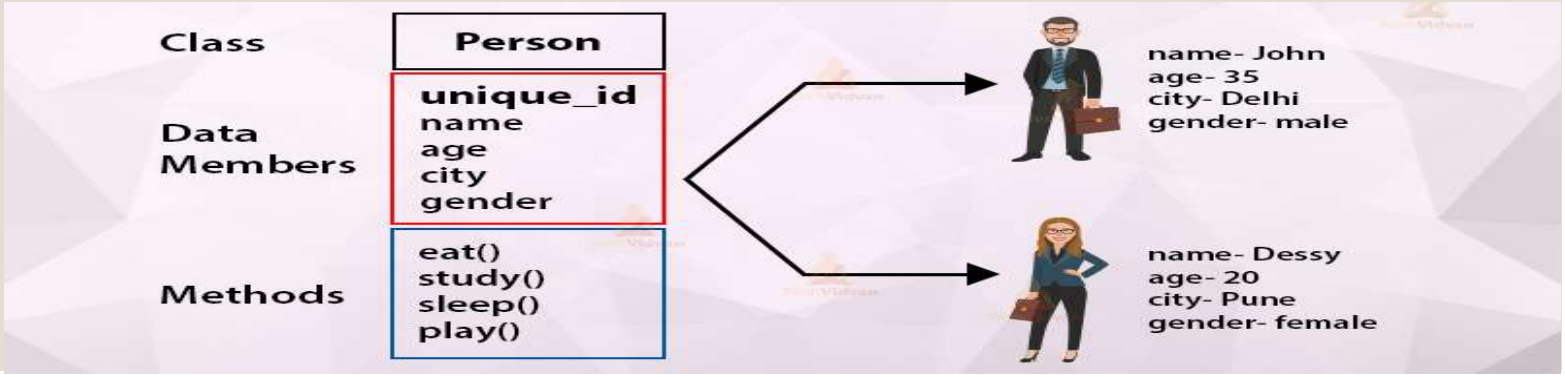
OBJECT ORIENTED PROGRAMMING

JAVA

Object Oriented Programming Concepts

- Aim of object-oriented programming is to **implement real-world entities.**
- A paradigm to design a program using **classes and objects**.
- **Object** means a real-world entity, for example, chair, table, pen, computer, watch, etc.
- **Class** means ***Collection of objects***. It is a logical entity.
- A blueprint from which you can create an individual object. It doesn't consume any space.



What is Java?

- Java is a general-purpose **object oriented programming language** and a platform.

- Java is a high level, robust, secured and object-oriented programming language.

- Works on **WORA(Write Once Run Anywhere) model**.

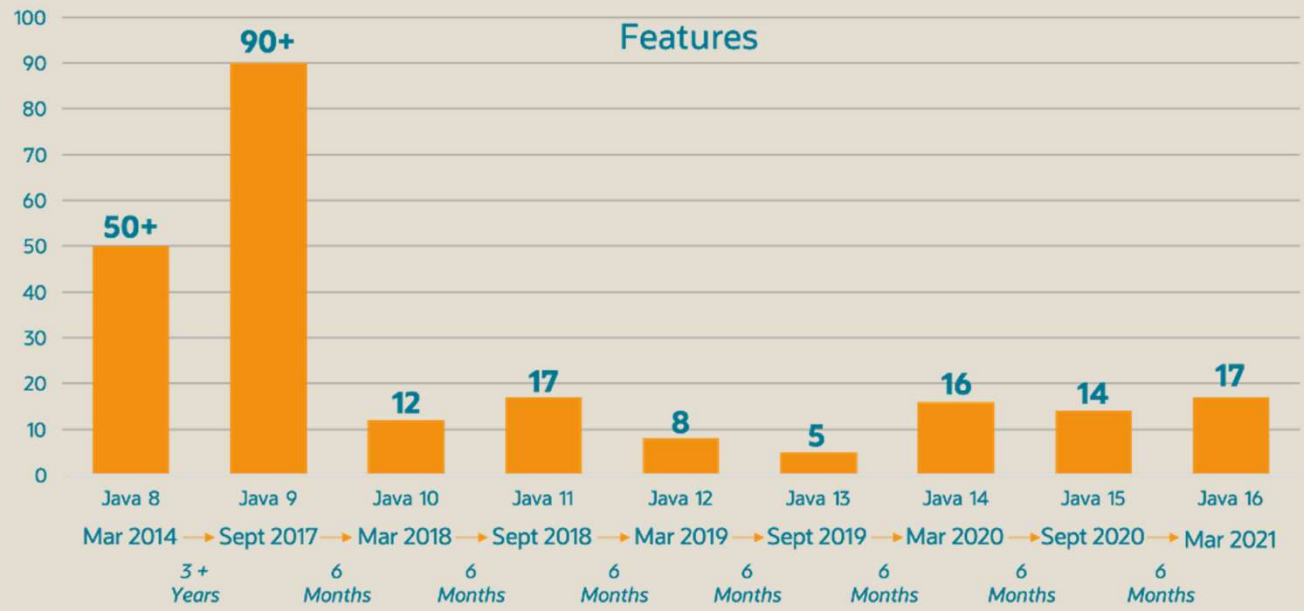
What is a platform?

- Any hardware or software environment in which a program runs, is known as a **platform**.

- Since Java has is own **runtime environment** (JRE) and API, it is called platform.

History of Java

- **James Gosling** - Sun Microsystems
- Oak - Java, May 20, 1995, Sun World
- JDK Evolutions



Significance of Java

- Two reasons :
  - Trouble with C/C++ language is that they are not portable and are not platform independent languages.
  - Emergence of World Wide Web, which demanded portable programs

- Portability and security necessitated the invention of Java

Where it is used?

- According to Sun, 3 billion devices run java.
- There are many devices where java is currently used. Some of them are as follows:
    - Desktop Applications
    - Web Applications
    - Enterprise Applications
    - Mobiles
    - Embedded Systems
    - Smart Card
    - Robotics
    - Games

Java Editions

- **Java platform** is a collection of programs that help to develop and run programs written in the Java programming language.

1) **Java SE (Java Standard Edition)**

2) **Java EE (Java Enterprise Edition)**

3) **Java ME (Java Micro Edition)**

4) **JavaFX**

Java Installation

- Please go to the link https://www.oracle.com/in/java/technologies/javase/jdk14-archive-downloads.html
- Download JDK as per OS, you are using (Linux/Mac/Windows)
- Then, follow the JDK Installation Instructions for Windows/Mac/Linux from below link

https://docs.oracle.com/javase/9/install/installation-jdk-and-jre-microsoft-windows-platforms.htm#JSJIG-GUID-DAF345BA-B3E7-4CF2-B87A-B6662D691840

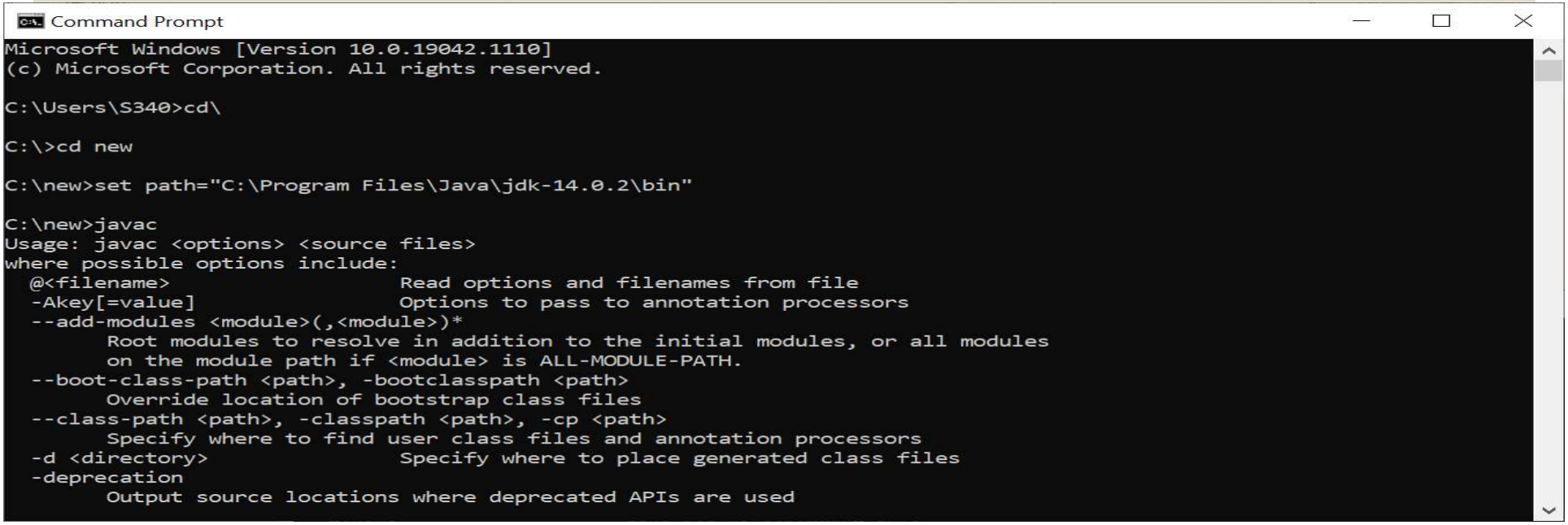
- Once installation is done need to set path, which is mentioned in next slide.

Setting the path environment variable

There are two ways for setting the path:

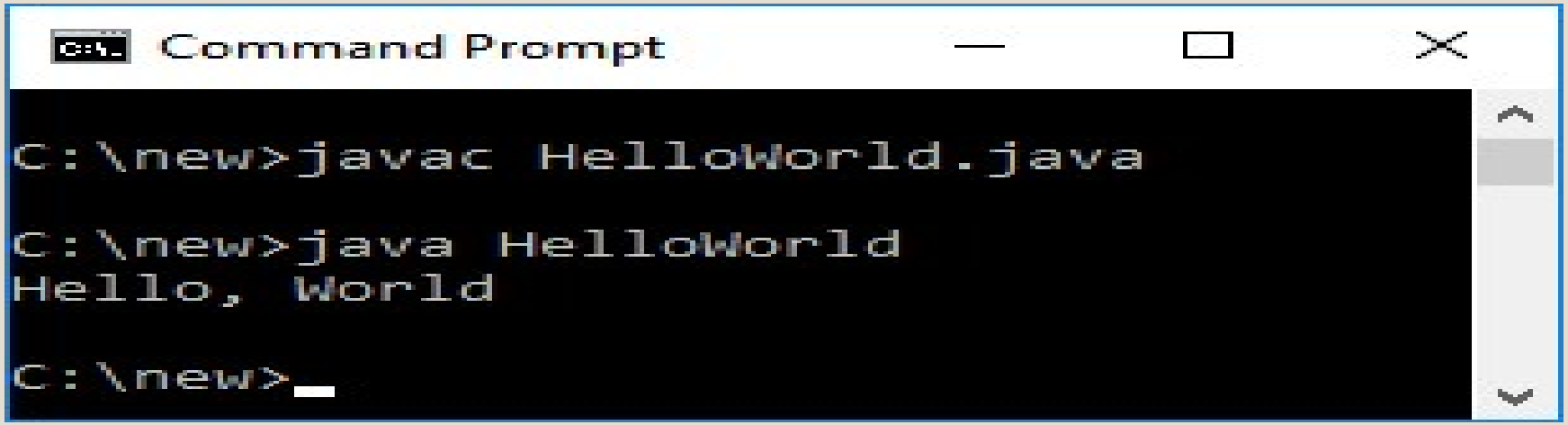
1. Path can be set via the Command Prompt(To set Temporary Path)

- Open the command prompt
- Copy the path of the JDK/bin directory
- Write in command prompt: set path=javabin_path



Setting the path environment variable

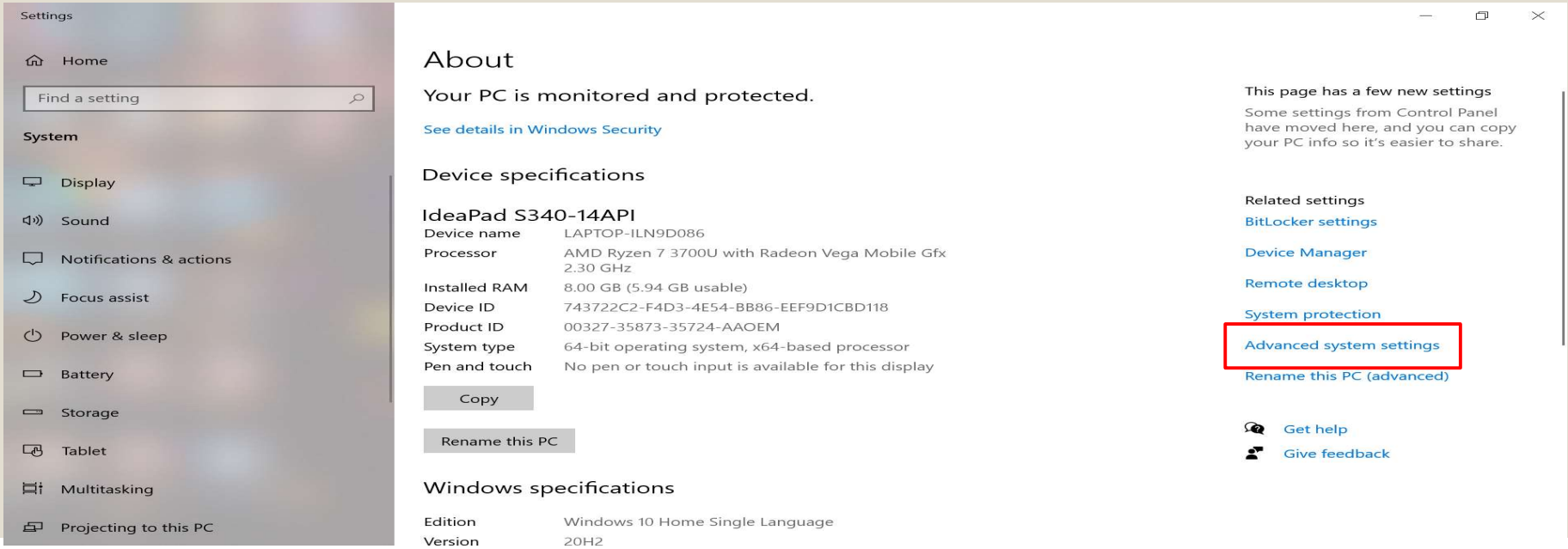
Path can be set via the Command Prompt (Contd.)



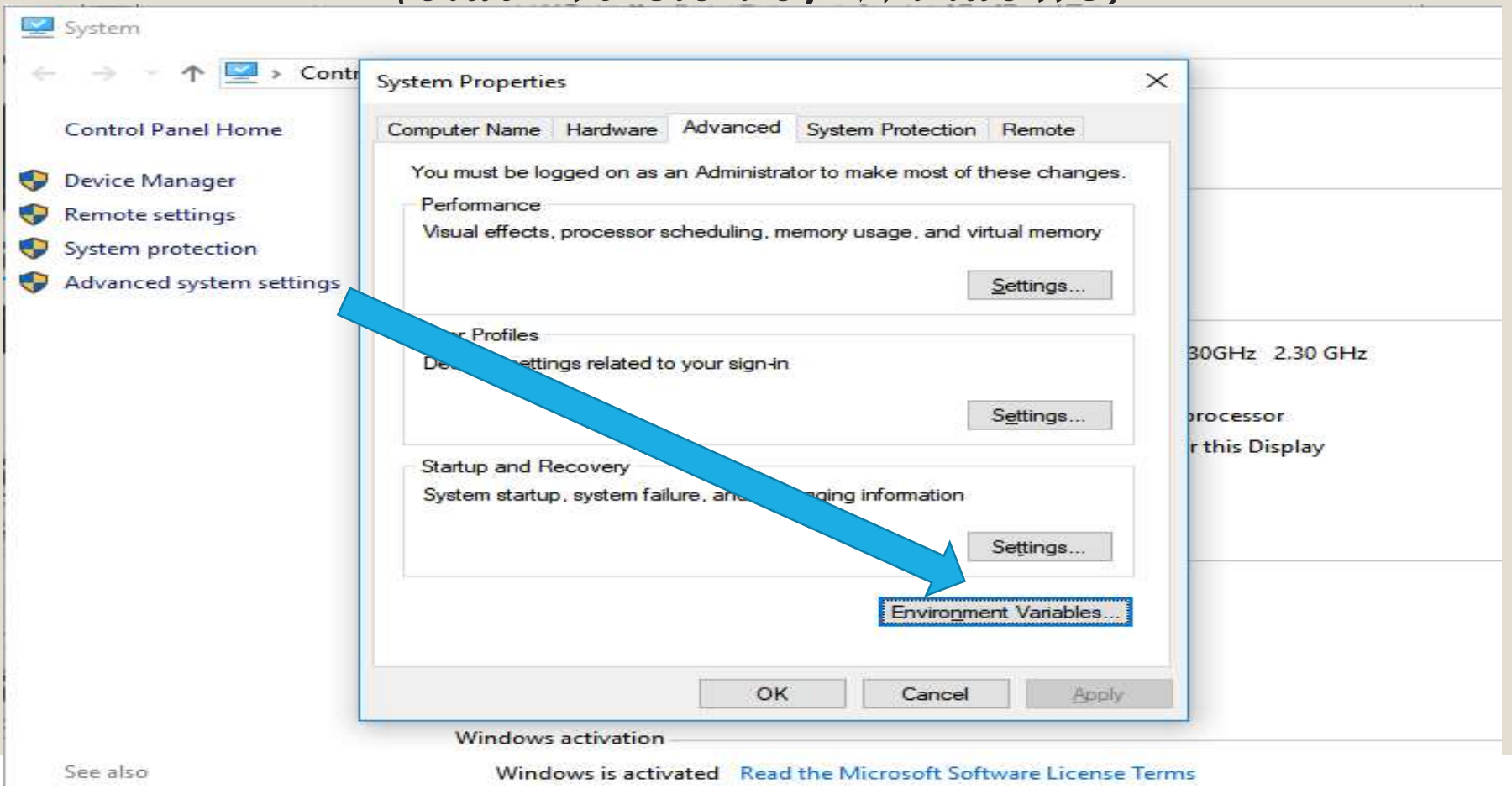
Setting the path environment variable

Path can be set via the Control Panel (To set Permanent Path)

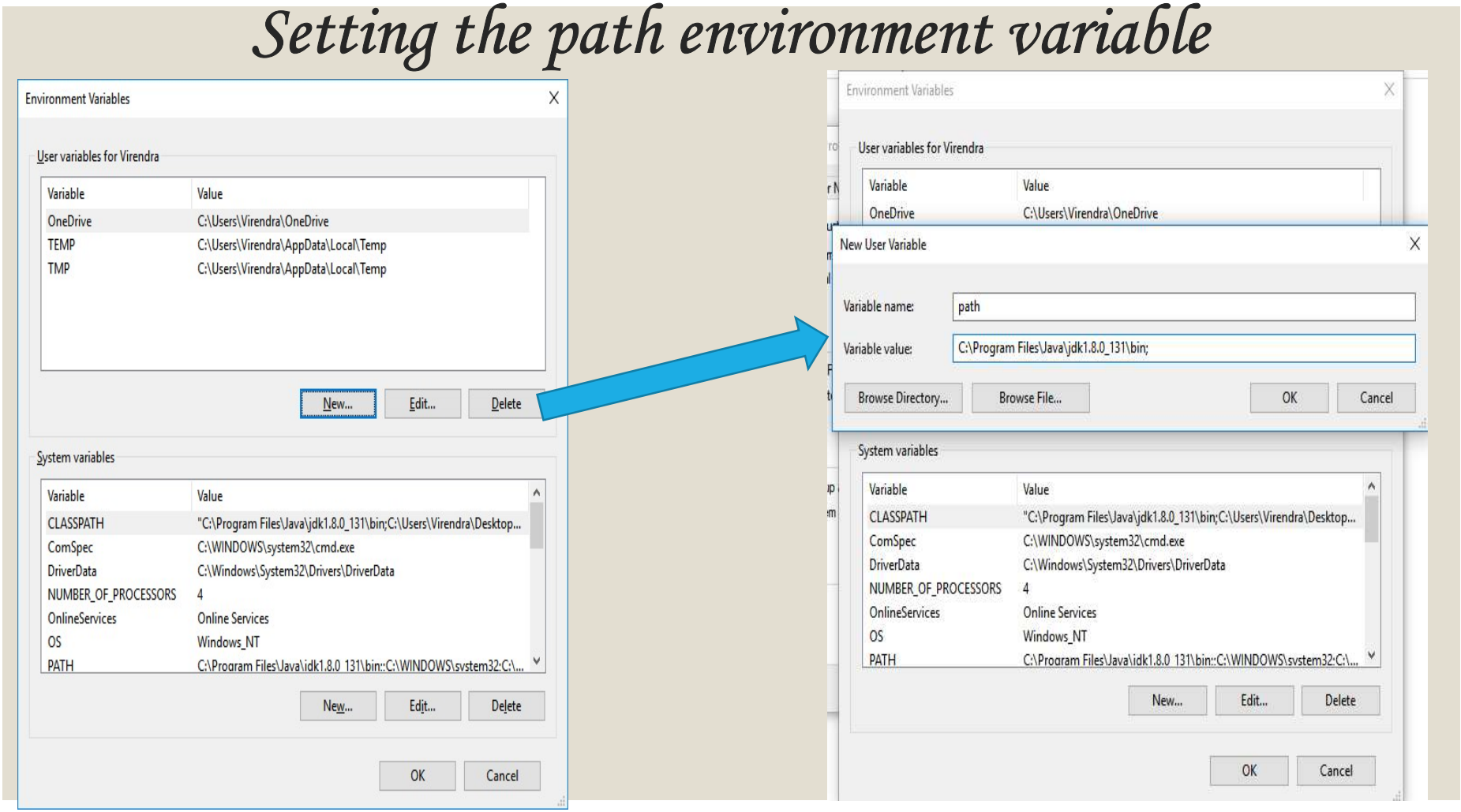
Go to My Computer properties -> Right hand side check ‘Advanced System Settings’ -> environment variables -> new tab of user variable -> write the path in variable name -> write path of bin folder in variable value -> ok -> ok -> ok



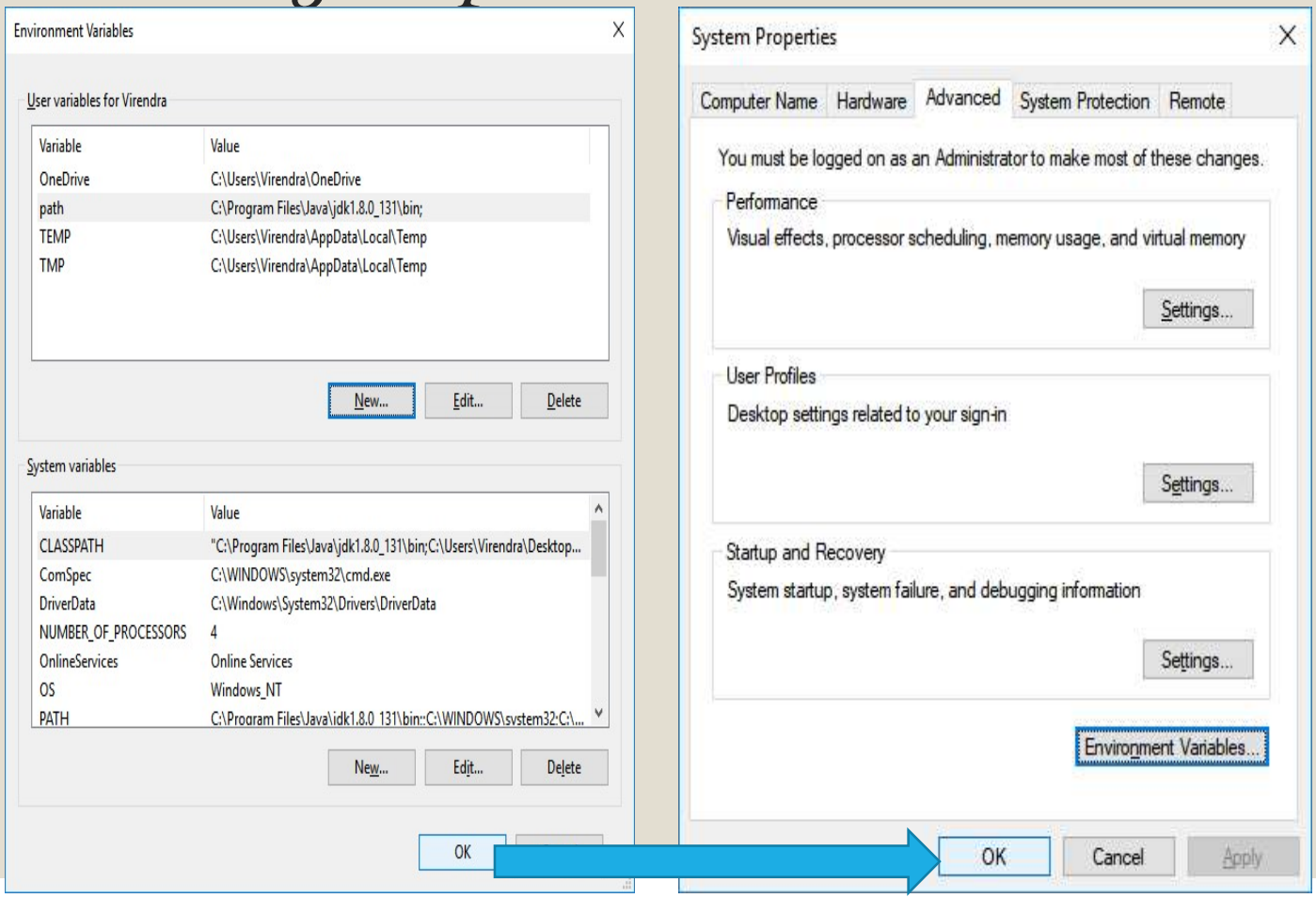
Setting the path environment variable (older version of Windows)



Setting the path environment variable

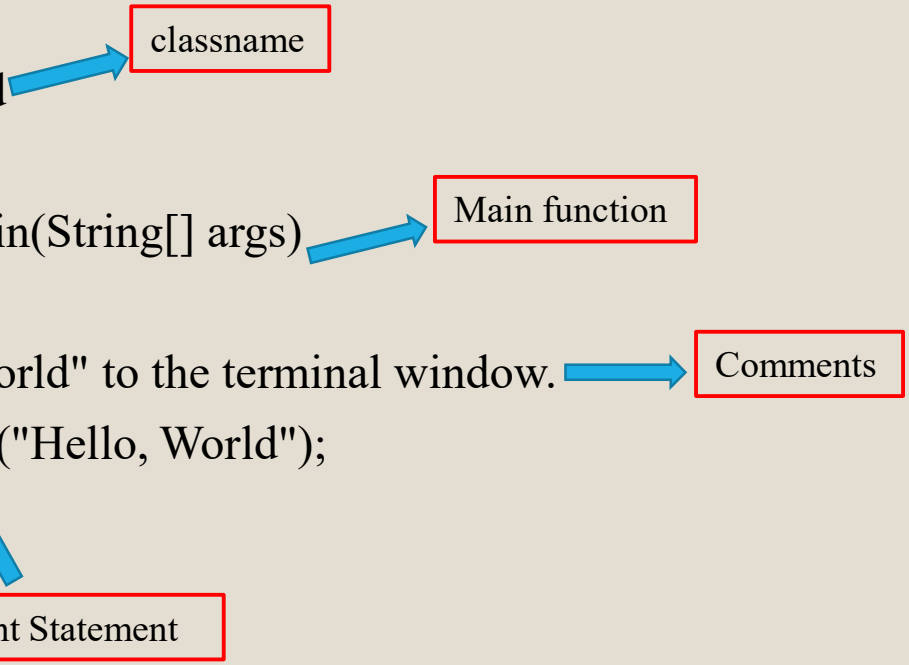


Setting the path environment variable

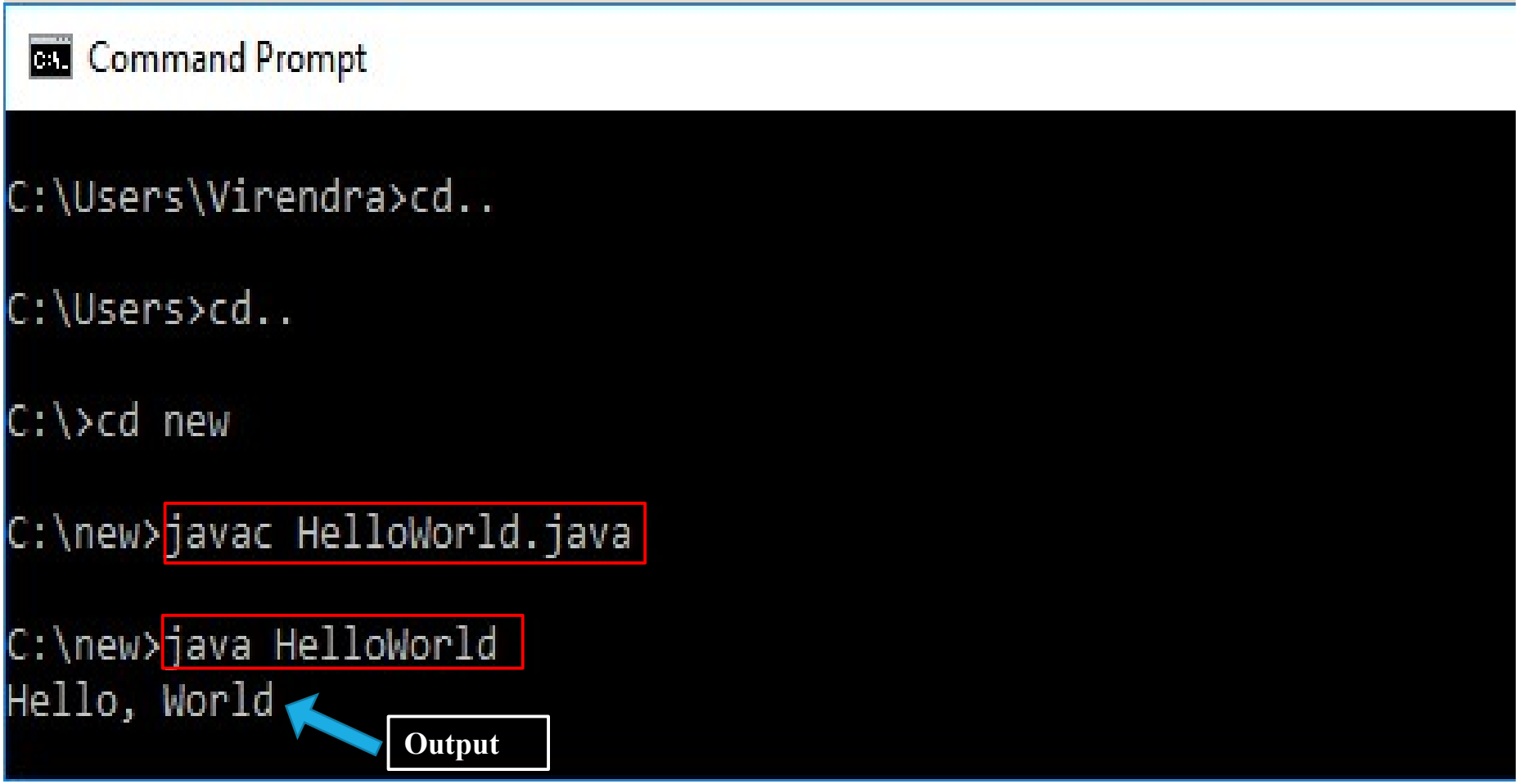


Java Program (HelloWorld.java)

```
import java.io.*;
public class HelloWorld
{
    public static void main(String[] args)
    {
        // Prints "Hello, World" to the terminal window.
        System.out.println("Hello, World");
    }

}
```



Setting the path environment variable

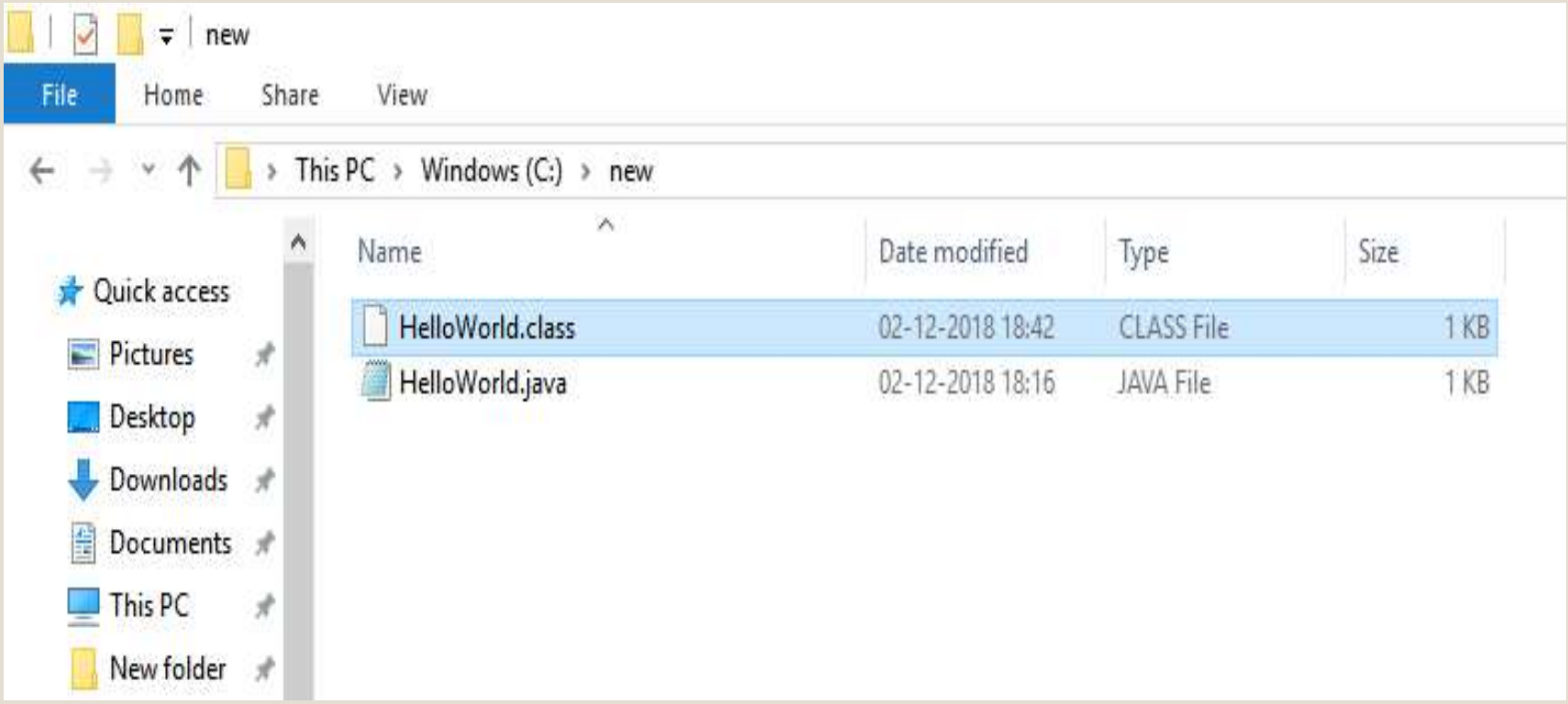


Compiling and Interpreting Java Program

```
C:\Users\Virendra>cd\

C:\>cd new

C:\new>set path="C:\Program Files\Java\jdk1.8.0_131\bin"

C:\new>javac
Usage: javac <options> <source files>
where possible options include:
  -g                         Generate all debugging info
  -g:none                    Generate no debugging info
  -g:{lines,vars,source}     Generate only some debugging info
  -nowarn                    Generate no warnings
  -verbose                   Output messages about what the compiler is doing
  -deprecation               Output source locations where deprecated APIs are used
  -classpath <path>          Specify where to find user class files and annotation processors
  -cp <path>                 Specify where to find user class files and annotation processors
  -sourcepath <path>         Specify where to find input source files
```

```
C:\new>javac HelloWorld.java

C:\new>java HelloWorld
Hello, World
```

Compiling and Interpreting Java Program



Assignment: Practical No. 01

Aim: Ankit and his friends went out for a Pizza party. Ankit's friend asks him to cover the entire area of the Pizza with chilli flakes to have a strong hot taste. Compute the area and perimeter of Pizza using java program and print statement, where the diameter of Pizza is 20 cm.

Exercises

System.out.println(1+0+1+“ Hello”);

Output: 2 Hello

System.out.println(“Hello ”+1+0+1);

Output: Hello 101

System.out.println(“Hello ”+(1+0+1));

Output: Hello 2

Syntax & Examples

- datatype variable_name=value;
- **Examples:**

int num1=10, num2=1;

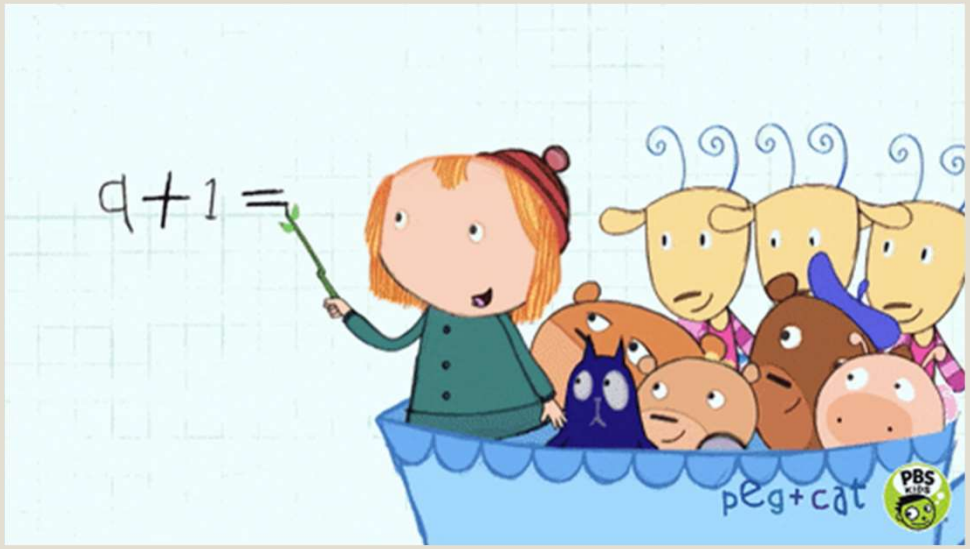
float z=6.2123;

double ax=2.33;

String name=“OOP”;

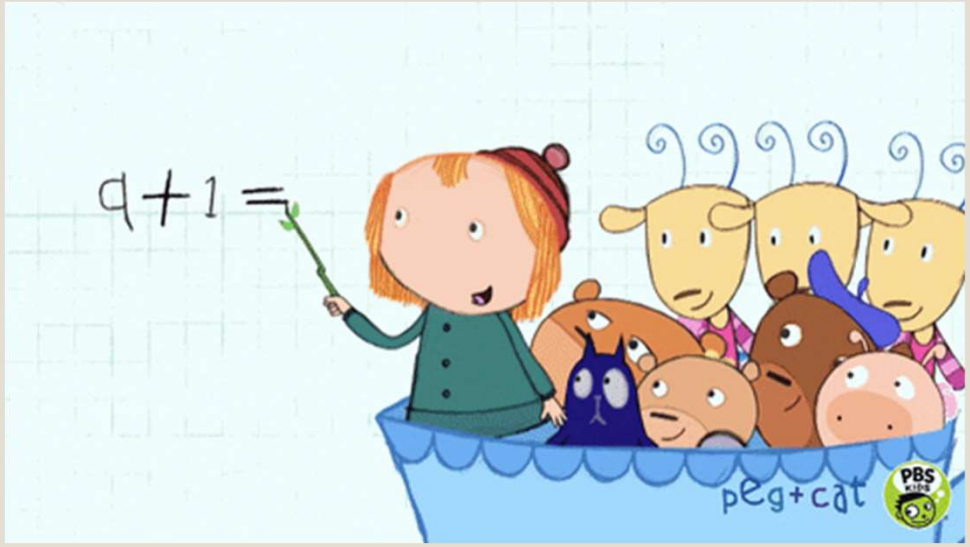
Practice

Aim: Aahana had her Mathematics subject final examination. Her teacher instructed the students to solve the equation using the formula: **3.0 * (1 + (4.0/4) + (2.0*5))**through a java program, and print the output.



Assignment: Practical No. 02

Aim: Aahana had her Mathematics subject final examination. Her teacher instructed the students to solve the equation using the formula: **2.0 * (1 - (3.0/3) + (1.0/5) - (2.0/14) + (1.0/12) - (2.0/22))** through a java program, and print the output.



return statement

- To return a value from function, we use the keyword **return.**
- We can return a direct console value of variable value. But, a function can return only one value.
- **return statement should be the last statement of a function, because it also returns the controls back to the calling function.**
- The datatype of returned value will be the return-type of that function.
- If a function does not return anything, then return-type will be void.
- **Syntax:**

  return value/variable_name;

Example:

return z;

return 12;

Functions

Syntax to create a function:

```
return-type function_name
{
  //block of code
}
```

Example 1:

```
void getData()
{
 System.out.println("Hi");
}
```

Example 2:

```
int getData()
{
  int x=11;
  return x;
}
```

Example 3:

```
double passInfo()
{
    return 11.22;
}
```

Assignment: Practical No. 03

Aim: Aditya went to a supermarket to purchase 12 pens worth Rs. 144 and a set of 6 books costing Rs. 120. Compute the total cost incurred by Aditya in purchasing the stationary items, that is, the total invoice to be generated by the shopkeeper through java program implementation.

NetBeans Installation

Practice

Aim: Ojaswitaa's company assigned her to develop a module in a number validation system. The client instructed her to design the module which will verify whether a number entered is positive or negative using a Java program implementation.

Practice Solution

```
public class PosNegNum
{
   public static void main(String[] args)
   {
     int x=10;
     if(x>0)
     {
        System.out.println(x+" is positive");
     }
     else if(x<0)
     {
        System.out.println(x+" is negative");
     }
     else
     {
        System.out.println(x+" is zero");
     }
   }

}
```

Practice Alternate Solution using Objects

```
public class PosNegNum
{
   void verify()
   {
     int x=10;
     if(x>0)
     {
        System.out.println(x+" is positive");
     }
     else if(x<0)
     {
        System.out.println(x+" is negative");
     }
     else
     {
        System.out.println(x+" is zero");
     }
   public static void main(String[] args)
   {
      PosNegNum p=new PosNegNum();
      p.verify();
    }

}
```

User Input on a Console

- One really useful class that handles input from a user is called the **Scanner** class. The Scanner class can be found in the **java.util** library. To use the Scanner class, you need to reference it in your code:

  import **java.util.Scanner;**

- The next thing you need to do is to **create an object from the Scanner class.** To create a new Scanner object the code is this:

  Scanner a = new Scanner(System.in);

Here Scanner is the class name, a is the name of the object, new keyword is used to allocate the memory and System.in is the input stream.

User Input on a Console

- To **get the user input**, you can call into action one of the many methods available to your new Scanner object. One of these methods is called next(). This gets the next string of text that a user types on the keyboard:

```
String stream_name;
Scanner course_input=new Scanner(System.in);
stream_name = course_input.next( );
```

- Following methods of Scanner class are used in the program:
  - **next() or nextLine() to input a string**
  - **nextInt() to input an integer**
  - **nextFloat() to input a float**

Practice Alternate Solution using Objects

```
import java.util.*;
public class PosNegNum
{
   void verify()
   {
    Scanner sc=new Scanner(System.in);
    int x=sc.nextInt();
    if(x>0)
    {
       System.out.println(x+" is positive");
    }
    else if(x<0)
    {
       System.out.println(x+" is negative");
    }
    else
    {
       System.out.println(x+" is zero");
    }
}
   public static void main(String[] args)
   {
      PosNegNum p=new PosNegNum();
      p.verify();
   }

}
```

Assignment: Practical No. 04

Aim: Rajan is designing a car rental website which requires the customer to log in to the website for renting a car using a java program to input the login details such as username, password and print the message as ‘Welcome Username’ or ‘Failed to login!! Please try again’ depending on successful or failure in login.

Assignment: Practical No. 05

Aim: A company received a project to develop an employee management system. Neha was assigned to develop a module of taking the user input of employee details such as name, age and salary. Design a program to accept input type in string, integer and double datatype respectively and display the details of the employee.

Assignment: Practical No. 06

Aim: A bank management system is being developed which requires taking input of the customer id, customer name of a specific bank. Consider the bank name and account balance as a static variable through Java implementation and display the values.

Practice

Program 1:

Aim: A college university wants to generate a marksheet designing system using java where the enrollment id, name of the student, three subject marks should be taken as input and displayed along with the average of the three subjects.

Program 2:

Aim: A mathematical application is to be developed for a student training program with inbuilt calculator system. Design a calculator application using java using classes and objects.

Practice: Polymorphism

Aim: Riya created a calculator to support addition of 2 numbers, 3 numbers and 4 numbers using java program through method overloading.

Assignment: Practical No. 07

Aim: Ravi and his friends are playing a multiplayer game which requires each player to compute the area of a shape that is displayed in real time. Thus, overload the function compute() to print the area of different shapes (square, rectangle, circle) using the concept of polymorphism.

Array

- An array is a **collection of similar type** of elements that have a contiguous memory location.
- Java **array is an object** which contains elements of a similar data type. It is a data structure where we store similar elements. We can store only a fixed set of elements in a Java array.
- Array in java **is index-based**, the first element of the array is stored at the 0 index.
- **Syntax:**

```
datatype array_name[]={value1,value2,….};                    //Array
```

Example:

```
int a[]={111,32,411,15};
```

Practice: Basic Array

Aim: Aashvika randomly inputs following values for sorting in two different variables: **11,33,22,44,88,77,99,66** and **Java, Python, PHP, C#, C Programming, C++**. Design a basic application to sort and display those values.

```
run:
Original numeric array : [11, 33, 22, 44, 88, 77, 99, 66]
Sorted numeric array : [11, 22, 33, 44, 66, 77, 88, 99]
Original string array : [Java, Python, PHP, C#, C Programming, C++]
Sorted string array : [C Programming, C#, C++, Java, PHP, Python]
```

Practice: Solution

```
package arraydata;
import java.util.*;
public class ArrayData
{
   public static void main(String[] args)
   {
     int[] num_array1 = {11,33,22,44,88,77,99,66};
   String[] var_array2 = {"Java", "Python", "PHP", "C#", "C Programming", "C++"};
   System.out.println("Original numeric array : "+Arrays.toString(num_array1));
   Arrays.sort(num_array1);
   System.out.println("Sorted numeric array : "+Arrays.toString(num_array1));
   System.out.println("Original string array : "+Arrays.toString(var_array2));
   Arrays.sort(var_array2);
   System.out.println("Sorted string array : "+Arrays.toString(var_array2));
   }
}
```

Assignment: Practical No. 08

Aim: Aashka is designing a module for an office management system which will help her colleagues reduce their work by detecting the duplicate values in their data. Design a java program to implement the concept of array and print duplicate values from two arrays, if any.

```
run:
Array1 : [1, 2, 5, 5, 8, 9, 7, 10]
Array2 : [1, 0, 6, 15, 6, 4, 7, 0]
Common elements is/are : 1  7  BUI
```

Practice: Solution

```
package arraydata;
import java.util.Arrays;
public class ArrayDuplicate
{
public static void main(String[] args)
{
      int[] array1 = {1, 2, 5, 5, 8, 9, 7, 10};
      int[] array2 = {1, 0, 6, 15, 6, 4, 7, 0};

       System.out.println("Array1 : "+Arrays.toString(array1));
       System.out.println("Array2 : "+Arrays.toString(array2));
       System.out.print("Common elements is/are : ");
```

```
for (int i = 0; i < array1.length; i++)
      {
         for (int j = 0; j < array2.length; j++)
         {
            if(array1[i] == (array2[j]))
            {
             System.out.print((array1[i])+"  ");
             }
         }
      }

   }
}
```

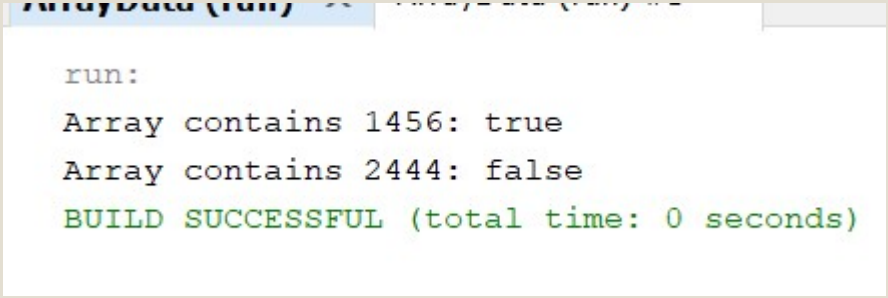
Practice: ArrayCopy

```
package arraydata;


import java.util.*;


public class Arraycopy
{
  int[] old_array = {25, 14, 56, 15, 36, 56, 77, 18, 29, 49};
  int[] new_array;
  void getD()
  {
     Arrays.sort(new_array);
      System.out.println("SourceArray                    :
"+Arrays.toString(old_array));
      new_array=new int[10];
```

```
for(int i=0; i < old_array.length; i++)
       {
            new_array[i] = old_array[i];
       }
      Arrays.sort(new_array);
      System.out.println("NewArray:
"+Arrays.toString(new_array));
  }
 public static void main(String[] args)
 {

  Arraycopy c;
  c=new Arraycopy();
  c.getD();

}

}
```

Assignment: Practice

Aim: Arjun was assigned a task to search for certain values in a worksheet. Owing to multiple values, it was difficult for him to search a data, develop a java program to help him implement the logic in java to search for an element in an array.



Assignment: Practice

```
package arraydata;

public class ArrayFindElement
{
  public static boolean contains(int[] arr, int item) {
      for (int n : arr)
      {
         if (item == n)
         {
            return true;
         }
      }
      return false;
   }
   public static void main(String[] args)
   {
         int[] arr = {1789, 2035, 1899, 1456, 2013, 1458, 2458, 1254, 1472, 2365, 1456, 2265, 1457, 2456};
         System.out.println("Array contains 1456: "+(contains(arr, 1456)));
         System.out.println("Array contains 2444: "+(contains(arr, 2444)));
   }
}
```

Assignment: Practical No. 09

Aim: Rehana has her mathematics assignment deadline today, where she is asked to compute the addition of following values [12,24,1,4] and [2,12,13,21]. Design a java program to help her complete the assignment through a java program implementation.

```
run:
Input number of rows of matrix
2
Input number of columns of matrix
2
Input elements of first matrix
12
24
1
4
Input the elements of second matrix2
12
13
21

Sum of the matrices:-
14      36
14      25
```