If you only need to **run Java applications**, install the **JRE**.   Difference Between JDK, JRE, and JVM | Board Infinity  What jdk(Java development kit) contains?  It contains set of tools and JRE  What is JRE(Java Runtime Environment)?  It contains JVM + JCL  What is JVM?  Java Virtual Machine which is used to run the java programs  What is JCL (Java Class Library)  Set of pre-defined classes. |

What is a package?

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| --- |
| 1. A package is a container of classes. 2. A package contains collection classes. 3. A package is a folder which contains classes, interfaces, Enums and annotations.   There are 2 types of packages   1. Pre-defined (provided by inventors of Java) 2. User-defined (Written by programmers)   Some of the pre-defined available in Java are:   1. Java.lang 2. Java.util 3. Java.io 4. Java.awt 5. Java.text 6. Java.awt.event 7. Java.sql 8. Java.net 9. Java.util.stream 10. Etc.. |

What is java API (Application Programming Interface)?

|  |
| --- |
| Collection of pre-defined packages |

We can write comments in 3 ways?

|  |
| --- |
| 1. Single line (//………………) 2. Multi line comments (/\*……….\*/) 3. Documentation comments (/\*\*…………………………………\*/) |

What is the use of “import java.lang.\*” statement in our program?

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| --- |
| It is a statement which is used to import a package. |

What is Java API?

|  |
| --- |
| Collection of pre-defined packages |

What is JCL(Java Class Library)?

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| --- |
| Collection of pre-defined classes. |

What is a keyword?

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| It is a pre-defined word, provided by inventors of Java |

What is a class?

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| A class is a block which contains functions(methods) and variables(fields/attributes/properties) |

**Sixth.java**

|  |
| --- |
| //this is my sixth program  /\* multi line comments  Author: Balaji B  Date: 08-Feb-2025  \*/  /\*\* documentation comments  Org: Madhu Tech Skills  City: vijayawada  \*/  package p1; //creating a package by using a keyword called package  import java.lang.\*; //importing a package called java.lang  interface MyInterface{}  enum Colors{  }  @interface MyAnnotation{}  class Ayyo{  public static void main(String[] args)  {  System.out.println("Ayyaaaa...");  }  } |

**What is package p1; statement?**

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| --- |
| * It is a statement which is used to create a new package. Here package is a keyword and p1 is the package name. |

**What is the use of “import java.lang.\*;” ?**

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| It is used to import all the classes, interfaces, enums and annotations existed in a package called java.lang. |

**Why we import classes of a package?**

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| To use those classes, you have to import them |

What is the command to compile the program if it contains package statement?

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| Javac -d . Sixth.java  If I compile the program like above then 4 .class files will be created in p1 folder(package)   * + 1. MyInterface.class file     2. My Annotation.class     3. Colors.class     4. Ayyo.class |

**How to run the program if main method class is existed in p1 package?**

|  |
| --- |
| java p1.Ayyo |

**Can we write print statement outside the function in Java?**

|  |
| --- |
| No we can’t, but we can write it in any block which is written in a class. |

**If you write print statement outside the function what error you will get?**

|  |
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|  |

**Can I declare a variable with in a class and outside the function?**

|  |
| --- |
| **Yes we can declare 2 types of variables**   * Instance variables (it is not declared as static) * Static variables (it is declared as static) |

**Can I write statements other than declarations in a class and outside the functions?**

|  |
| --- |
| No we can write only variable declaration(definition) statements. |

**If I write the “c=a\*s;” statement outside the function within a class what kind of error you will get?**

|  |
| --- |
|  |

**What is String, System which are used in our program?**

|  |
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| * These are a pre-defined classes existed in java.lang package |

**Can we use String class without importing java.lang package?**

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| --- |
| Yes, we can because java.lang package is the default package, which means the compiler imports it automatically. |

**When the java.lang package will be imported automatically?**

|  |
| --- |
| During compilation |

What is a string?

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| --- |
| A string is nothing but collection of characters represented by pair of double quotations  Ex-1: “ravi teja” -> string literal(value)  Ex-2: “Vamsi” -> string literal  Ex-3: “12345” -> string literal  Ex-4: “+-\*&^@” -> string literal |

What is a concatenation symbol?

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| --- |
| If you find a ‘+’ symbol after or before a string literal it is called as a concatenation symbol |

What is the use of concatenation symbol?

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| --- |
| It appends any value to the string  Ex: “a=”+10 result is “a=10” |

What are the differences between print and println()?

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| --- | --- |
| Print | Println |
| 1. It prints the data without moving cursor to the new line | 1. It moves the cursor to the new line after printing the data. |
| 1. We can pass only one argument to the print function | 1. We can pass zero or one argument to the println function |

Third.java

|  |
| --- |
| //this is my sixth program  /\* multi line comments  Author: Balaji B  Date: 08-Feb-2025  \*/  /\*\* documentation comments  Org: Madhu Tech Skills  City: vijayawada  \*/  package p1; //creating a package by using a keyword called package  import java.lang.\*; //importing a package called java.lang  interface MyInterface{}  enum Colors{  }  @interface MyAnnotation{}  class Ayyo  {  static int s=1;  int a=2;  int c=a+s;  //c=a\*s; Error non declaration statements are not allowed here  public static void main(String[] args)  {  int a=2,b=3,c=a+b;  System.out.println("Ayyaaaa...");  System.out.println(); //it displays new line  System.out.println(a,b,c); //error  System.out.print(); //error  }  }  //this is my sixth program  /\* multi line comments  Author: Balaji B  Date: 08-Feb-2025  \*/  /\*\* documentation comments  Org: Madhu Tech Skills  City: vijayawada  \*/  package p1; //creating a package by using a keyword called package  import java.lang.\*; //importing a package called java.lang  interface MyInterface{}  enum Colors{  }  @interface MyAnnotation{}  class Ayyo  {  static int s=1;  int a=2;  int c=a+s;  //c=a\*s; Error non declaration statements are not allowed here  public static void main(String[] args)  {  int a=2,b=3,c=a+b;  System.out.println("Ayyaaaa...");  System.out.println(); //it displays new line  //System.out.println(a,b,c); //error  //System.out.print(); //error  }  }  How to compile the program to create a package?     * + 1. -d: it tells the compiler to create a folder with package name     2. . : it tells where to create the folder (Here . means present folder)   If you compile the above program like below then the package will be create din hari3 folder  Compile: javac -d C:\Users\kalla\OneDrive\Dokumen\hari3 Sixth.java |

How to declare a variable?

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| In Java we can declare a variable by using a data type  Syntax: <data-type> <var-name>[=value]; Ex: int a; Ex: float f=10.00f;  Syntax: <data-type> <var-1[=value]>[,var-2[=value],var-3[=value]…var-n[=value]]; |

Example to declare multiple variables

Four.java (no need to execute this program)

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| --- |
| import java.lang.\*; //import statement  class Four  {  public static void main(String args[])  {  int a,b,c; //multiple variables declaration of same type  int x=10,y=20,z=0;// defining varaibles.  byte b;  short s;  int i;  long l;  //we can't declare multiple types of variables in a single statement;  }  } |

What is a local variable?

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| --- |
| 1. It is a variable which is declared within a block existed in a class is called as local variable 2. Local variables are created either in java stack memory or native method stacks memory. 3. Local variables will not be initialized with default values, so you have to initialize them before usage. |

What error you will get if we use local variable without initializing it?

|  |
| --- |
| **Seven.java**  public class Seven {      public static void main(String[] args) {          int a,b,c; //3 local variables          System.out.println(a);      }  }  Compilation error:  Seven.java:4: error: variable a might not have been initialized  System.out.println(a);  ^  1 error |

Why java is called as extensible programming language?

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| --- |
| Because in Java we can use native methods |

What are native methods?

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| --- |
| 1. Methods which are written in other languages like C are called as native methods 2. It is possible to use native methods in Java   Ex: public static native long currentTimeMillis(); method of System class is a native method |

**Formatting methods**

**What are formatting () methods:**

In jdk1.5 version two new methods are introduced, to replace the print() and println() methods, and these methods are called as formatting methods.

**Note:** these methods are called as formatting methods because these methods formats the given string by using converters and then prints the formatted string.

What is the first argument we should pass to the formatting method?

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| --- |
| String literal |

How many arguments we can pass to the formatting method?

|  |
| --- |
| 1 or more arguments |

Those are:

* 1. Printf()
  2. Format()

These methods are existed in the java.io.PrintStream class and these methods, format and printf, are equivalent to one another.

**What is the difference between printf() and format() method?**

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| --- |
| Actually **printf()** method is internally calls the **format()** method, that is actual code is existed in the format method. The printf() method is just provided for our convenience. |

**Some of the converters which are used in format method**

|  |  |  |
| --- | --- | --- |
| Converter | Flag | Explanation |
| d |  | A decimal integer |
| f |  | A float |
| n |  | A new line character appropriate to the platform running the application. You should always use %n rather than \n. |
| tB |  | Full name of month |
| tb |  | Short name of month |
| td |  | day of month, if it is single digit, it puts zero before that number |
| te |  | Day of month, it will not put zero before single digit. |
| ty |  | 2-digit year |
| tY |  | 4 digit year |
| tl |  | Hour in 12 hours clock |
| tM |  | Minutes in 2 digits, with leading zeros as necessary |
| tS |  | Seconds |
| tp |  | Am/pm |
| tm |  | Month in 2 digits, with leading zeros as necessary |
| tD |  | Date as %tm%td%ty |
|  | 08 | 8 characters in width, with leading zeros as necessary |
|  | + | Includes sign, whether positive or negative |
|  | , | Includes Locale-specific grouping characters. |
|  | - | Left-justified |
|  | .3 | Three places after decimal part |
|  | 10.3 | Ten characters in width, right justified, with three places, after decimal point |

**Printf():**

It is existed in the PrintStream class; it takes 1 or more arguments.

**FormattingMethods1.java**

|  |
| --- |
| import java.util.Date;  public class Seven {      public static void main(String[] args) {          int a,b,c; //3 local variables          a=10;          b=3;          c=a-b;          System.out.format("Hello%n");          System.out.format("%d-%d=%d%n",a,b,c);          System.out.println(a+"-"+b+"="+c);            //Native method usage          long l=System.currentTimeMillis();          System.out.println("l:\t"+new Date(l));      }  }  **Output:**  Hello  10-3=7  10-3=7  l: Sat Feb 08 16:26:14 IST 2025 |

**FormattingMethodsDemo**

|  |
| --- |
| import java.util.Date;  public class Seven  {      public static void main(String[] args)      {          String name="madhu";          int i=100;          float f=200;          double d=200;          char ch='A';          boolean bl=true;          System.out.printf("name:\t%s%n",name);          System.out.printf("i:\t%d%n",i);          System.out.printf("f:\t%.2f%n",f);          System.out.printf("d:\t%.3f%n",d);          System.out.printf("ch:\t%c%n",ch);          System.out.printf("bl:\t%s%n",bl);      }  }  Output:  name: madhu  i: 100  f: 200.00  d: 200.000  ch: A  bl: true |

**%s can be used for any type of object or value(see the below example)**

|  |
| --- |
| import java.util.Date;  public class Seven  {      public static void main(String[] args)      {          String name="madhu";          int i=100;          float f=200;          double d=200;          char ch='A';          boolean bl=true;          System.out.printf("name:\t%s%n",name);          System.out.printf("i:\t%s%n",i);          System.out.printf("f:\t%s%n",f);          System.out.printf("d:\t%s%n",d);          System.out.printf("ch:\t%s%n",ch);          System.out.printf("bl:\t%s%n",bl);      }  }  **Output:**  name: madhu  i: 100  f: 200.0  d: 200.0  ch: A  bl: true |

**FormatDemo3.java**

|  |
| --- |
| import static java.lang.System.\*;  class FormatDemo3  { public static void main(String args[])  { long n = 261011;  out.format("%d%n",n); // --> "261011"  out.format("%09d%n",n); // --> "000261011"  out.format("%9d%n",n); // --> " 261011"  out.format("%,9d%n",n); // --> " 261,011"  out.format("%+,9d%n%n",n); // --> " +261,011"  }  }  Output:  261011  000261011  261011  261,011  +261,011 |

**FormatDemo4.java(Example on alignment)**

|  |
| --- |
| public class Eight {      public static void main(String[] args) {          double pi =3.141593;          System.out.format("%f%n", pi);       // -->  "3.141593"          System.out.format("%.3f%n", pi);     // -->  "3.142"          System.out.format("%10.3f%n", pi);   // -->  "     3.142"          System.out.format("%-10.3f%n", pi);  // -->  "3.142     "// left justified          System.out.printf("%3f%n",pi);  //it displays total value          System.out.printf("Madhu Tech Skills...");      }  }  **Output:**  3.141593  3.142  3.142  3.142  3.141593  Madhu Tech Skills... |

**FormatDemo5.java**

|  |
| --- |
| import static java.lang.System.\*;  import java.util.\*;  class FormatDemo5  { public static void main(String args[])  { Date date=new Date();  out.println("Actual Date:\t"+date);  out.printf("Month=%tB %n",date);  out.printf("Day=%td%n",date);  out.printf("Year=%tY%n",date);  Calendar c = Calendar.getInstance();  out.format("%tB %td, %tY%n", c, c, c); // --> "July 09, 2013"  out.format("%tb %te, %tY%n", c, c, c); // --> "Jul 9, 2013"  out.format("%tl:%tM %tp%n", c, c, c); // --> "2:34 am"  out.format("%tD%n", c); // --> "07/09/13"//month/day/year  }  } |

**FormatDemo6.java**

|  |
| --- |
| import static java.lang.System.\*;  import java.util.\*;  class FormatDemo6  { public static void main(String args[])  { Date sd=new Date();  out.println("SystemDate:\t"+sd);  out.format("%td-%tB-%tY%n",sd,sd,sd);  out.format("%te-%tb-%ty%n",sd,sd,sd);  out.printf("%tl:%tM:%tS %tp",sd,sd,sd,sd);  }  } |

**Functions**

**What is a function?**

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| * A function is a block which contains re-usable set of statements * We write a function to perform a task * Once the function is written, to execute the statements of it, we have to call it |

A function is a block which has a name ends with pair of parentheses and the name is preceded by a data type (it is called as return type). It contains set of statements which are used to perform a task.

What is a static method?

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| * 1. If a method is declared by using static keyword then it is called as static method   2. We can call a static method in another static method of same class directly.   Note: we can’t call non-static method (instance method) in a static method directly. Even though it is existed in the same class. |

Who calls the main function?

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| JVM calls the main function |

What is the advantage of functions?

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| Functions provide several advantages in programming:   1. **Code Reusability** – Functions allow you to reuse code multiple times without rewriting it, reducing redundancy. 2. **Modularity** – They break a large program into smaller, manageable parts, making the code easier to understand and maintain. 3. **Improved Readability** – Well-named functions make the code more readable and self-explanatory. 4. **Easier Debugging** – Errors are easier to find and fix when the code is modular, as you can test individual functions separately. 5. **Scalability** – Functions help in building scalable applications by organizing code efficiently. 6. **Encapsulation** – They allow you to hide implementation details and expose only necessary functionality, improving security and organization. 7. **Avoiding Code Duplication** – Instead of writing the same logic multiple times, you can call a function whenever needed. 8. **Efficient Memory Use** – Functions help optimize memory usage by executing only when called and releasing resources when done. |

**A simple example on functions**

|  |
| --- |
| public class Nine  {      static void add(){          int a=10,b=3,c;          c=a+b;          System.out.printf("%d + %d = %d %n",a,b,c);      }      public static void main(String[] args) {          add();      }  }  **Output:**  10 + 3 = 13 |

**Another example on functions with parameters**

|  |
| --- |
| public class Nine  {      static void add()      {          int a=10,b=3,c;          c=a+b;          System.out.printf("%d + %d = %d %n",a,b,c);      }      static void sub(int a,int b){          int c;          c=a-b;          System.out.printf("%d - %d = %d %n",a,b,c);      }      public static void main(String[] args) {          add();          sub(100,200);      }  }  **Output:**  10 + 3 = 13  100 - 200 = -100 |

**What is a parameter?**

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| * + 1. Variables which are declared within parenthesis of a function are called as parameters.     2. Parameters are separated by comma (,)     3. After last parameter no need to give semicolon or comma |

**Example on Types of functions**

|  |
| --- |
| public class Nine  {      //function without parameters and without return type      static void add()      {          int a=10,b=3,c;          c=a+b;          System.out.printf("%d + %d = %d %n",a,b,c);      }      //function with parameters and without return type      static void sub(int a,int b){          int c;          c=a-b;          System.out.printf("%d - %d = %d %n",a,b,c);      }      //function with parameters and with return type      static int multi(int a,int b)      {          int c=a\*b;          return c;      }      //function without parameters and with return type      static int div()      {          int a=10,b=3;          return a/b;      }      public static void main(String[] args) {          add();          sub(100,200);   //to the sub function i am passing two arguments          int x=multi(10, 5); //to the multi() function i am passing two arguments and it is returning the result(int)          System.out.println("x:\t"+x);          int r1=x/2;          System.out.println("r1:\t"+r1);          System.out.println( div() );      }  }  **Output:**  10 + 3 = 13  100 - 200 = -100  x: 50  r1: 25  3 |

**Variable length arguments**

**Example on variable length argument**

|  |
| --- |
| public class Ten  {      static void display(int... enos)      {          System.out.println("..................");          for(int n:enos)          System.out.println(n);      }      public static void main(String[] args)      {          display();          display(1);          display(1,2);          display(1,2,3);      }  }  Output:  ..................  ..................  1  ..................  1  2  ..................  1  2  3 |

**Note:** A method can have variable length parameters with other parameters too, but one should ensure that there exists only one varargs parameter that should be written last in the parameter list of the method declaration. For example:

Another example on variable length arguments

|  |
| --- |
| public class Ten  {      static void display(String ename, int eno,int... marks)      {          System.out.printf(".....%s..with....eno....%d...marks....%n",ename,eno);          for(int mark:marks)          System.out.println(mark);      }      public static void main(String[] args)      {          display("Madhu.K",101,78,77,66,77,88);          display("Manish",102,78,77,66);          display("Lakshman",103,78,77,66);      }  }  **Output:**  .....Madhu.K..with....eno....101...marks....  78  77  66  77  88  .....Manish..with....eno....102...marks....  78  77  66  .....Lakshman..with....eno....103...marks....  78  77  66 |

What is a method?

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| A method is a function written in a class. |

What is the starting point of the program?

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| --- |
| 1. Main method 2. In Java main method should be a static method 3. In Java main method return type should be only void.   Note: In Java you should declare the main method as public and static |

How to read total line at a time from keyboard?

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| --- |
| readLine() method of DataInputStream class  (or)  readLine() method of BufferedReader class |

Reading data from keyboard by using readLine() method of DataInputStream class?

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| * readLine() method is a non-static method existed in DataInputStream class, so we have to call it by using object of DataInputStream class * readLine() method returns string only.. |

How to read the data from keyboard?

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| By using readLine () method we can read the data see the below example  import java.io.DataInputStream;  import java.io.IOException;  public class Eleven {      public static void main(String[] args) throws IOException      {          //Creating object for DataInputStream class          DataInputStream dis=new DataInputStream(System.in);          System.out.print("Enter your name:\t");          String name=dis.readLine();  //  name <-  = <- "sambasivarao" <- readLine()  <- sambasivarao <- keyboard          System.out.println("Hi "+name);        }  }  Output: |

**Operators**

What is an operator?

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| Operator is a symbol, which is used to perform an operation.  **Different types of operators supported by Java**  Ex: +, -, \*, /, %, (arithmetic operators)  Ex: <,>,<=,>=,==,!=,instanceof (relational operators  Ex: &&,||, ! (logical operators)  Ex: &,|,^,<<,>>, ~, >>>(Bitwise Operators)(zero fill right shift operator)  Ex: = (assignment operator)  Ex: new (memory allocation operator), . (dot is called as memory access operator), () type cast operator  Ex: ++,--, +=,-=,\*=,/=,%= (short cut operators) |

Example on Arithmetic Operators

|  |
| --- |
| import java.io.DataInputStream;  import java.io.IOException;  public class Eleven {      public static void main(String[] args) throws IOException      {          DataInputStream dis=new DataInputStream(System.in);          System.out.print("Enter int:\t");          String s1=dis.readLine();  // a <-  = <- "10" <- readLine()  <- 10 <- keyboard          int a=Integer.parseInt(s1);          System.err.print("Enter another int value:\t");          String s2=dis.readLine();          int b=Integer.parseInt(s2);          System.out.println(a+b);          System.out.println(a-b);          System.out.println(a\*b);          System.out.println(a/b);          System.out.println(a%b);      }  }  Output:  Enter int: 10  Enter another int value: 2  12  8  20  5  0 |

What is the drawback of readLine() of DataInputStream class? And why it is deprecated?

|  |
| --- |
| * by using this method, we can read only the characters which are in a range of 0 to 255 (ASCII character set). * this method can’t read other than ASCII character set (i.e. it can’t read all the characters of Unicode character set). * The method has been deprecated since Java 1.1 because it does not properly convert bytes to characters in a way that supports internationalization. * readLine() reads input as a **byte stream** and does not properly decode characters according to the character encoding (e.g., UTF-8). This can lead to **incorrect character conversions**, especially for non-ASCII characters. |

readLine() method of BufferedReader class

|  |
| --- |
| * 1. by using this method, we can read the characters which are in Unicode character set. |

Example on usage of readLine() method of BufferedReader class

|  |
| --- |
| import java.io.BufferedReader;  import java.io.IOException;  import java.io.InputStreamReader;  public class Eleven {      public static void main(String[] args) throws IOException      {          InputStreamReader isr=new InputStreamReader(System.in);          BufferedReader br=new BufferedReader(isr);          System.out.print("Enter int:\t");          String s1=br.readLine();  // a <-  = <- "10" <- readLine()  <- 10 <- keyboard          int a=Integer.parseInt(s1);          System.err.print("Enter another int value:\t");          String s2=br.readLine();          int b=Integer.parseInt(s2);          System.out.format("%d + %d = %d%n",a,b,a+b);          System.out.format("%d - %d = %d%n",a,b,a-b);          System.out.format("%d \* %d = %d%n",a,b,a\*b);          System.out.format("%d / %d = %d%n",a,b,a/b);          System.out.format("%d %% %d = %d%n",a,b,a%b);        }  }  **Output:**  Enter int: 12  Enter another int value: 3  12 + 3 = 15  12 - 3 = 9  12 \* 3 = 36  12 / 3 = 4  12 % 3 = 0 |

Where the parseInt() method is existed?

|  |
| --- |
| * It is existed in Integer class * It takes string as an argument and converts it into int value and returns that int value |

Relational Operators

|  |
| --- |
| Relational Operators are used to compare 2 values(operands), after comparison these operators gives us a Boolean value(true/false) |

Example on relational operators

|  |
| --- |
| import java.io.BufferedReader;  import java.io.IOException;  import java.io.InputStreamReader;  public class Twelve  {      public static void main(String[] args) throws IOException       {          InputStreamReader isr = new InputStreamReader(System.in);          BufferedReader br = new BufferedReader(isr);          System.out.print("Enter a number :\t");          int i = Integer.parseInt(br.readLine());          System.out.print("Enter another number :\t");          int j = Integer.parseInt(br.readLine());          System.out.println("i:\t "+i);          System.out.printf("j:\t%d %n",j);          // test case-1          //i=10          //j=5          boolean b1= i>j; //b1=true          boolean b2=i>=j; // (i>j or i==j)  b2=true          boolean b3=i<j;  //b3=false          boolean b4= i<=j; //i<j or i==j  b4=false          boolean b5=i==j; //b5=false          boolean b6=i!=j; //b6=true          System.out.println("i>j:\t"+b1);          System.out.println("i>=j:\t"+b2);          System.out.println("i<j:\t"+b3);          System.out.println("i<=j:\t"+b4);          System.out.println("i==j:\t"+b5);          System.out.println("i!=j:\t"+b6);      }  }  Output:  Enter a number : 10  Enter another number : 5  i: 10  j: 5  i>j: true  i>=j: true  i<j: false  i<=j: false  i==j: false  i!=j: true |

**What is an operand?**

|  |
| --- |
| It is a value on which the operator performs an operation.  Ex: 10+20 Here 10,20 are operands and + is an operator |

**Logical Operators (Boolean operators)**

|  |
| --- |
| * 1. Logical operators are used to perform operation on Boolean values only   2. These operators gives us Boolean values as a result. * Logical and operator (&&): it gives us true if both operands are true, otherwise false * Logical or operator (||):it gives us true if any one or both operands are true, otherwise false * Logical not operator (!): it returns true if operands is false vice versa. |

How parseBoolean() method works?

|  |
| --- |
| * 1. It converts “TRUE” to true and returns it   2. It converts “true” to true and returns it   3. If any string other than “true” (case-insensitive) is passed then It returns false |

Example on parseBoolean() method which returns true

|  |
| --- |
| public class Fourteen  {      public static void main(String[] args) {          System.err.println(Boolean.parseBoolean("true"));          System.err.println(Boolean.parseBoolean("truE"));          System.err.println(Boolean.parseBoolean("trUE"));          System.err.println(Boolean.parseBoolean("True"));          System.err.println(Boolean.parseBoolean("TRUE"));      }  }  Output:  true  true  true  true  true |

Example on parseBoolean() method which returns false

|  |
| --- |
| public class Fourteen  {      public static void main(String[] args) {          System.err.println(Boolean.parseBoolean("false"));          System.err.println(Boolean.parseBoolean("madhu"));          System.err.println(Boolean.parseBoolean("1234"));          System.err.println(Boolean.parseBoolean("Flaws"));          System.err.println(Boolean.parseBoolean("FALSE"));          System.err.println(Boolean.parseBoolean("TOKKALEY"));          System.err.println(Boolean.parseBoolean("1"));          System.err.println(Boolean.parseBoolean("C"));      }  }  Output:  false  false  false  false  false  false  false  false |

Example on logical operators

|  |
| --- |
| import java.io.BufferedReader;  import java.io.InputStreamReader;  public class Thirteen {      public static void main(String[] args) throws Exception      {          InputStreamReader isr=new InputStreamReader(System.in);          BufferedReader br=new BufferedReader(isr);          System.out.print("Enter a boolean value:\t");          boolean a = Boolean.parseBoolean(br.readLine());  //"true"          System.out.print("Enter another boolean value:\t");          boolean b = Boolean.parseBoolean(br.readLine());  //"true"          System.out.println("a:\t"+a);          System.out.println("b:\t"+b);          System.out.println("a&&b:\t"+(a&&b));          System.out.println("a||b:\t"+(a||b));          System.out.println("!a:\t"+!a);          System.out.println("!b:\t"+!b);        }  }  Output:  Enter a boolean value: madhu  Enter another boolean value: TrUe  a: false  b: true  a&&b: false  a||b: true  !a: true  !b: false |

How to read a single character (within a range of 0 to 255)?

|  |
| --- |
| public class Fifteen {      public static void main(String[] args) throws Exception      {          System.out.println("Enter any character:\t");          int n=System.in.read();  //it reads only single character within range of 0 t 255 and returns it’s Unicode value( or ascii value)          System.out.println("n:\t"+n);      }  }  Output:  Enter any character:  A  n: 65 |

Does JVM is able to display Telugu letter అ(see the below example)

|  |
| --- |
| import java.io.BufferedReader;  import java.io.InputStreamReader;  public class Fifteen {      public static void main(String[] args) throws Exception      {          char ch1='\u0C05'; //in ch1 i am storing telugu letter అ it's unicode value is 3077          System.out.println("int(ch1):\t"+(int)ch1);          System.out.println("int:\t"+ch1);      }  }  **Output:**  int(ch1): 3077  int: ? |

Can we declare a local variable as static?

|  |
| --- |
| No, local variables can’t be either static or instance |

What is a literal?

|  |
| --- |
| 1. It is a value used in a program   Different types of literals supported by Java   1. Integer literal (10,20) 2. Float literal (10.0,2.0) 3. String literal(“madhu”,”123”) 4. Boolean literal(true,false) 5. Character literal (‘a’,’1’) |

What is a token?

|  |
| --- |
| Each and every individual unit in a program is called as token.  The list of tokens supported by Java   1. Keywords 2. Identifiers 3. Literals 4. Operators 5. Separators 6. Special characters 7. Comments |

What is a comment?

|  |
| --- |
| A **comment** in Java is a piece of text in the code that is ignored by the compiler and is used to provide explanations, notes, or documentation for better code readability. Java supports three types of comments:  **1. Single-line Comment (//)**   * Used for short, single-line explanations. * Anything after // on the same line is ignored by the compiler.   **2. Multi-line Comment (/\* ... \*/)**   * Used for longer explanations spanning multiple lines.   **3. Javadoc Comment (/\*\* ... \*/)**   * Used for generating documentation using the **Javadoc** tool. * Typically used for describing classes, methods, and parameters. |

Example on documentation comments

Comments.java

|  |
| --- |
| package pack1; //it is a package statement: by using it i am creating pack1 package  /\*  importing all the static methods and fields of Integer class,  so that we can use them direclty without using class name.   \*/  import static java.lang.Integer.\*;  //this is a main method class  public class Comments {      /\*\*       main() method is the starting point of the program       \*/      public static void main(String[] args)      {                  System.out.println("Comments example...");      }  } |

MyMath.java

|  |
| --- |
| package pack1;  /\*\*  it is a class which contains methods to perform  arithmetic operations. it is existed in pack1 package   \*/  public class MyMath {      public int add(int a,int b){          return a+b;      }      public int sub(int a,int b){          return a-b;      }      public int multi(int a,int b){          return a\*b;      }  } |

How to generate documentation for the above programs(MyMath.java and Comments.java)

|  |
| --- |
| We have to use Javadoc tool to generate documentation |

How to see the documentation generated Javadoc command?

|  |
| --- |
| Click on index.html file to see the documentation  If you run the index.html (just double click it to run) page then you can see the documentation like below |

What is String in “String args[]”?

|  |
| --- |
| It is a pre-defined class existed in java.lang package |

What is a System in “System.out.println()”?

|  |
| --- |
| It is a pre-defined class existed in java.lang package |

What is a println() in “System.out.println()”?

|  |
| --- |
| It is a pre-defined method |

What is a reference variable?

|  |
| --- |
| If we declare a variable by using class name as a data type. Then those variables are called as reference variables (like pointer variables in C/C++). |

What is a reference data type?

|  |
| --- |
| It is a data type which is used to declare reference variables. |

Conditional statements allow the program to make decisions based on certain conditions. The main conditional statements available in Java are:

* + 1. If statement
    2. If…else… statement
    3. Else…if. Ladder (if..else..if) (if..else if…else)
    4. Nested if statement
    5. Switch statement
    6. Ternary operator
    7. While
    8. for
    9. Do..while
    10. Foreach

If statement?

|  |
| --- |
| If you want to execute one or more statements whenever a condition is true then we write if statement.  Syntax-1: if (condition)  Single-statement-1;  Syntax-2: if (condition){  Stmt-1;  Stmt-2;  …………  Stmt-n;  } |

Example on if statement(condition)

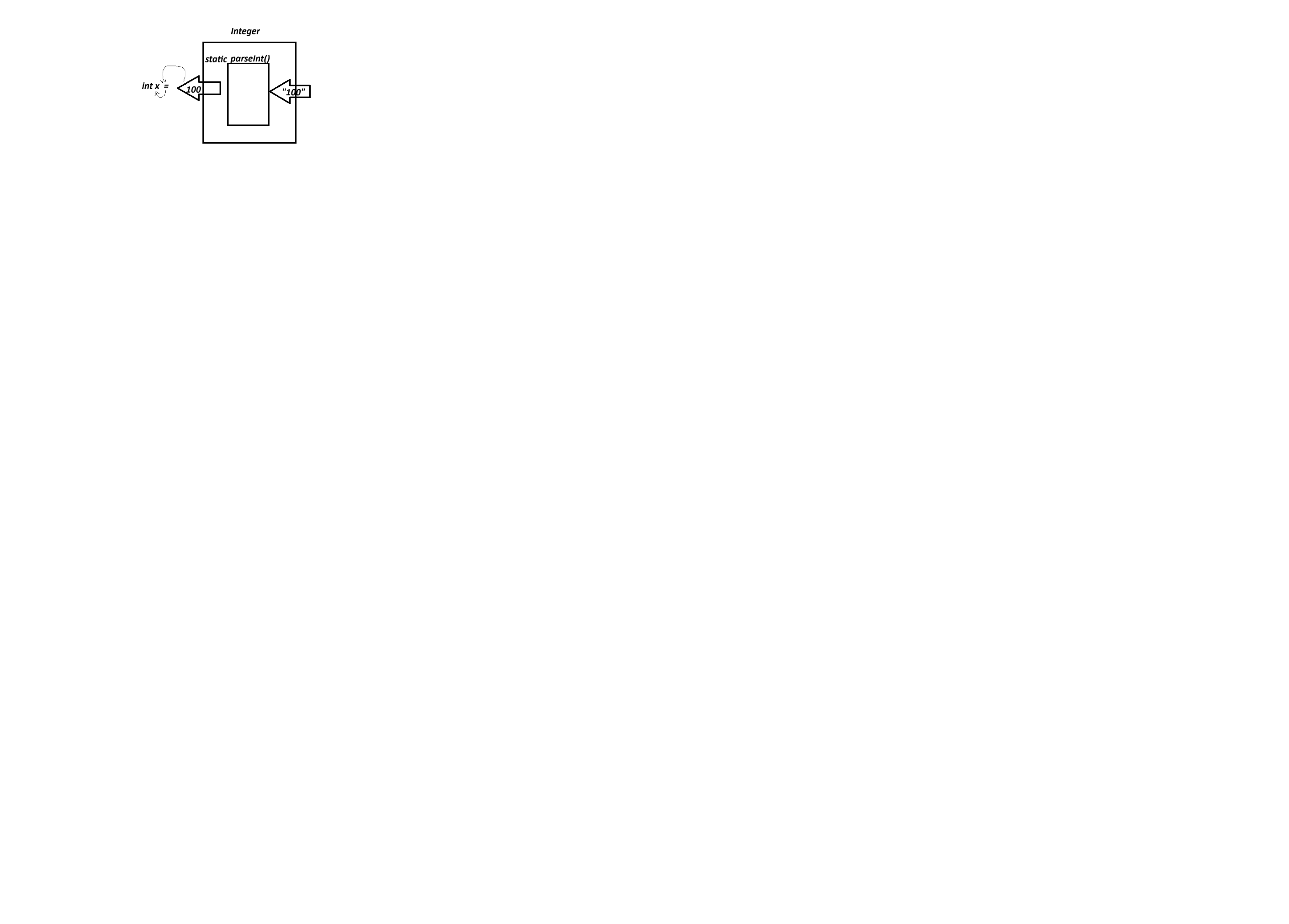
|  |
| --- |
| import java.io.BufferedReader;  import java.io.IOException;  import java.io.InputStreamReader;  public class SeventeenIfDemo {      public static void main(String[] args) throws IOException {          InputStreamReader isr=new InputStreamReader(System.in);          BufferedReader br= new BufferedReader(isr);          System.out.print("Enter a value:\t");          String s1=br.readLine();          int x=Integer.parseInt(s1);          System.out.print("Enter another value:\t");          String s2=br.readLine();          int y=Integer.parseInt(s2);          if (x>y){              System.out.println("true");          }      }  }  Output: |

What is Integer in Integer.parseInt() statement?

|  |
| --- |
| It is a pre-defined class existed in java.lang package |

What is parseInt() in Integer.parseInt() statement?

|  |
| --- |
| * It is a pre-defined method existed in Integer class * This method takes string as an argument and returns int(primitive int) value. |



how we can call the static method?

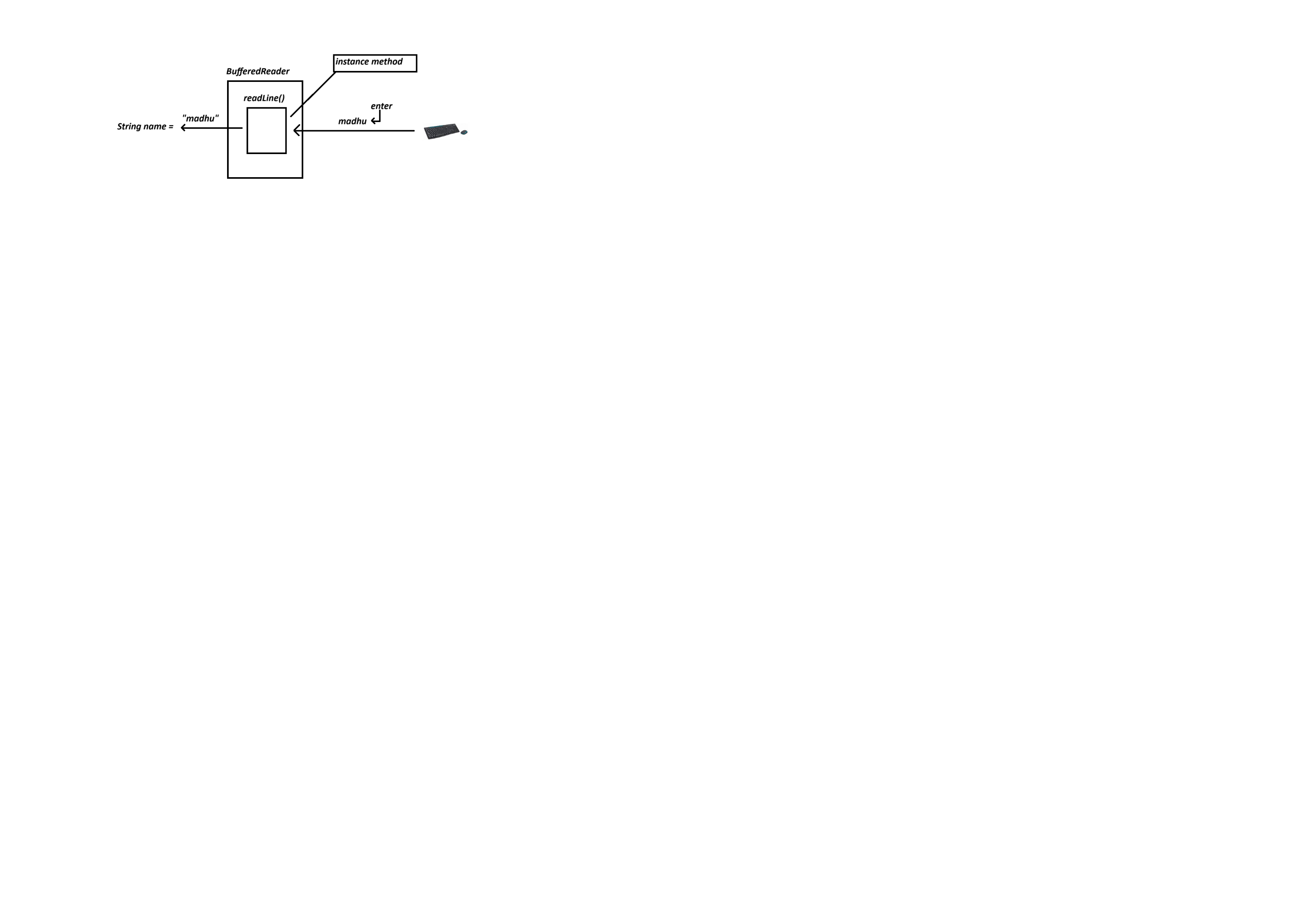
|  |
| --- |
| We can call the static method by using class name or a reference variable name(don’t bother whether it contains address of the object or null)  Ex: int x=Integer.parseInt(“100:); |

Why we write a class?

|  |
| --- |
| 1. We write a class to create objects |

What is the job of readLine() method?

|  |
| --- |
| * 1. It waits in the terminal (console monitor) to take the input from the keyboard   2. Whenever you press the enter after typing something then readLine() method takes it and returns as a string |



How to call instance method?

|  |
| --- |
| * + 1. We can call instance method by using object only     2. We can all instance method by using reference variable which must contain object address. |

Why NullPointerException will raise during program execution?

|  |
| --- |
| If you call instance method by using reference variable which contains null, then we will get this exception. |

If…else…

|  |
| --- |
| import java.io.BufferedReader;  import java.io.IOException;  import java.io.InputStreamReader;  public class Eighteen {      public static void main(String[] args) throws IOException      {          InputStreamReader isr=new InputStreamReader(System.in);          BufferedReader br=new BufferedReader(isr);          System.out.print("Enter a value:\t");          float x=Float.parseFloat(br.readLine());          System.out.print("Enter anothor value:\t");          float y=Float.parseFloat(br.readLine());          if (x > y)              System.out.printf("%.2f is Bigger Number",x);          else              System.out.printf("%.2f is Bigger Number",y);      }  }  **Output:**  Enter a value: 10.90  Enter anothor value: 11.00  11.00 is Bigger Number |

Else…if.. ladder and switch statement

|  |
| --- |
| If you want to execution one option among many then we can use either else…if ladder or switch statement. |

What is static import?

|  |
| --- |
| It is used to import static variables and static methods of a class into our program. If we import them then we can use them directly without using class name. |

What is the scope and life of local variable?

|  |
| --- |
| * + - 1. Life means: time between creation and destruction of a variable       2. Local variables are created whenever the declaration statement is executed by JVM and destroyed from stack frame whenever the block where declared execution is completed.       3. Scope: in which block or blocks it is accessible is called as the scope of a variable.       4. Local variables are accessible only within the block where these variables are declared. |

Example on else..if... ladder usage to performing arithmetic operation based on the option you have given

|  |
| --- |
| import java.io.BufferedReader;  import java.io.InputStreamReader;  import static java.lang.Integer.parseInt;  public class Nineteen {      public static void main(String[] args) throws Exception      {          BufferedReader br=new BufferedReader(new InputStreamReader(System.in));          System.out.println("1.add");          System.out.println("2.sub");          System.out.println("3.multiply");          System.out.println("4.div");          System.out.println("5.modulus");          System.out.println("Option Please:\t");          int opt=parseInt(br.readLine());          if(opt>=1 && opt<=5)          {              System.out.print("Enter first int:\t");              int a=parseInt(br.readLine());              System.out.print("Enter second int:\t");              int b=parseInt(br.readLine());              if(opt==1)                  System.err.printf("%d + %d = %d",a,b,a+b);              else if(opt==2)                  System.err.printf("%d - %d = %d",a,b,a-b);              else if(opt==3)                  System.err.printf("%d \* %d = %d",a,b,a\*b);              else if(opt==4)                  System.err.printf("%d / %d = %d",a,b,a/b);              else                  System.err.printf("%d %% %d = %d",a,b,a%b);          }else{              System.out.println("Given Option is Invalid");          }      }  }  **Output:**  1.add  2.sub  3.multiply  4.div  5.modulus  Option Please:  10  Given Option is Invalid |

Example on usage of switch

|  |
| --- |
| import java.io.BufferedReader;  import java.io.InputStreamReader;  import static java.lang.Integer.parseInt;  public class Nineteen {      public static void main(String[] args) throws Exception      {          BufferedReader br=new BufferedReader(new InputStreamReader(System.in));          System.out.println("1.add");          System.out.println("2.sub");          System.out.println("3.multiply");          System.out.println("4.div");          System.out.println("5.modulus");          System.out.println("Option Please:\t");          int opt=parseInt(br.readLine());          if(opt>=1 && opt<=5)          {              System.out.print("Enter first int:\t");              int a=parseInt(br.readLine());              System.out.print("Enter second int:\t");              int b=parseInt(br.readLine());              switch (opt) {                  case 1:                      System.err.printf("%d + %d = %d",a,b,a+b);                      break;                  case 2:                      System.err.printf("%d - %d = %d",a,b,a-b);                      break;                  case 3:                      System.err.printf("%d \* %d = %d",a,b,a\*b);                      break;                  case 4:                      System.err.printf("%d / %d = %d",a,b,a/b);                      break;                  case 5:                      System.err.printf("%d %% %d = %d",a,b,a%b);              }          }else{              System.out.println("Given Option is Invalid");          }      }  }  Output:  1.add  2.sub  3.multiply  4.div  5.modulus  Option Please:  2  Enter first int: 10  Enter second int: 2  10 - 2 = 8 |

Switch Statement (with advanced features) without break statement but behaves like old switch statement

|  |
| --- |
| import java.io.BufferedReader;  import java.io.InputStreamReader;  import static java.lang.Integer.parseInt;  public class Nineteen {      public static void main(String[] args) throws Exception      {          BufferedReader br=new BufferedReader(new InputStreamReader(System.in));          System.out.println("1.add");          System.out.println("2.sub");          System.out.println("3.multiply");          System.out.println("4.div");          System.out.println("5.modulus");          System.out.println("Option Please:\t");          int opt=parseInt(br.readLine());          System.out.print("Enter first int:\t");          int a=parseInt(br.readLine());          System.out.print("Enter second int:\t");          int b=parseInt(br.readLine());          switch (opt) {                  case 1->System.err.printf("%d + %d = %d",a,b,a+b);                  case 2->System.err.printf("%d - %d = %d",a,b,a-b);                  case 3->System.err.printf("%d \* %d = %d",a,b,a\*b);                  case 4->System.err.printf("%d / %d = %d",a,b,a/b);                  case 5->System.err.printf("%d %% %d = %d",a,b,a%b);                  default->System.out.println("Invalid Option..");              }      }  }  Output:  1.add  2.sub  3.multiply  4.div  5.modulus  Option Please:  1  Enter first int: 10  Enter second int: 2  10 + 2 = 12 |

Switch expression

|  |
| --- |
| A switch statement can return a value. These kind of switch statements are called as switch expressions  Note: every case must yield a value or thow an exception and it must contain default case |

Example on switch expression

|  |
| --- |
| import java.io.BufferedReader;  import java.io.InputStreamReader;  import static java.lang.Integer.parseInt;  public class Nineteen {      public static void main(String[] args) throws Exception      {          BufferedReader br=new BufferedReader(new InputStreamReader(System.in));          System.out.println("1.add");          System.out.println("2.sub");          System.out.println("3.multiply");          System.out.println("4.div");          System.out.println("5.modulus");          System.out.println("Option Please:\t");          int opt=parseInt(br.readLine());          System.out.print("Enter first int:\t");          int a=parseInt(br.readLine());          System.out.print("Enter second int:\t");          int b=parseInt(br.readLine());          int result=switch (opt) {                  case 1->{                      int c=a+b;                      System.out.println("chachinodaaa...");                      yield c;}                  case 2->{yield a-b;}                  case 3->{yield a\*b;}                  case 4->{yield a/b;}                  case 5->{yield a\*b;}                  default->{throw new RuntimeException("Invalid Option");}              };              System.out.println("Result:\t"+result);      }  }  Output:  1.add  2.sub  3.multiply  4.div  5.modulus  Option Please:  1  Enter first int: 10  Enter second int: 2  chachinodaaa...  Result: 12 |

**Looping Statements (or) Iterative Statements**

|  |
| --- |
| **If we want to execute one or more statements repeatedly until the given condition becomes false.**  **Iterative statements are**   * **while** * **do...while…** * **for** * **foreach** |

**While loop**

|  |
| --- |
| **Syntax-1: while(condition)**  **stmt-1**  **Syntax-2: while(condition){**  **stmt-1;**  **stmt-2;**  **…………**  **stmt-n;**  **}** |

**Basic example on while loop**

|  |
| --- |
| **public class TwentyWhileDemo1 {**  **public static void main(String[] args) {**  **/\***  **1. declare a variable and intialize it with a starting value**  **Task: print welcome 10 times**  **1,2,3,4,5,6,7,8,9,10**  **2. use that variable in the condition**  **\*/**  **int i=1; //i=1,2,3**  **int n=10; //n=1**  **while(i<=n){**  **System.out.println("welcome");**  **i++;  //i=i+1**  **}**  **System.out.println("Iyyipayee..");**  **}**  **}**  **Output:**  **welcome**  **welcome**  **welcome**  **welcome**  **welcome**  **welcome**  **welcome**  **welcome**  **welcome**  **welcome**  **Iyyipayee..** |

**Example to print 1 to 10 natural numbers**

|  |
| --- |
| **public class TwentyWhileDemo1 {**  **public static void main(String[] args) {**  **/\***  **1. declare a variable and intialize it with a starting value**  **Task: print welcome 10 times**  **1,2,3,4,5,6,7,8,9,10**  **2. use that variable in the condition (Note: write the condition in such a way that it should become false once the goal is reached)**  **3.  update the value of variable**  **\*/**  **int i=1; //i=1,2,3**  **int n=10; //n=1**  **while(i<=n){**  **System.out.println(i);**  **i++;  //i=i+1**  **}**  **System.out.println("Iyyipayee..");**  **}**  **}**  **Output:**  **1**  **2**  **3**  **4**  **5**  **6**  **7**  **8**  **9**  **10** |

**Program to print 1 to 10 even numbers**

|  |
| --- |
| **public class TwentyWhileDemo1 {**  **public static void main(String[] args) {**  **/\***  **1. declare a variable and intialize it with a starting value**  **Task: print welcome 10 times**  **1,2,3,4,5,6,7,8,9,10**  **2. use that variable in the condition (Note: write the condition in such a way that it should become false once the goal is reached)**  **3.  update the value of variable**  **\*/**  **int i=2; //i=2,4**  **int n=10; //n=1**  **while(i<=n){**  **System.out.println(i);**  **i=i+2;**  **}**  **System.out.println("Iyyipayee..");**  **}**  **}**  **Output:**  **2**  **4**  **6**  **8**  **10**  **Iyyipayee..** |

**Example to print 1 to 10 odd numbers**

|  |
| --- |
| **public class TwentyWhileDemo1 {**  **public static void main(String[] args) {**  **/\***  **1. declare a variable and intialize it with a starting value**  **Task: print welcome 10 times**  **1,2,3,4,5,6,7,8,9,10**  **2. use that variable in the condition (Note: write the condition in such a way that it should become false once the goal is reached)**  **3.  update the value of variable**  **\*/**  **int i=1; //i=1,3....**  **int n=10; //**  **while(i<=n){**  **System.out.println(i);**  **i=i+2;**  **}**  **System.out.println("Iyyipayee..");**  **}**  **}**  **Output:**  **1**  **3**  **5**  **7**  **9**  **Iyyipayee..** |

**Program to print factors of a given number**

|  |
| --- |
| **public class TwentyWhileDemo1 {**  **public static void main(String[] args) {**  **int i=1; //i=1,2,3...**  **int n=10; //**  **while(i<=n){**  **if(n%i ==0)**  **System.out.println(i);**  **i++;**  **}**  **System.out.println("Iyyipayee..");**  **}**  **}**  **Output:**  1  2  5  10  Iyyipayee.. |

**Another example on while loop**

|  |
| --- |
| **import java.io.BufferedReader;**  **import java.io.InputStreamReader;**  **import static java.lang.Integer.parseInt;;**  **public class TwentyTwoLoop**  **{**  **static int count(int n)**  **{**  **//test-1: n=123,12,1**  **int count=0; //count=0,1,2,3**  **while (n>0)**  **{**  **n=n/10;**  **count++;**  **}**  **return count;**  **}**  **public static void main(String[] args) throws Exception**  **{**  **BufferedReader br=new BufferedReader(new InputStreamReader(System.in));**  **System.out.println("Enter n value:\t");**  **int n=parseInt(br.readLine());**  **int c=count(n);**  **System.out.println("count:\t"+c);**  **int d=0;**  **int sum=0;**  **while(n>0)**  **{**  **d=n%10;**  **n=n/10;**  **System.out.println();**  **sum=sum+(int)Math.pow(d,c);**  **}**  **System.out.println(sum);**  **}**  **}**  **Output:**  **Enter n value:**  **1634**  **count: 4**  **1634** |

**For loop**

|  |
| --- |
| **Syntax-1: for(initialization;condition;updation)**  **Stmt-1**  **Syntax-2: for(initialization;condition;updation){**  **Stmt-1**  **……….**  **Stmt-n**    **}** |

**Example on for loop**

|  |
| --- |
| **public class ForDemo {**  **public static void main(String[] args)**  **{**  **int n=10;**  **//i=1,2**  **System.out.println("for loop");**  **for(int i=1;i<=n;i++)**  **{   System.out.println(i);**  **}**  **}**  **}**  **Output:**  **for loop**  **1**  **2**  **3**  **4**  **5**  **6**  **7**  **8**  **9**  **10** |

**Another example on for loop**

|  |
| --- |
| **public class ForDemo {**  **public static void main(String[] args)**  **{**  **int n=10;**  **int i=1;**  **//i=1,2**  **System.out.println("for loop");**  **for(;i<=n;)**  **{   System.out.println(i);**  **i++;**  **}**  **}**  **}**  **Output:**  **for loop**  **1**  **2**  **3**  **4**  **5**  **6**  **7**  **8**  **9**  **10** |

**Do…while…**

|  |
| --- |
| In do…while… we will enter into the loop first, after that condition checking will be done.  Syntax-1: do{  Stmt-1;  …………;  Stmt-n;  }while(condition); |

**Example on do…while… and switch statements**

|  |
| --- |
| import java.io.BufferedReader;  import java.io.InputStreamReader;  import static java.lang.Integer.parseInt;  public class ForDemo  {      public static void main(String[] args) throws Exception      {          String opt3="";          System.out.println("BackBenchers...");          BufferedReader br=new BufferedReader(new InputStreamReader(System.in));          do{              System.out.println("1. Veg");              System.out.println("2. Non-veg");              System.out.print("Sir! Veg(1) or Non-veg(2)?:\t");              int opt1=parseInt(br.readLine());              switch (opt1) {                  case 1->{                      float plate\_meal=150;                      float panner\_biryani=350;                      float vegFriedRice=200;                      System.out.println("Veg-Menu");                      System.out.printf("1. Meals - %.2f %n",plate\_meal);                      System.out.printf("2. Panner Biryani - ( %.2f ) %n",panner\_biryani);                      System.out.printf("3. Veg-fried rice - ( %.2f ) %n",vegFriedRice);                      System.out.print("Order please!");                      int opt2=parseInt(br.readLine());                      int plate\_count=0;                      switch (opt2) {                          case 1->{                              System.out.print("How plates sir!:\t");                              plate\_count=parseInt(br.readLine());                              System.out.printf("Billing Amount:\t%.2f",(plate\_count\*plate\_meal));                          }                          case 2->{                              System.out.print("How plates sir!:\t");                              plate\_count=parseInt(br.readLine());                              System.out.printf("Billing Amount:\t%.2f",(plate\_count\*panner\_biryani));                          }                          case 3->{                              System.out.print("How plates sir!:\t");                              plate\_count=parseInt(br.readLine());                              System.out.printf("Billing Amount:\t%.2f",(plate\_count\*vegFriedRice));                          }                          default->{                              System.out.println("Not Available Sir!");                          }                      }                  }                  case 2->{                      float plate\_nonVegMeal=250;                      float chicken\_biryani=450;                      float eggFriedRice=250;                      System.out.println("Non-Veg-Menu");                      System.out.printf("1. Non-Veg-Meals - %.2f %n",plate\_nonVegMeal);                      System.out.printf("2. Chicken-Biryani - ( %.2f ) %n",chicken\_biryani);                      System.out.printf("3. Egg-Fried-Rice - ( %.2f ) %n",eggFriedRice);                      System.out.print("Order please!");                      int opt2=parseInt(br.readLine());                      int plate\_count=0;                      switch (opt2) {                          case 1->{                              System.out.print("How plates sir!:\t");                              plate\_count=parseInt(br.readLine());                              System.out.printf("Billing Amount:\t%.2f",(plate\_count\*plate\_nonVegMeal));                          }                          case 2->{                              System.out.print("How plates sir!:\t");                              plate\_count=parseInt(br.readLine());                              System.out.printf("Billing Amount:\t%.2f",(plate\_count\*chicken\_biryani));                          }                          case 3->{                              System.out.print("How plates sir!:\t");                              plate\_count=parseInt(br.readLine());                              System.out.printf("Billing Amount:\t%.2f",(plate\_count\*eggFriedRice));                          }                          default->{                              System.out.println("Not Available");                          }                      }                  }                  default->{                      System.out.println("Sorry sir! Not Available!");                  }              }              System.out.println("\nInka yemanna kavala sir!(yes/no)");              opt3=br.readLine();          }while(  opt3.equals("yes") );          System.out.println("Thank u sir! Visit Again!");      }  } |

How many times the memory will be allocated for a static variable in a program?

|  |
| --- |
| 1. Only once |

How many times the memory will be allocated for instance variables in a program?

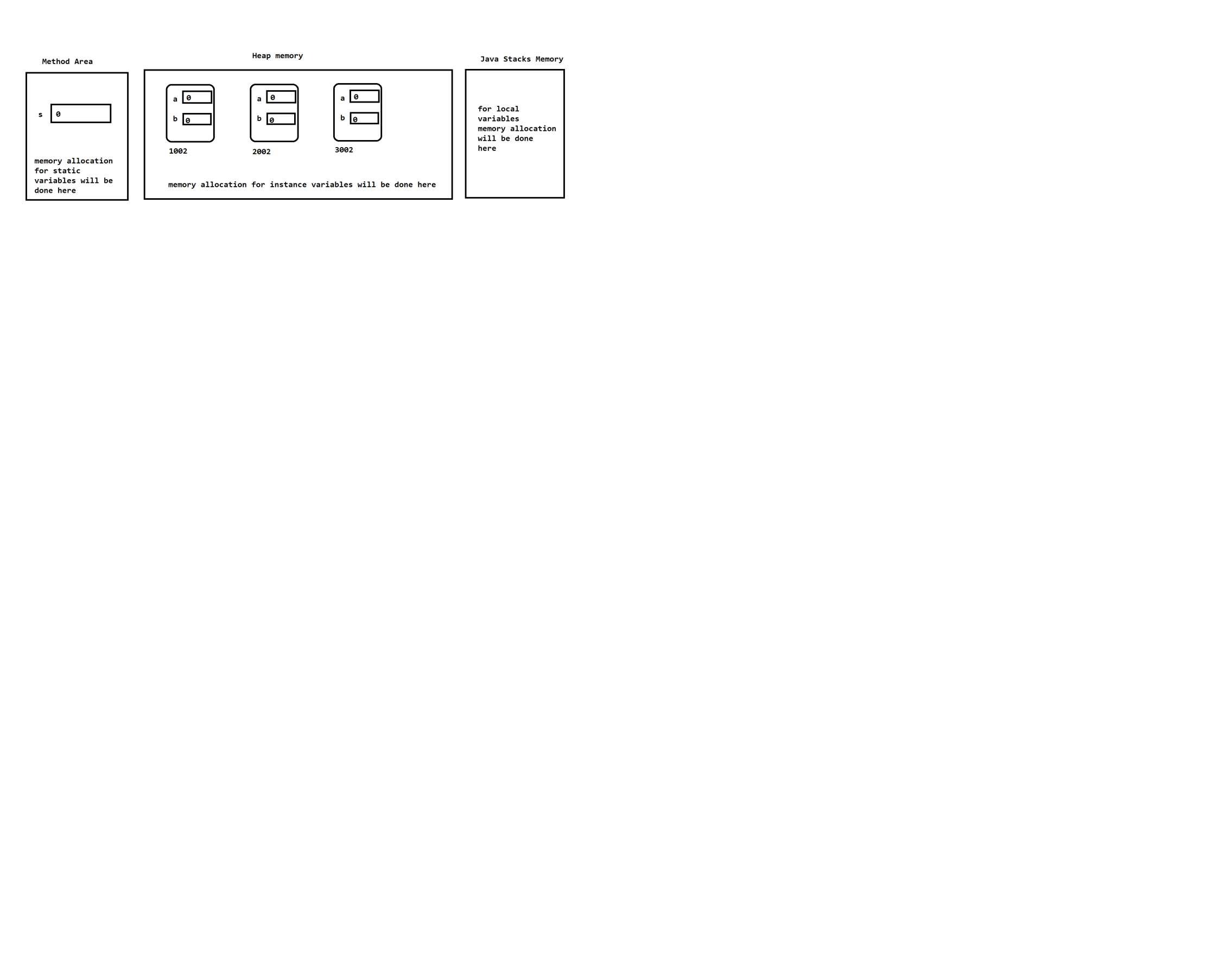
|  |
| --- |
| 1. N times if you create n objects. |

How to create an object?

|  |
| --- |
| We can create an object by using   1. new operator (new) 2. Constructor calling statement ( Dog()-> it is called as constructor calling ) |

Seven.java

|  |
| --- |
| import java.lang.\*; //import statement  class Dog  { static int s;  int a,b;  }  class Seven  { public static void main(String args[])  { int a;  Dog e1=new Dog();// object creation  Dog e2=new Dog();// object creation  Dog e3=new Dog();// object creation  }  } |



**Modified code (Seven.java)**

|  |
| --- |
| import java.lang.\*; //import statement  class Dog  {  static int s;  int a,b;  }  class Seven  {  public static void main(String args[])  {  int a;  //e1=1002  Dog e1=new Dog();// object creation  System.out.println("e1......object.....state....");  System.out.println(e1.a);  System.out.println(e1.b);  //e2=2002  Dog e2=new Dog();// object creation  System.out.println("e2......object.....state....");  System.out.println(e2.a);  System.out.println(e2.b);  //e3=3002  Dog e3=new Dog();// object creation  System.out.println("e3......object.....state....");  System.out.println(e3.a);  System.out.println(e3.b);  }  }  **Output:**  e1......object.....state....  0  0  e2......object.....state....  0  0  e3......object.....state....  0  0 |

Nested loops

|  |
| --- |
| We can write a loop within another loop, it is called as nested loops  Syntax:  for(initialization;condition;update){  stmt-1;  stmt-2;  for(initialization;condition;update){  stmt-1;  ………..  stmt-n;  }  Stmt-3;  ………..  Stmt-n;  } |

Example to print the below pattern

|  |
| --- |
| 1 1 2 3 4 5  2 1 2 3 4 5  3 1 2 3 4 5  4 1 2 3 4 5  5 1 2 3 4 5  ...end...  Program:  public class NestedForDemo {      public static void main(String[] args)      {          for(int i=1;i<=5;i++)          {              System.out.printf("%-8d",i);              for(int j=1;j<=5;j++)              {                  System.out.printf("%-3d",j);              }              System.out.println();          }          System.out.println("...end...");      }  }  /\*   1       1  2  3  4  5  \_   2       1  2  3  4  5  \_   3       1  2  3  4  5  \_   4       1  2  3  4  5  \_   5       1  2  3  4  5  \_   ...end...     \*/ |

Example to print the below pattern

|  |
| --- |
| 1 1  2 1 2  3 1 2 3  4 1 2 3 4  5 1 2 3 4 5  ...end...  Program:  public class NestedForDemo {      public static void main(String[] args)      {          for(int i=1;i<=5;i++)          {              System.out.printf("%-8d",i);              for(int j=1;j<=i;j++)              {                  System.out.printf("%-3d",j);              }              System.out.println();          }          System.out.println("...end...");      }  } |

Program to print the below pattern

|  |
| --- |
| \*  \* \*  \* \* \*  \* \* \* \*  \* \* \* \* \*  ...end...  Program  public class NestedForDemo {      public static void main(String[] args)      {          for(int i=1;i<=5;i++)          {              for(int j=1;j<=i;j++)              {                  System.out.printf("%-3s","\*");              }              System.out.println();          }          System.out.println("...end...");      }  } |

Write a program to print the below pattern

|  |
| --- |
| 1  2 2  3 3 3  4 4 4 4  5 5 5 5 5  ...end...  Program:  public class NestedForDemo {      public static void main(String[] args)      {          for(int i=1;i<=5;i++)          {              for(int j=1;j<=i;j++)              {                  System.out.printf("%-3d",i);              }              System.out.println();          }          System.out.println("...end...");      }  } |

Write a program to print the pyramid shape like below

|  |
| --- |
| Program  public class Pattern  {      public static void main(String[] args)      {          int n=5;          //n=5          //i=1,2,3,4,5,6          for(int i=1;i<=n;i++)          {              //j=1              for(int j=1;j<=(n-i);j++)              System.out.printf(" ");              //k=1,2,3              for(int k=1;k<=i;k++)                  System.out.printf("%-2s","\*");                System.out.println();          }      }  } |

Write a program to print the below pattern

|  |
| --- |
| Program  public class NestedLoop {      public static void main(String[] args)      {          int n=4;          int k=1;          for(int i=1;i<=n;i++)          {              for(int j=1;j<=i;j++)              {                  System.out.printf("%-2d",k);                  k++;              }              System.out.println();          }      }  }  /\*  1  23  456  78910  \*/ |

Write a program to print the below pattern

|  |
| --- |
| public class NestedLoop {      public static void main(String[] args)      {          int n=6;          int k=1;          for(int i=1;i<=n;i++)          {              for(int j=1;j<=i;j++)              {                  System.out.printf("%-2d",k);                  if(k==1)                      k=0;                  else                      k=1;              }              System.out.println();          }      }  } |

Write a program to print the below pattern

|  |
| --- |
| public class NestedLoop {      public static void main(String[] args)      {          int n=6;          int k=1;          for(int i=1;i<=n;i++)          {              for(int j=1;j<=i;j++)              {                  if ((i+j)%2==0)                      System.out.printf("%-2d",1);                  else                      System.out.printf("%-2d",0);                }              System.out.println();          }      }  } |

Write a program to print the below pattern



|  |
| --- |
| public class NestedLoop {      public static void main(String[] args)      {          int n=4;          //i=1          //n=4          for(int i=1;i<=n;i++)          {              for(int j=1;j<=n;j++)              {                  //j=1,2,3,4                  if (i==j || j== n-(i-1))                      System.out.printf("%s","\*");                  else                      System.out.print("   ");              }              System.out.println();          }      }  } |

**Arrays**

What is an array?

|  |
| --- |
| * 1. Till now to store values we declare variables. And memory allocation for the variables will be done in different addresses. So memory allocation is not contiguous. To allocate memory contiguously we use arrays.      * 1. Array is a collection similar data element (data items) stored at contiguous memory locations and shared by a common name.   2. After array creation the default values will be stored in each block.   Advantages of array   * + 1. Accessing/modifying elements is fast     2. We can get/access or modify the elements randomly   **Dis-advantages**   * + - 1. Array size is fixed |

How to create an array?

|  |
| --- |
| We have different ways to create an array in Java? |

In which memory arrays will be created?

|  |
| --- |
| Arrays will be created in heap memory |

What will be considered as array address?

|  |
| --- |
| First block address will be considered as array address |

What is an index?

|  |
| --- |
| * + - 1. It is a number given to each and every block of an array. And it always starts with zero       2. By using index, we can access elements faster |

Example-1: Basic example on 1D array

|  |
| --- |
| public class ArrayDemo1  {      public static void main(String[] args)      {         int[] arr=new int[5];         //arr=1000         System.out.println(arr);         System.out.println(arr[0]);         System.out.println(arr[1]);         System.out.println(arr[2]);         System.out.println(arr[3]);         System.out.println(arr[4]);      }  }  Output:  [I@5caf905d  0  0  0  0  0 |

Types of arrays?

|  |
| --- |
| There are 2 types of arrays   * 1D array: it is an array, which is created with single subscript and it contains list of elements of the same type stored in a single row. * 2D array: collection of 1D arrays   (or)  A two-dimensional array is an array of arrays, which is commonly used to represent matrices or tables. |

Which class object will be created if we create an array in Java?

|  |
| --- |
| The Java compiler creates an instance of a class that extends java.lang.Object and implements java.lang.Cloneable and java.io.Serializable.  **The class created:**   * Java does **not** explicitly create a named class for the array, but internally, it is represented as a **special class** that extends Object. * The **runtime type** of the array is int[], which is a subclass of Object. |

Example to see the class of the array object?

|  |
| --- |
| public class ArrayDemo1  {      public static void main(String[] args)      {         int[] arr=new int[5];         float[] farr=new float[10];         System.out.println("arr is the object of class called:\t"+arr.getClass());         System.out.println("farr is the object of class called:\t"+farr.getClass());         String s1="array";         System.out.println("s1 is the object of a class called :\t"+s1.getClass());      }  }  Output:  arr is the object of class called: class [I  farr is the object of class called: class [F  s1 is the object of a class called : class java.lang.String |

**ArrayDemo2.java**

|  |
| --- |
|  |

**What is length of an array?**

|  |
| --- |
| * It is an instance variable existed in every array. Which is used to find the length of an array. |

**How to access static variable or static method?**

|  |
| --- |
| * 1. We can access static variable (or) static method by using either class name or a ref-variable |

**How to access instance variable or instance method?**

|  |
| --- |
| * We can access instance variable or instance method by using object only. |

When we will get NullPointerException?

|  |
| --- |
| * 1. We will get NullPointerException when we call instance method or instance variable by using reference variable which is pointing to null. |

Example on getting NullPointerException

|  |
| --- |
| import java.io.BufferedReader;  import java.io.IOException;  import java.io.InputStreamReader;  import static java.lang.Integer.parseInt;  public class ArrayDemo1  {      int a; //instance variable      static int s; //static variable      public static void main(String[] args) throws IOException      {            ArrayDemo1 ad1=null;          System.out.println(ad1.s);          System.out.println(ArrayDemo1.s);        System.out.println(ad1.a);      }  }  Run:  0  0  Exception in thread "main" java.lang.NullPointerException: Cannot read field "a" because "<local1>" is null  at ArrayDemo1.main(ArrayDemo1.java:16) |

Example to get NullPointerException, while accessing instance variable length of an array

|  |
| --- |
| import java.io.BufferedReader;  import java.io.IOException;  import java.io.InputStreamReader;  import static java.lang.Integer.parseInt;  public class ArrayDemo1  {      int a; //instance variable      static int s; //static variable      public static void main(String[] args) throws IOException      {          int[] arr=null;          System.out.println("size of array:\t"+arr.length);      }  }  Run:  Exception in thread "main" java.lang.NullPointerException: Cannot read the array length because "<local1>" is null  at ArrayDemo1.main(ArrayDemo1.java:12) |

Example to print the elements of an array using for loop

|  |
| --- |
| import java.io.BufferedReader;  import java.io.IOException;  import java.io.InputStreamReader;  import static java.lang.Integer.parseInt;  public class ArrayDemo1  {      int a; //instance variable      static int s; //static variable      public static void main(String[] args) throws IOException      {          int[] arr=null;          //System.out.println("size of array:\t"+arr.length);          BufferedReader br=new BufferedReader(new InputStreamReader(System.in));          System.out.println("Enter array size:\t");          int n=parseInt(br.readLine());          arr=new int[n];          System.out.println("size of array:\t"+arr.length);          System.out.println("Elements in an array:\t");          //n=5          //0,1,2,3,4          //i=0,1          for(int i=0;i<arr.length;i++)          {   System.out.println(arr[i]);          }      }  } |

Example to get elements from an array using while loop

|  |
| --- |
| import java.io.BufferedReader;  import java.io.IOException;  import java.io.InputStreamReader;  import static java.lang.Integer.parseInt;  public class ArrayDemo1  {      int a; //instance variable      static int s; //static variable      public static void main(String[] args) throws IOException      {          int[] arr=null;          //System.out.println("size of array:\t"+arr.length);          BufferedReader br=new BufferedReader(new InputStreamReader(System.in));          System.out.println("Enter array size:\t");          int n=parseInt(br.readLine());          arr=new int[n];          System.out.println("size of array:\t"+arr.length);          System.out.println("Elements in an array:\t");          //n=5          //0,1,2,3,4          //i=0,1          int i=0;          while(i<arr.length)          {   System.out.println(arr[i]);              i++;          }      }  }  Output:  Enter array size:  10  size of array: 10  Elements in an array:  0  0  0  0  0  0  0  0  0  0 |

Example to get ArrayIndexOutOfBoundsException(Samba)

|  |
| --- |
| import java.io.BufferedReader;  import java.io.IOException;  import java.io.InputStreamReader;  import static java.lang.Integer.parseInt;  public class ArrayDemo1  {      int a; //instance variable      static int s; //static variable      public static void main(String[] args) throws IOException      {          int[] arr=null;          //System.out.println("size of array:\t"+arr.length);          BufferedReader br=new BufferedReader(new InputStreamReader(System.in));          System.out.println("Enter array size:\t");          int n=parseInt(br.readLine());          arr=new int[n];          System.out.println("size of array:\t"+arr.length);          System.out.println("Elements in an array:\t");          int i=0;          do          {              System.out.println(arr[i]);              i++;          }while(i<arr.length);        }  }  Output:  Enter array size:  0  size of array: 0  Elements in an array:  Exception in thread "main" java.lang.ArrayIndexOutOfBoundsException: Index 0 out of bounds for length 0  at ArrayDemo1.main(ArrayDemo1.java:22) |

Scanner

|  |
| --- |
| * It is a pre-defined class existed in java.util package * This class has many instance methods which are used to get the data from either keyboard (standard input device) or a file. |

Storing and getting elements from an array by using Scanner class method nextInt()

|  |
| --- |
| import java.util.Scanner;  import static java.lang.System.in;  public class ArrayDemo1  {      int a; //instance variable      static int s; //static variable      public static void main(String[] args)      {          int[] arr=null;          //System.out.println("size of array:\t"+arr.length);          Scanner scan=new Scanner(in);          System.out.println("Enter array size:\t");          int n=scan.nextInt();          arr=new int[n];          System.out.println("size of array:\t"+arr.length);          for(int i=0;i<arr.length;i++)          {   System.out.printf("anniyaa elementu enter seyyiraa index  %d  lo:\t",i);              arr[i]=scan.nextInt();          }          System.out.println("Elements in an array:\t");          for(int i=0;i<arr.length;i++)          {             System.out.println(arr[i]);          }      }  }  Output:  Enter array size:  5  size of array: 5  anniyaa elementu enter seyyiraa index 0 lo: 10  anniyaa elementu enter seyyiraa index 1 lo: 20  anniyaa elementu enter seyyiraa index 2 lo: 30  anniyaa elementu enter seyyiraa index 3 lo: 40  anniyaa elementu enter seyyiraa index 4 lo: 50  Elements in an array:  10  20  30  40  50 |

Initializing array during creation itself

|  |
| --- |
| Syntax-1: int [] arr={10,20,30,40,50};  Syntax-2: int[] arr=new int[]{10,20,30,40,50};  At the time of reference variable declaration, the subscript can be placed either side of the variable.  Ex-1: int[] arr;  Ex-2: int [] arr;  Ex-3: int []arr;  Ex-4: int arr[]; |

Reading and writing array elements by using user defined methods

|  |
| --- |
| import java.util.Scanner;  import static java.lang.System.in;  public class ArrayDemo1  {      static void display(int[] arr)      {  //arr=1000          System.out.println("Elements in an array:\t");          for(int i=0;i<arr.length;i++)          {   System.out.println(arr[i]);          }      }      static void read(int arr[])      {   //arr=1000          Scanner scan=new Scanner(in);          System.out.println("size of array:\t"+arr.length);          for(int i=0;i<arr.length;i++)          {   System.out.printf("anniyaa elementu enter seyyiraa index  %d  lo:\t",i);              arr[i]=scan.nextInt();          }      }      public static void main(String[] args)      {          //System.out.println("size of array:\t"+arr.length);          Scanner scan=new Scanner(in);          System.out.println("Enter array size:\t");          int n=scan.nextInt();          int[] arr=new int[n];          read(arr);          display(arr);  //display(1000)          int[] arr2=new int[3];          read(arr2);      }  }  Output:  Enter array size:  3  size of array: 3  anniyaa elementu enter seyyiraa index 0 lo: 100  anniyaa elementu enter seyyiraa index 1 lo: 200  anniyaa elementu enter seyyiraa index 2 lo: 300  Elements in an array:  100  200  300  size of array: 3 |

Foreach

|  |
| --- |
| For each is used to get the elements from a collection object or an array. |

Example to get the elements from an array by using foreach

|  |
| --- |
| import java.util.Scanner;  import static java.lang.System.in;  public class ArrayDemo1  {      static void display(int[] arr)      {          //arr=1000          System.out.println("Elements in an array:\t");          for(int ele:arr)          {   System.out.println(ele);          }      }      static void read(int arr[])      {   //arr=1000          Scanner scan=new Scanner(in);          System.out.println("size of array:\t"+arr.length);          for(int i=0;i<arr.length;i++)          {   System.out.printf("anniyaa elementu enter seyyiraa index  %d  lo:\t",i);              arr[i]=scan.nextInt();          }      }      public static void main(String[] args)      {          //System.out.println("size of array:\t"+arr.length);          Scanner scan=new Scanner(in);          System.out.println("Enter array size:\t");          int n=scan.nextInt();          int[] arr=new int[n];          read(arr);          display(arr);  //display(1000)      }  }  **Output:**  Enter array size:  5  size of array: 5  anniyaa elementu enter seyyiraa index 0 lo: 10  anniyaa elementu enter seyyiraa index 1 lo: 20  anniyaa elementu enter seyyiraa index 2 lo: 30  anniyaa elementu enter seyyiraa index 3 lo: 40  anniyaa elementu enter seyyiraa index 4 lo: 50  Elements in an array:  10  20  30  40  50 |

What is an anonymous array?

|  |
| --- |
| It is an array which is created without name and without specifying size. |

Example to find whether the given element is found or not

|  |
| --- |
| import java.util.Scanner;  import static java.lang.System.\*;  public class ArrayDemo2  {      static void display(int[] arr)      {          boolean flag=false;          Scanner scan=new Scanner(System.in);          //arr=1000          System.out.println("Enter element to find:\t");          int ele\_to\_find=scan.nextInt();          for (int ele : arr) {              if(ele==ele\_to\_find){                  flag=true;                  break;              }          }          if(flag==true)          System.out.println("Element found");          else          System.out.println("Element not found");      }      public static void main(String[] args) {            display( new int[]{1,8,2,9,5,3,6,7} );      }  }  **Output:**  Enter element to find:  5  Element found |

**Two Dimensional Arrays**

|  |
| --- |
| * 1. A two-dimensional array is an array which contains collection of single dimensional arrays.   2. It is an array of arrays |

**Syntax to create a two-dimensional array**

|  |
| --- |
| Syntax-1: data\_type[][] arr=new data\_type[row\_size][col\_size];  Syntax-2: data\_type arr2[][]=new data\_type[1D arrays count][size of each 1D array]; |

Example on Two dimensional arrays

|  |
| --- |
| public class TDA1 {      public static void main(String[] args)      {          int arr[][]=new int[2][3];          System.out.println("arr.length:\t"+arr.length);          System.out.println("arr[0]:\t"+arr[0]);          System.out.println("arr[1]:\t"+arr[1]);          System.out.println("arr[0].length:\t"+arr[0].length);          System.out.println("arr[1].length:\t"+arr[1].length);          for(int i=0;i<arr.length;i++){              for(int j=0;j<arr[i].length;j++){                  System.out.printf("[%d,%d]:\t%d %n",i,j,arr[i][j]);              }              System.out.println();          }      }  }  **Output:**  arr.length: 2  arr[0]: [I@1fb3ebeb  arr[1]: [I@548c4f57  arr[0].length: 3  arr[1].length: 3  [0,0]: 0  [0,1]: 0  [0,2]: 0  [1,0]: 0  [1,1]: 0  [1,2]: 0 |

Example on 2D array

|  |
| --- |
| import java.util.Scanner;  public class TDA1 {      public static void main(String[] args)      {          int arr[][]=new int[2][3];          Scanner scan=new Scanner(System.in);          //i=0,1,2          //arr.length  =  2          for(int i=0;i<arr.length;i++){              System.out.printf("Enter elements into row  %d:\n",i);              //j=0,1,2,3              //arr[0].length=3              //arr[1].length=3              for(int j=0;j<arr[i].length;j++){                  arr[i][j]=scan.nextInt();              }          }          //i=0          //arr.length=2          for(int i=0;i<arr.length;i++){              //j=0              //arr[0].length=3              for(int j=0;j<arr[i].length;j++){                  System.out.printf("[%d,%d]:\t%d %n",i,j,arr[i][j]);              }              System.out.println();          }      }  }  Output:  Enter elements into row 0:  1  2  3  Enter elements into row 1:  4  5  6  [0,0]: 1  [0,1]: 2  [0,2]: 3  [1,0]: 4  [1,1]: 5  [1,2]: 6 |

Example to get the elements from 2D array using for each

|  |
| --- |
| import java.util.Scanner;  public class TDA1 {      public static void main(String[] args)      {          int arr[][]=new int[2][3];          Scanner scan=new Scanner(System.in);          //i=0,1,2          //arr.length  =  2          for(int i=0;i<arr.length;i++){              System.out.printf("Enter elements into row  %d:\n",i);              //j=0,1,2,3              //arr[0].length=3              //arr[1].length=3              for(int j=0;j<arr[i].length;j++){                  arr[i][j]=scan.nextInt();              }          }          //i=0          //arr.length=2          for(int[] sda:arr){              for(int ele:sda){                  System.out.printf("%-5d",ele);              }              System.out.println();          }          System.out.println("aapararai.....");      }  }  /\*   10\_\_\_20\_\_\_30\_\_\_   40\_\_\_50\_\_\_60\_\_\_   \_   \*/ |

When we will get array constants only be used in initializers?

|  |
| --- |
| See the below image    If you try to assign array constants after array initialization, we will get the above error. |

**Jagged (or) Ragged Array**

|  |
| --- |
| A **jagged array** is an array of arrays where the sub-arrays can have different lengths. Unlike a two-dimensional array (which has fixed row and column sizes), a jagged array allows each row to have a different number of elements.  **Key Characteristics of Jagged Arrays:**   * It is an array of arrays. * Each inner array can have a different size. * It is useful for scenarios where a rectangular structure is not needed. * In languages like Java and C#, jagged arrays are implemented as an array of references to other arrays.     Example on Jagged Array  public class ArrayDemo3 {      public static void main(String[] args)      {          //here 1st subscript represents rows  and subscripts represents columns count of each row          int[][] arr=new  int[3][];          System.out.println(arr.length);          System.out.println(arr[0]);          System.out.println(arr[1]);          System.out.println(arr[2]);          //System.out.println(arr[0].length);  //length is a variable existed in every array and it is instance variable            arr[0]=new int[]{10};          int arr2[]={10,20};          arr[1]=new int[]{10,20};          arr[2]=new int[]{10,20,30};          System.out.println("Elements existed in Jagged array");          for(int[] sda:arr)          {              //sda=1000,2000              for(int ele:sda)              {                  System.out.print(ele+"\t");              }              System.out.println();          }          System.out.println("ayipayeee...");      }  }  **Output:**  3  null  null  null  Elements existed in Jagged array  10  10 20  10 20 30  ayipayeee... |

**What is matrix addition?**

|  |
| --- |
|  |

**Example on matrix addition**

**What is matrix multiplication?**

|  |
| --- |
| Matrix multiplication is a method of finding the product of two matrices to get the result as one matrix. It is a type of binary operation.  **Rules for Matrix Multiplication:**   * If A is an 𝑚×𝑛 matrix and B is an n×p matrix, then the resulting matrix C will be an m×p matrix. * The number of columns in the first matrix (A) must be equal to the number of rows in the second matrix (B). |

**Frequently asked questions in matrix multiplication**

|  |
| --- |
| **What is matrix multiplication?**  Matrix multiplication is a method of finding the product of two matrices to get the result as one matrix. It is a type of binary operation.  Q2  **How to multiply two given matrices?**  To multiply one matrix with another, we need to check first, if the number of columns of the first matrix is equal to the number of rows of the second matrix. Now multiply each element of the column of the first matrix with each element of rows of the second matrix and add them all. We need to do the dot product of columns and rows here.  Q3  **What is the result of multiplication of (2**×**3) matrix and (3**×**3) matrix?**  The result of multiplication of (2×3) matrix and (3×3) matrix will be 2×3 matrix only.  Q4  **How to multiply 3**×**3 matrix?**  Multiply each row of the first matrix with each column of the second matrix and add all to get the first element. Similarly, multiply and add the elements of the two matrices, column and row-wise, to get the elements of the product of two 3×3 matrices.  Q5  **How do we find the multiplication of two matrices?**  If A is a m×n matrix and B is a p×q matrix, then the multiplication of A and B is denoted by dot matrix, such as: C = AB Thus, C will be an m×q matrix. |

**Example on matrix multiplication**

|  |
| --- |
| import static java.lang.System.out;  import static java.lang.System.in;  import java.util.Scanner;  class MatrixMultiplication  {      /\*\*       this method takes the 2d array(matix) as an arugument       later it takes the elements from the keyboard and stores them in to array.       \*/      static void readElements(int[][] arr)      {  //arr=5000          Scanner scan=new Scanner(in);          out.printf("Enter Elements into %d X %d matrix%n ",arr.length,arr[0].length);          //arr.length=2          for(int i=0;i<arr.length;i++)          {   //i=0,1              //j=0              for(int j=0;j<arr[i].length;j++)              {   //j=0,1,2,3                  //arr[0].length=3                  //arr[1].length=3                  out.printf("Enter Element at arr[%d][%d] matrix:\t ",i,j);                  arr[i][j]=scan.nextInt();              }          }      }      static void display(int arr[][])      {          for(int[] sda:arr)          {              for(int ele:sda)              {                  System.out.printf("%-5d",ele);              }              System.out.println();          }      }      public static void main(String[] args)      {              int fmr=2,fmc=3;              int smr=3,smc=3;              int[][] m1=new int[2][3];              int[][] m2=new int[3][3];              int[][] m3=null;;              if(fmc==smr){                  System.out.printf("Resultant matix will be %d X %d%n",fmr,smc);                  readElements(m1);                  readElements(m2);                  m3=multiply(m1,m2);                  System.out.println("Resultant matrix");                  display(m3);              }      }      static int [][] multiply(int[][] m1,int[][] m2)      {          int [][] m3=new int[m1.length][m2[0].length];          //i=0,1          //m1.length=2          for(int i=0;i<m1.length;i++)          {              //j=0,1              //m2[0].length=3              for(int j=0;j<m2[0].length;j++)              {                  int sum=0;                  //sum=0,4,24,66                  for(int k=0;k<m2.length;k++)                  {                      //k=0                      //m2.length=3                      sum=sum+ m1[i][k]\*m2[k][j] ;                  }                  m3[i][j]=sum;              }          }          return m3;      }  }  **Output:**  Resultant matix will be 2 X 3  Enter Elements into 2 X 3 matrix  Enter Element at arr[0][0] matrix: 1  Enter Element at arr[0][1] matrix: 2  Enter Element at arr[0][2] matrix: 3  Enter Element at arr[1][0] matrix: 4  Enter Element at arr[1][1] matrix: 5  Enter Element at arr[1][2] matrix: 6  Enter Elements into 3 X 3 matrix  Enter Element at arr[0][0] matrix: 7  Enter Element at arr[0][1] matrix: 8  Enter Element at arr[0][2] matrix: 9  Enter Element at arr[1][0] matrix: 1  Enter Element at arr[1][1] matrix: 2  Enter Element at arr[1][2] matrix: 3  Enter Element at arr[2][0] matrix: 4  Enter Element at arr[2][1] matrix: 5  Enter Element at arr[2][2] matrix: 6  Resultant matrix  21 27 33  57 72 87 |

* 1. Command line arguments
  2. Reading data from a file by using Scanner class methods