Java Fullstack

Course Agenda

* Core Java
* JDBC
* Javascript (ES new features)
* React.js
* Angular Framework
* Spring
* Spring Boot
* Spring Microservices
* DevOps and AWS

Core Java

Java is a platform independent programming language & it is object oriented as well.

Platform Independent: You can run java programs on any platforms without altering

Object Oriented: It allows you to create applications with real world entities which are called as objects, object will have 2 things mainly

1. properties (data/varaibles/fields)
2. behaviour (actions/functions/methods).

Software required

* JDK (Java Development Kit) - 1.8
* JRE (Java Runtime Environment) comes along with JDK
* Eclipse IDE (tools to develop java applications)

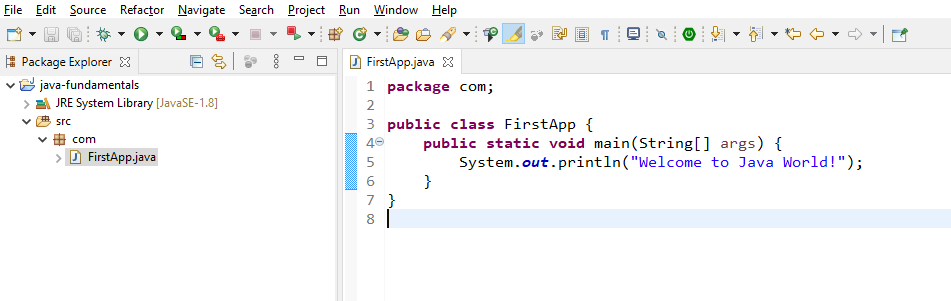
JRE: It is a runtime environment to run java applications, it will have JVM to execute byte codes

Building block of Object Oriented language

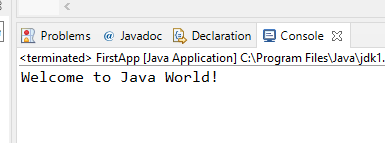
* Class: It is a template of an object, doesn’t take memory in the heap
* Object: It is a real world entity created from the class, takes memory in the heap

How to write our first java program

1. Use Eclipse & Create a java project, if in case you are in JavaEE perspective change it
2. Create a class & name it and also mention the package name
3. Create an entry point method i.e., main method
4. Run the main method.



Output:



Java Features

* Simple to understand, because most of the low level functionalities are abstract
* Object Oriented
* Platform Independent
* Architecture Neutral(x64, X86)
* Distributed applications
* Robust
* Secured
* Large Community
* Open Source

Fundamentals of Java

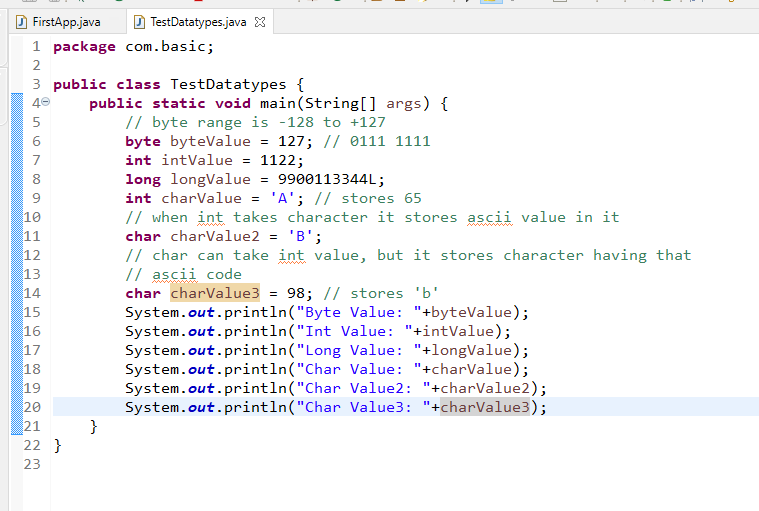
* Datatatypes
* Keywords
* Operators
* Conditional Statements
* Arrays
* Loops
* Variables
* Methods
* Classes
* Objects

Datatypes in Java

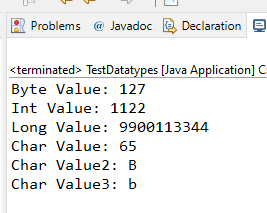
These are set of keywords used to create variables to store some value like numbers, characters, boolean, object and etc.

There are 2 types of datatypes in java

1. Primitive type: These are simple types whose size is defined
   1. byte = 1 byte
   2. short = 2 bytes
   3. int = 4 bytes
   4. long = 8 bytes
   5. float = 4 bytes
   6. double = 8 bytes
   7. char = 2 bytes
   8. boolean = 1 byte
2. Derived type: These are complex types that can store multiple values
   1. array
   2. class
   3. interface
   4. enum



Output:



Keywords in Java

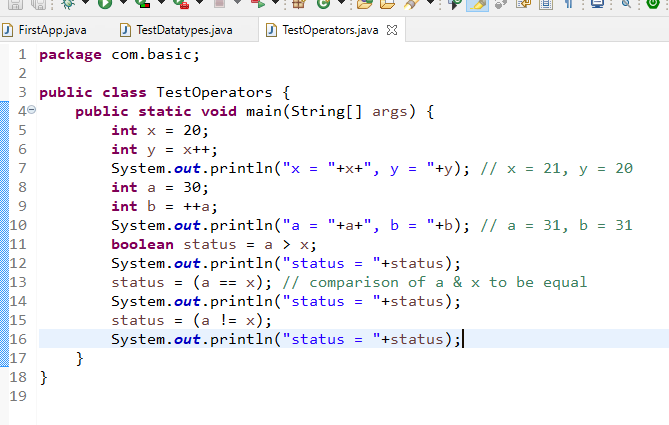
These are reserved words in Java, which must not be used to name the variables, methods or classes, they solve specific purpose

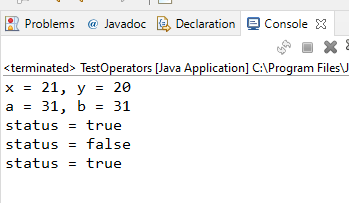
int, char, float, double, boolean, long, final, public, private, class, protected, static, void, return, if, for, do, while, switch, break, continue, abstract, interface, enum, extends, super, this and so on.

Operators in Java

+, -, \*, /, %, ++, --, =, ==, <, >, <=, >=, !=, &&, ||

TestOperators.java

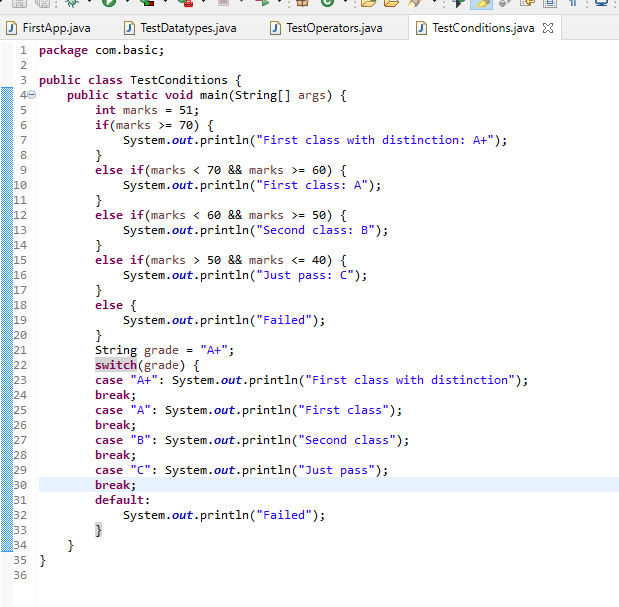




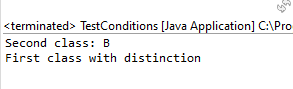
Conditional Statements

These are used when you want to execute the statements based on some conditions, we have following conditional statements

* if
* if else
* if else if .. else
* switch



Output:



Scanner class:

It is a predefined class present in java.util package, which is used to take input from the keyboard, you need to import this class using ‘import java.util.Scanner’

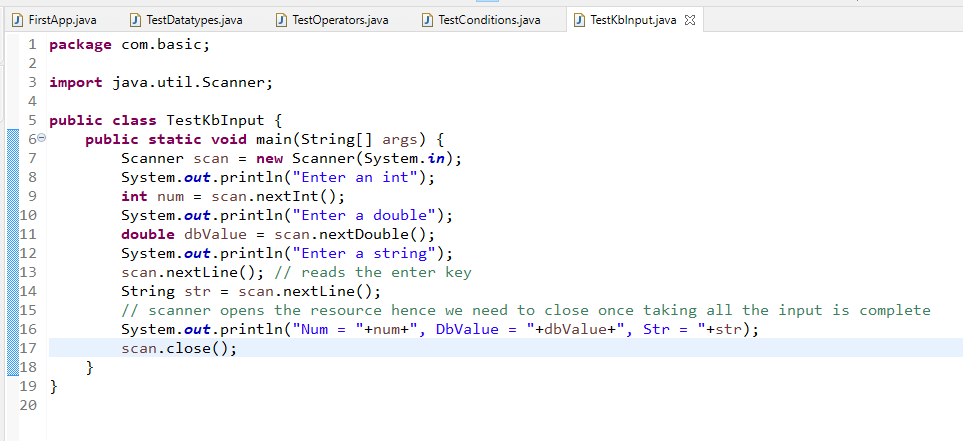
It defines lot of methods to accept different types of value like

nextInt(), nextLong(), next(), nextFloat(), nextDouble() and so on

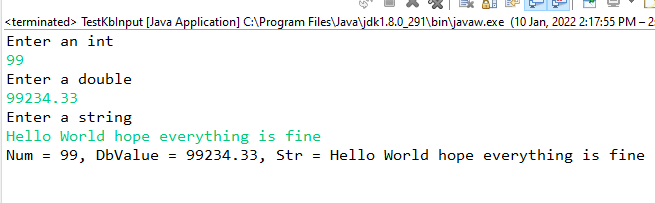
All the above methods you can call by creating scanner object

Scanner scan = new Scanner(System.in);

The above code creates object of scanner, System.in is a reference to the input stream i.e., keyboard



Output:



How to work with arrays

In Java you can create arrays using [], you can create arrays of simple types to complex types

Different ways of initializing array & their values

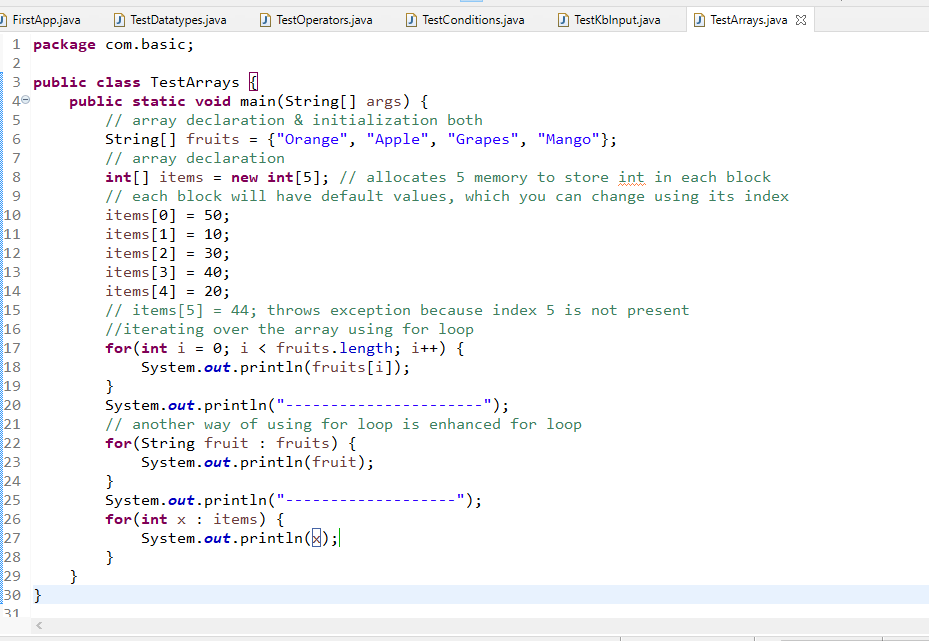
int[] items = {10, 20, 15, 35, 30}; // it is an integer array which is initialized

int[] items = new int[5]; // it is an integer array but not initialized the blocks

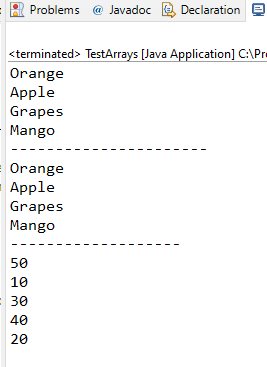
items[0] = 10; items[1] = 30, … items[4] = 50;

String[] fruits = {“Apple”, “Mango”, “Orange”}; // string array which is initialized

You can use loops to iterate over each items of the array i.e., for loop



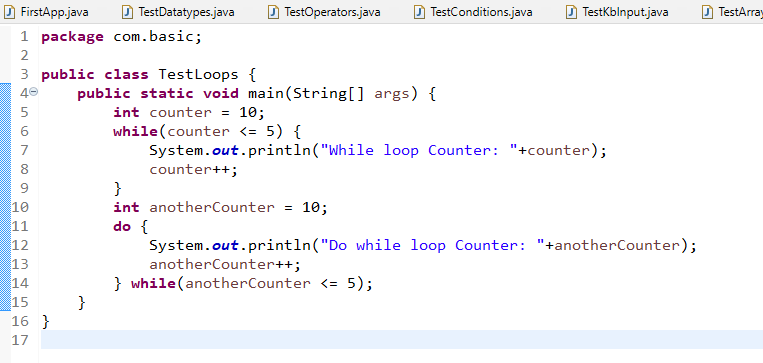
Output:



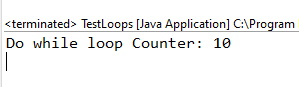
Loops in Java

We have 3 types of loops

1. for: When you want to iterate fixed number of times or you know how many times you want iterate
2. while: When you want to iterate until condition is true
3. do-while: When you want to iterate until condition is true, but in do while the statement is atleast executed once



Output:

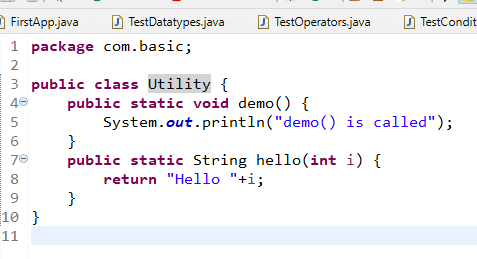


Methods in Java

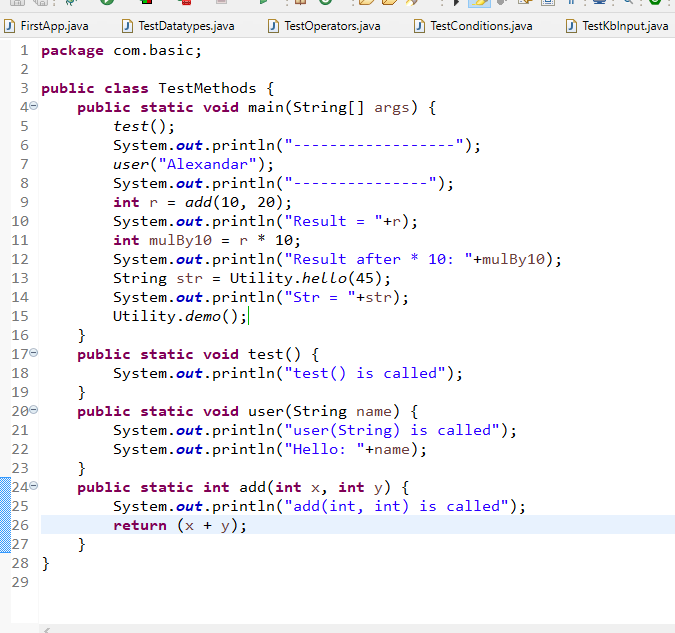
You can create methods in class in 2 ways

* Using static keyword: You can call this method without creating object
* Without static keyword: You can call this method by creating object

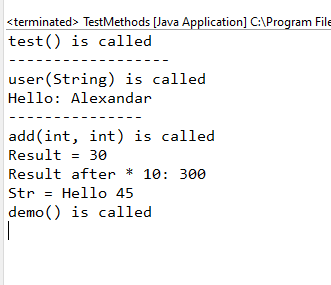
Utility.java



TestMethods.java



Output:



Activities

Create a Exercise folder & day1 sub-folder & keep all the day1 activities here, same way on 2nd day you will create day2 sub-folder and so on.

1. Try all the above examples
2. Create a method that accepts name as a parameter & returns a welcome message, call this method from the main method and display the welcome message

Ex: If you enter Raj the method should return Hello Raj, welcome to java

1. Create a method that accepts 3 numbers as parameters & returns the largest number among them

Ex: If you pass findLargest(3, 9, 1), then it must return 9

1. Create a method to accept 3 numbers & returns the sum of biggest & smallest number.

Ex: If you pass sum(9, 1, 3) then it must return (9 +1), if you pass sum(1, 2, 5) then it must return (5 + 1)

1. Create a method that accepts 3 numbers & prints their digits in words ex: If the input is 754 then the output should be “Seven Five Four”

Day 2 Agenda

* Method Overloading
* Classes & Objects
* OOPs concepts
* Static & Final Keywords
* String, Integer, Float, Double, Object

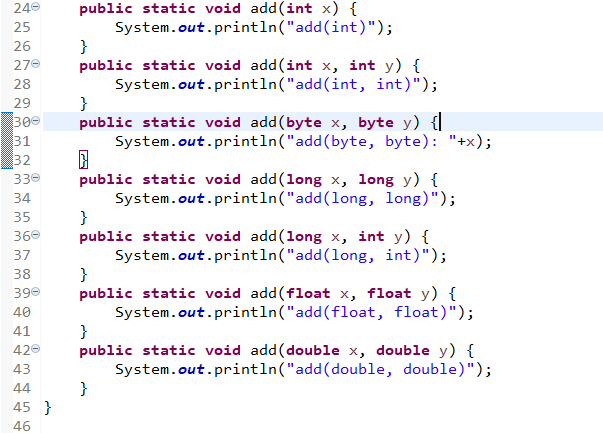
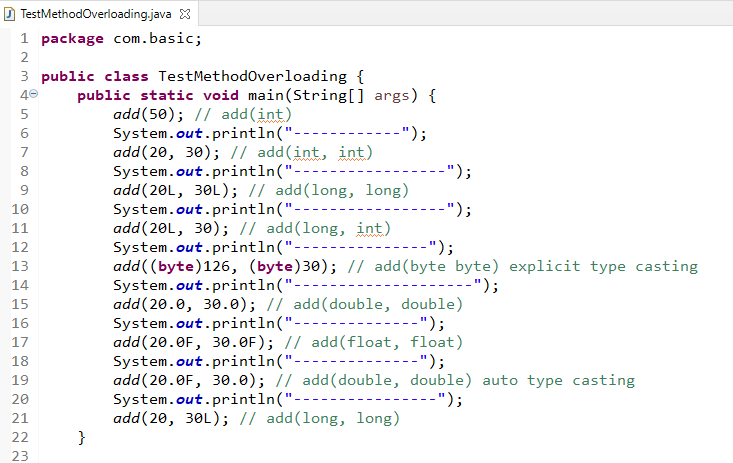
Method Overloading:

Multiple methods with the same name but different parameters or different signature, Compiler can identify which method needs to be called, hence it is also called as compile time polymorphism

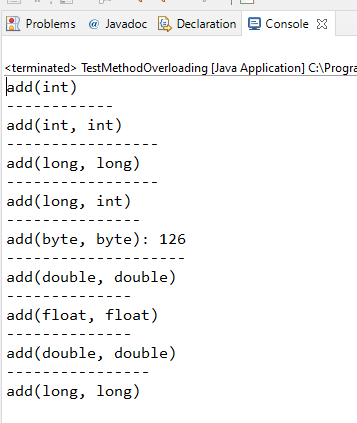
Polymorphism: Poly means many and morphism means forms, overloading is one of the type of polymorphism, there are 2 types of polymorphism

* Method overloading: Compile time polymorphism, methods are identified at compile time itself.
* Method overriding: Runtime polymorphism: Methods are identified at runtime.

TestMethodOverloading.java



Output:

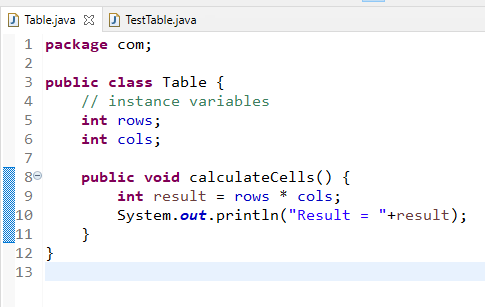


Classes & Objects

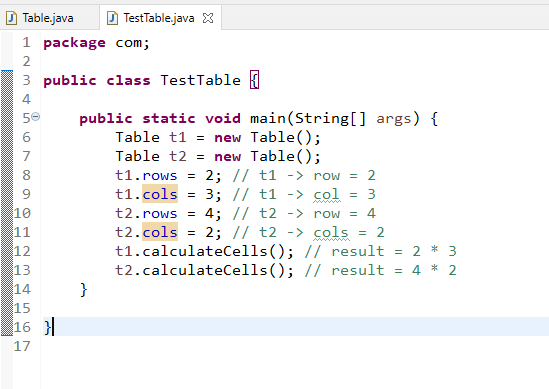
Class is a blueprint of an object, which describes the object

Object is an instance of the class.

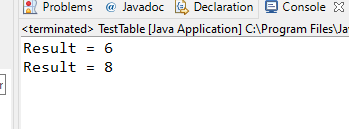
Table.java



TestTable.java



Output:



The above code is initializing the variables of each new object of Table, in a Table class we don’t have any constructor, but compiler creates a default constructor.

Constructor: It is a like a method but name will be same as class name & it should n’t have return types, In Java if you create a class *compiler automatically creates a default constructor if in case user has not created any constructor.*

For ex:

class Test {   
  
}

The compiler creates a default constructor as below

class Test {  
 Test() { …. } // default constructor  
}

Another ex:

class Demo {  
 Demo(int x) { … }  
}

Now the compiler retains the constructor user has provided

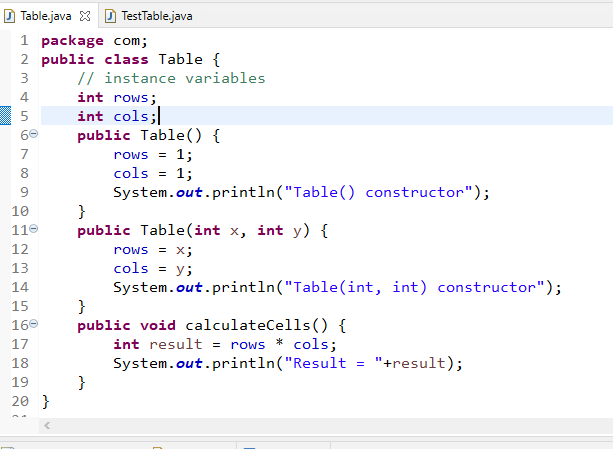
class Demo {  
 Demo(int x) { … }  
}

Another ex;

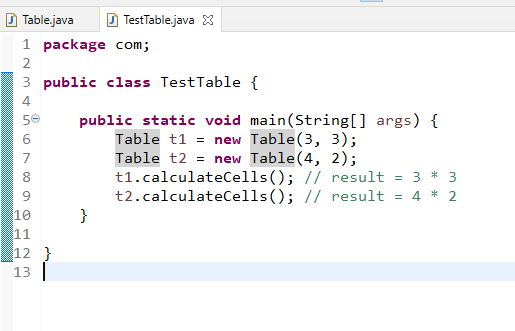
class Hello {  
 Hello() {..}  
 Hello(int x, int y) {…}  
}

Now the compiler retains both the constructors, it means you can also have multiple constructors which means constructor overloading.

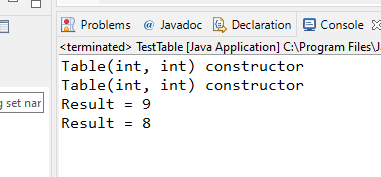
Table.java



TestTable.java



Output:

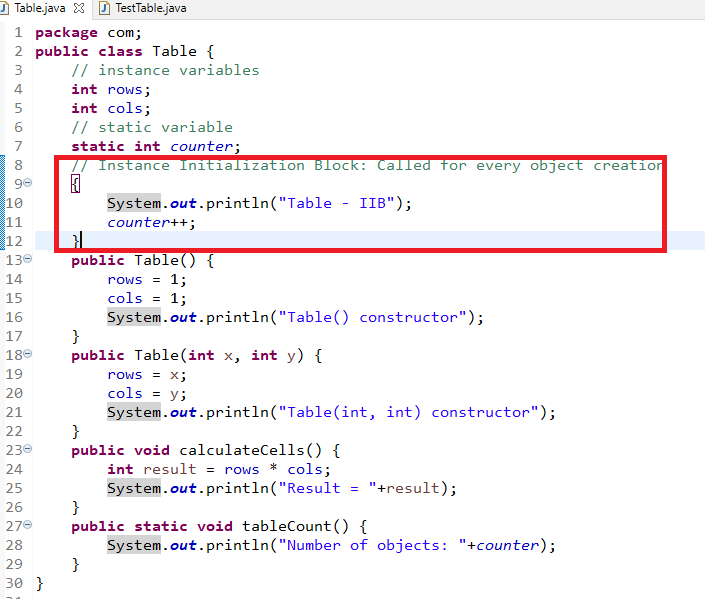


The above code uses parameterized constructor to initialize the instance variables, which also avoids lot of initialization statement at the caller side.

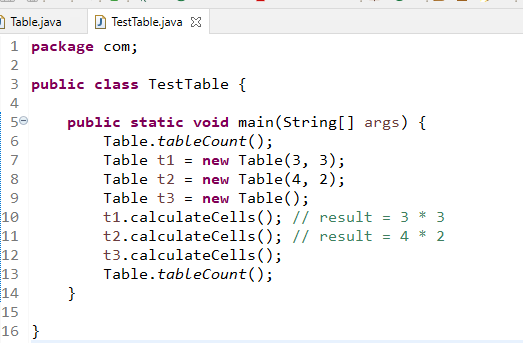
Instance Variables: These are the variables which are created for every object

Static Variables: These are the variables which are shared for all the objects, it will be a single copy created for all the objects of the class, you need to access static variables through class name though you can access it using reference variable, its recommended to access static variables or methods through class name, reason is compiler converts the reference type to class name

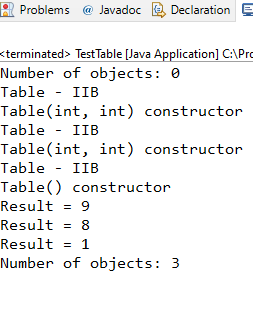
Table.java



TestTable.java



Output:



Features of OOPs

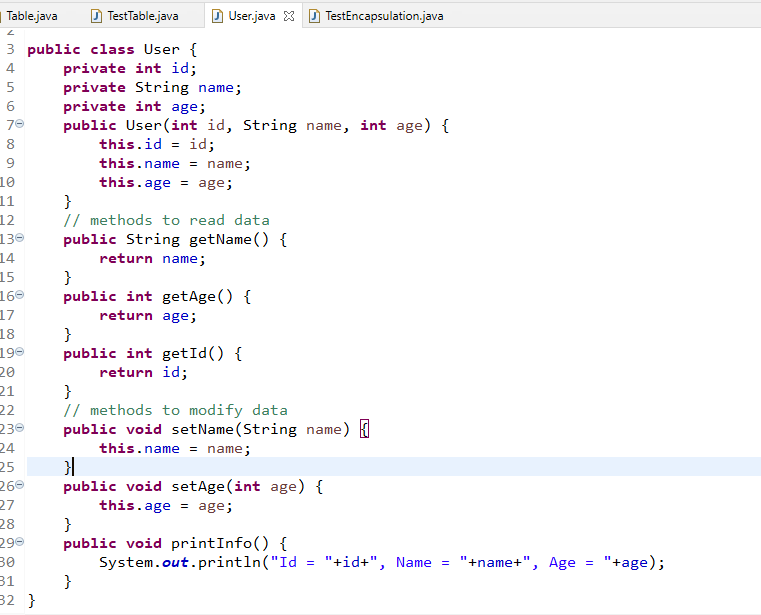
* Encapsulation
* Inheritance
* Polymorphism
* Abstraction

Encapsulation:

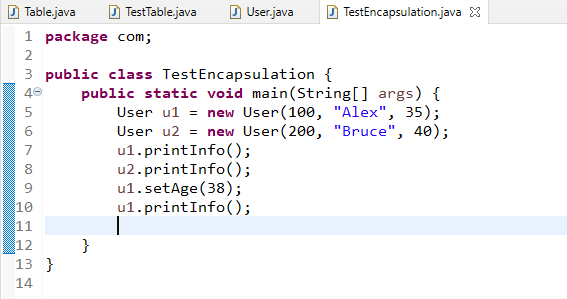
Binding the data & methods in a single entity, you will make data private so that it is accessible only within the class & you will have methods for each variables to read/write which are called getters & setters.

Through encapsulation you will have more control over the data, you can avoid invalid values and also avoid accessing the data if not required.

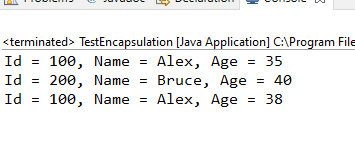
User.java



TestEncapsulation.java



Output:



In Eclipse you have an easier way to generate setters & getters as well as constructor also.

Right Click -> Source -> Generate Setters & Getters

Inheritance

When you want to acquire properties & behaviours of an object from another object you can use inheritance, in java you use extends keyword to achieve inheritance.

class A { }

class B extends A { }

Here A is a super class or parent class whereas B is subclass or child class

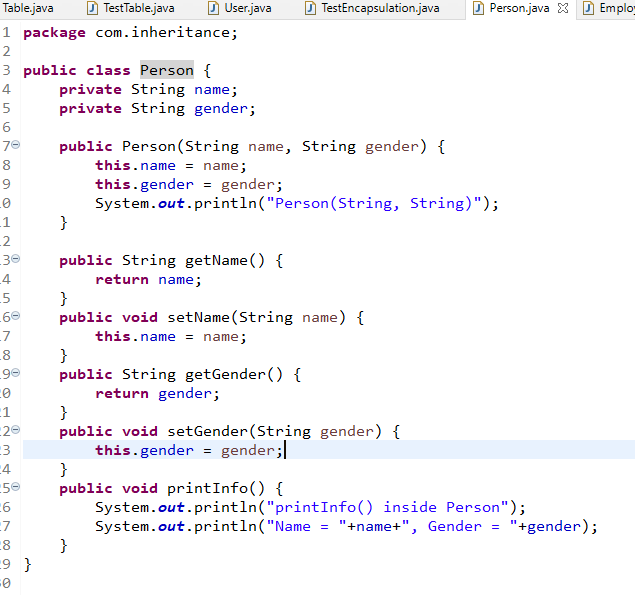
Note: Private members & Constructors wouldn’t be inherited

Note: You can use super keyword to access super class members & constructors

super.member // it accesses super class members from sub class

In Inheritance every constructor of the subclass calls the parent class default constructor from its first line implicitly, you can explicitly call the parameterized constructor of the parent class using super(args) on the first line of the subclass constructor

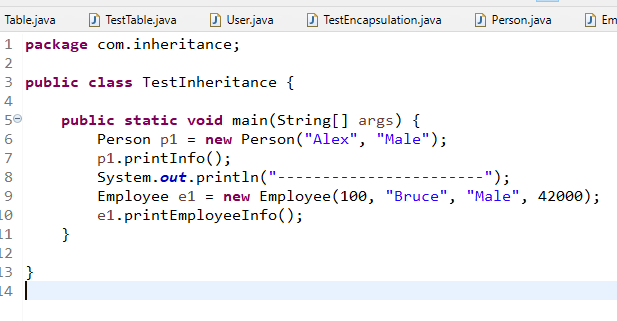
Person.java



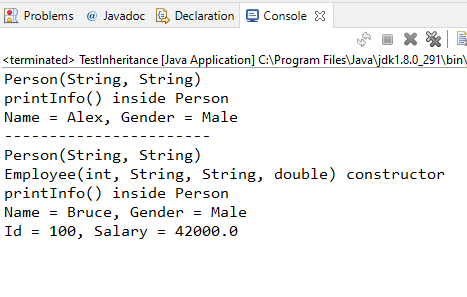
Employee.java



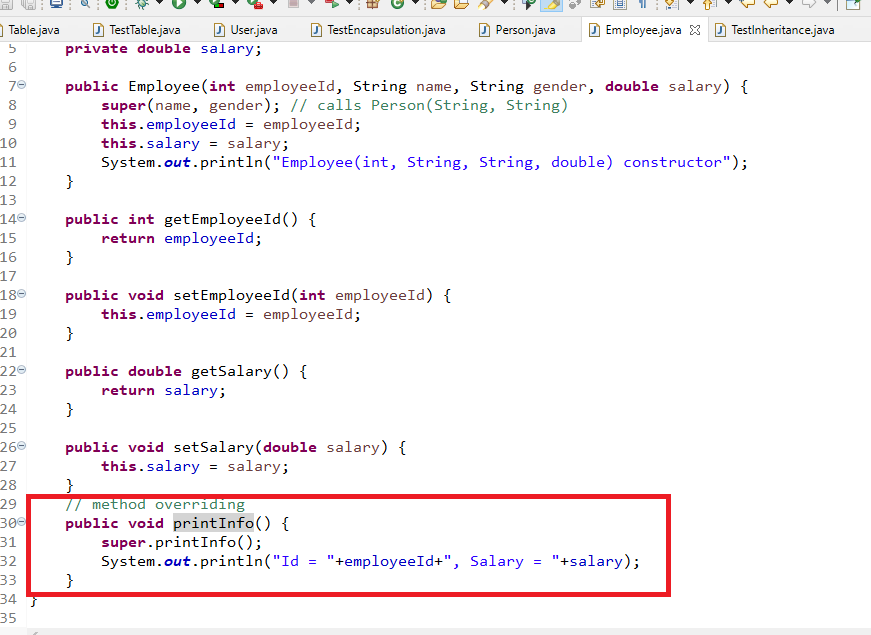
TestInheritance.java



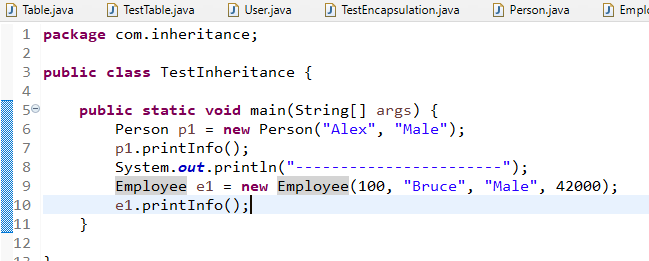
Output:



Instead of creating different methods in subclass to print the data you can override printInfo



Now if you call printInfo on employee object it calls the printInfo present in the Employee object.

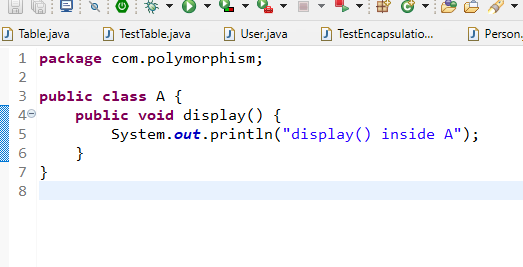


Polymorphism

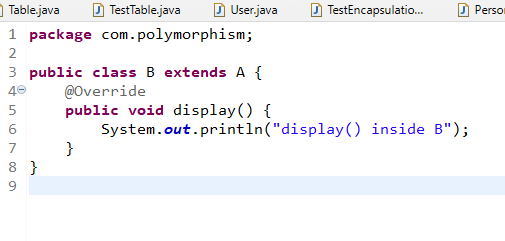
Ability of a method to give multiple results

ex: Single Power button acts like On and Off both, similarly single method can give different results based on the object you are using.

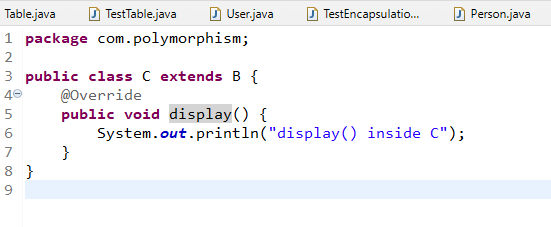
A.java



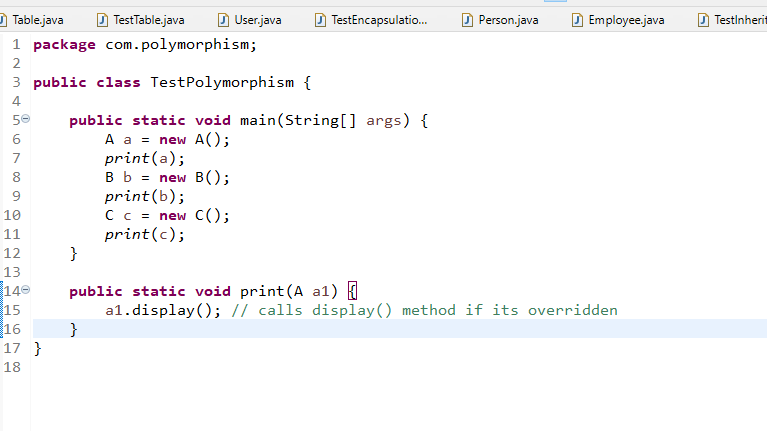
B.java



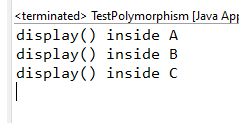
C.java



TestPolymorphism.java



Output:



Activity:

1. For the above inheritance & polymorphism example create display method in Person & override in Employee to print employee information
2. For the same example create a Student & Customer class that should extend Person,
   1. Student class must have rollNo & grade properties & Override display method to print rollNo, name, gender & grade
   2. Customer class must have customerId, accountNumber, balance & Override display method to print customerId, name, gender, accountNumber & balance
   3. From main method create Object of Student, Customer, Employee & Person and pass these objects to a single static print method that all the subclass of person like Customer, Employee, Student and Person also

ie., print(employeeObject), print(studentObject) and so on, it must call display method to print employee, student, customer informations.

1. Define a class Student with the following attributes

* studentId of type integer
* studentName of type String
* city of type String
* marks1 of type integer
* marks2 of type integer
* marks3 of type integer
* feePerMonth of type float
* isEligibleForScholarship of type boolean

Implement the following methods in addition to the setter and getter methods for the various attributes

* getAnualFee() which returns the product of feePerMonth and 12
* getTotalmarks() which returns the sum of marks1, marks2 and marks3
* getAverage() which returns the average of marks1, marks2 and marks3
* getResult() which returns “pass” if the person has scored more than 60 in each subject, or returns “fail” otherwise

Create another class TestMain with the main() method which performs the following actions

* Creates three Student objects
* Populates the objects using the setter methods
* Displays the name of the Student who has the highest total marks
* Prints the name and fee of the Student who pays the least monthly fee
* Prints the name, total marks , average marks , result, and “Scholarship available” or “Scholarship not available” based on the student’s eligibility for every student.

Abstraction

It is a process of hiding the complexity form the user and showing only the necessary details which the user can use without knowing the complexity.

In Java you can achieve abstraction in 2 ways

1. Interface: Fully abstraction
2. Abstract class: Partial abstraction

Interface: It is a kind of class where you will have only abstract methods and constants

abstract methods: These are methods without logics, it will have only method declaration

Interface methods needs to be implemented by classes using implements keyword

Ex:

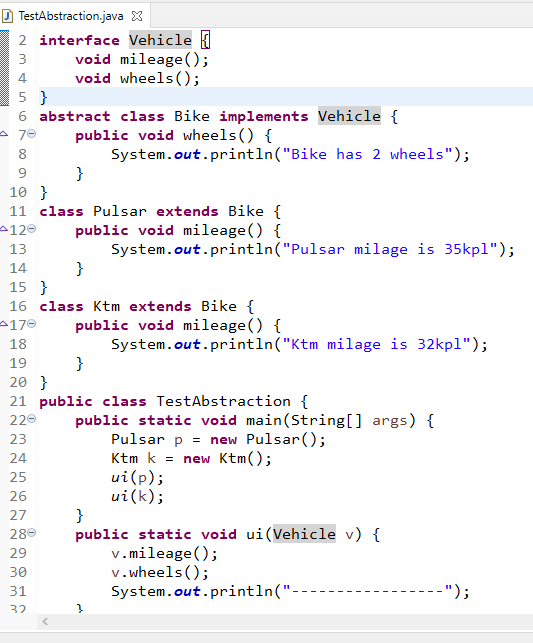
interface A {   
 int x = 10; // by default variables are final & static  
 void test1(); // by default methods are abstract  
 void test2(); // by default methods are abstract  
}

Note: All the members in the interface take public keyword

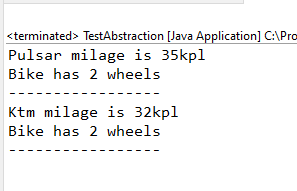
class X implements A {   
 // Now X must implement test1 & test2 mandatorily  
}

abstract class Y implements A {   
 test1() { …… }  
}

TestAbstraction.java



Output:



Activity:

Create an abstract class Car and implements wheels method of Vehicle, then create two classes that extends Car

* Swift >> implement milage
* Ferrari >> implement milage

Pass Switch & Ferrari object to the ui method that takes these objects and calls mileage() & wheels()

Predefined packages & classes & interfaces

In java there are lot of packages that you can import to use their classes, in that java.lang classes can be used without importing.

java.lang.\*: String, Object, StringBuffer, Integer, Long, Exception, ArithmeticException, RuntimeException, Thread, Comparable, Runnable, System

java.io.\*: FileInputStream, FileOutputStream, FileReader, FileWriter, BufferedReader, BufferedWriter, Serializable

java.util.\*: Collection, List, Set, Map, ArrayList, LinkedList, TreeMap, HashSet, LinkedHashMap, LinkedHashMap, Comparator and so on.

java.sql.\*: Connection, Statement, PreparedStatement, ResultSet and so on

All the above classes are public which has many methods that can be used to perform that task, every class will have constructors, methods

Every class has methods that can do the task particular to the class instance, ex: String class will have methods to work on strings,

Integer class has methods to work on int

Thread class has methods to work on threads

Exception class has methods to handle exceptions

FileReader class has methods to perform read operations

Object:

It is a root class for all the classes, by default every class is a subclass of Object

class A { }

class B extends A { }

Here A is the super class of B, but A is a subclass of Object, if a class doesn’t extend any class then by default they extend Object class.

Object class has some common methods that is available to every class, Since every object must have some common behaviours to act like an object, java by default extends Object class,

Some of the methods you can override in every class like

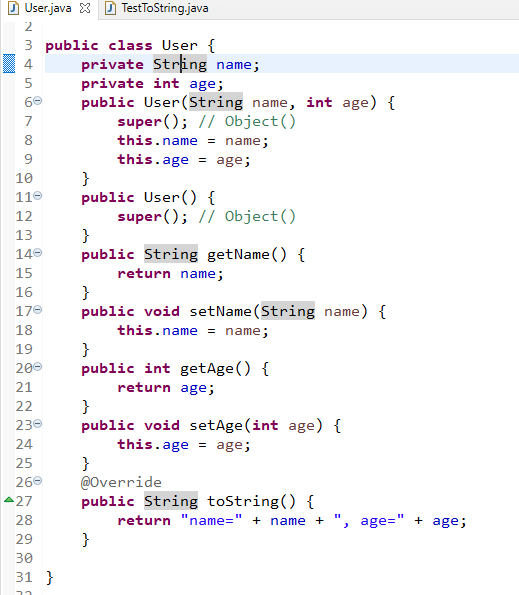
toString(): It returns object representation when you print the object, by default it returns memory address, but you can override to return specific properties

hashCode(): it returns an unique number for every object, it is mainly used in Collection framework, you can override hashCode() if you want to return some property value

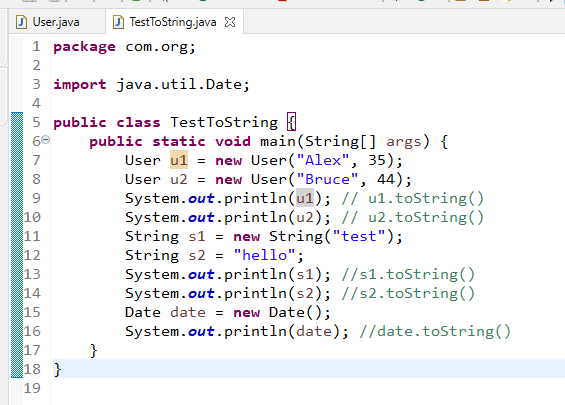
equals(): It returns true when 2 objects are same else it returns false, by default it compares 2 objects address, however you can override equals to compare specific properties or contents of 2 objects to check the equality, it is mainly useful in Collection framework.

Note: When any class overrides hashCode it must override equals also, and if you override equals you must override hashCode as well, i.e., the class must override both to follow certain equals & hashCode rules when it comes to maintaining the object in Set API.

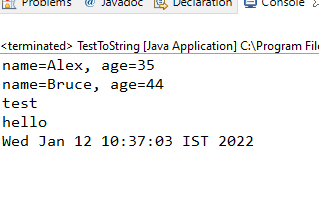
User.java



TestToString.java



Output:



Strings:

There are two types of strings you can create

* Immutable string object: Once the content is created, it can’t be modified
* Mutable string object: The content can be modified after it created

String class: It is used to create immutable string object, once the string is created its content can’t be modified

String methods: toUpperCase(), toLowerCase(), equals(), equalsIgnoreCase(), charAt(), length(), concat(),

Note: In String toString(), equals() & hashCode() of Object class is overridden

StringBuffer class: it is used to create mutable string object, you can modify the string present in string buffer,

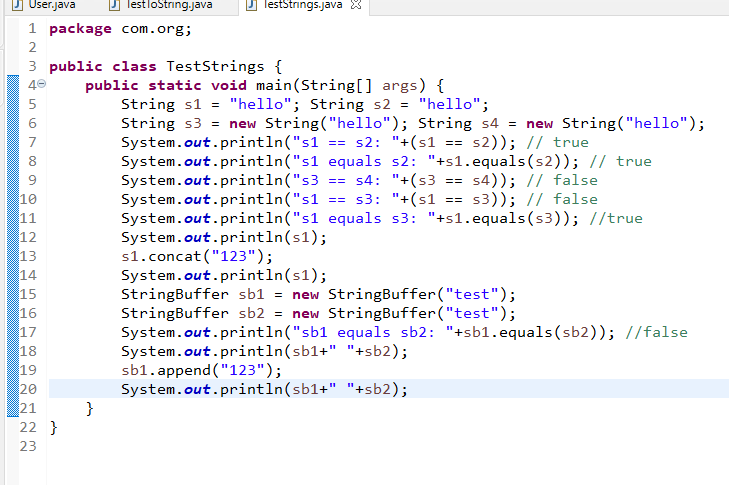
Note: In StringBuffer equals() method & hashCode() is not overridden to compare content, it uses equals() method of Object class only, it has overridden toString() method of Object class

StringBuffer sb1 = new StringBuffer(“test”);  
StringBuffer sb2 = new StringBuffer(“test”);

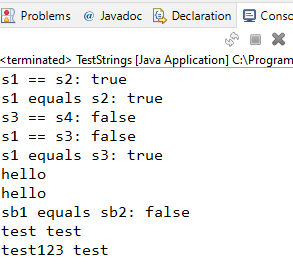
sb1.append(“123”); // now sb1 will be test123

sb2.append(“123”); // now sb2 will be test123

sb1.equals(sb2); // false, equals() method doesn’t compare content



Output:



Activities

Note: All classes should be organized into packages that follow a well-defined hierarchy.

1. Create a class Movie with attributes - movie name, produced by, directed by, duration, year, category (comedy/action/..). Write necessary methods that accept and display the information. Create the constructors based on the below rules.

* Movie name and produced by are mandatory fields and should be supplied at the time of creating the object
* Compiler should raise an error when you try to create Movie object without passing any parameters.
* Write a constructor which accepts all the attributes as parameters while creating the object. From this constructor call the constructor (mentioned at point a) to initialize mandatory fields

1. In the above class create a static variable moviesCount. Write necessary methods to get the values. Every time an object of Movie is created, increment the value of moviesCount variable.
2. Create a movieId field. Make this variable as a readOnly variable (i.e. make it private and write only a getter method). Generate movieId value by using the below formula  
   movieId=”movieName”+”\_”+moviesCount  
   eg. if the Movie name is “Hello” and the value of moviesCount variable is 31, then store Hello\_31
3. Define a new class SpecialMovie which contains all the attributes of Movie and other attributes to store the technology used for soundEffects and visualEffects. Define another class InternationalMovie which contains all attributes of Movie class and other attributes to store country and language.

* Write necessary classes, constructors and methods for storing and displaying additional information. Hint: use super keyword to call the methods/constructor of super class.

1. In the Movie class write a method called showDetails() which concatenates the value of all the attributes and returns it as a String
2. Complete the below tasks using appropriate example of your choice
3. Create Interfaces
4. Create inheritance by extending other interfaces
5. Create class by extending another class and implement more than 1 interface
6. Create a reference variable of an interface.
7. Create a class implementing above interface.
8. Store the object of class created in step e in the reference variable created in step d.
9. Call the methods by using interface reference variable

Exception Handling:

Exceptions are nothing but Runtime errors, which can abruptly stop program execution, hence you must handle the exceptions.

There are 5 keywords in exception handling mechanism

* try
* catch
* finally
* throw
* throws

try block: You write logics that can cause exception

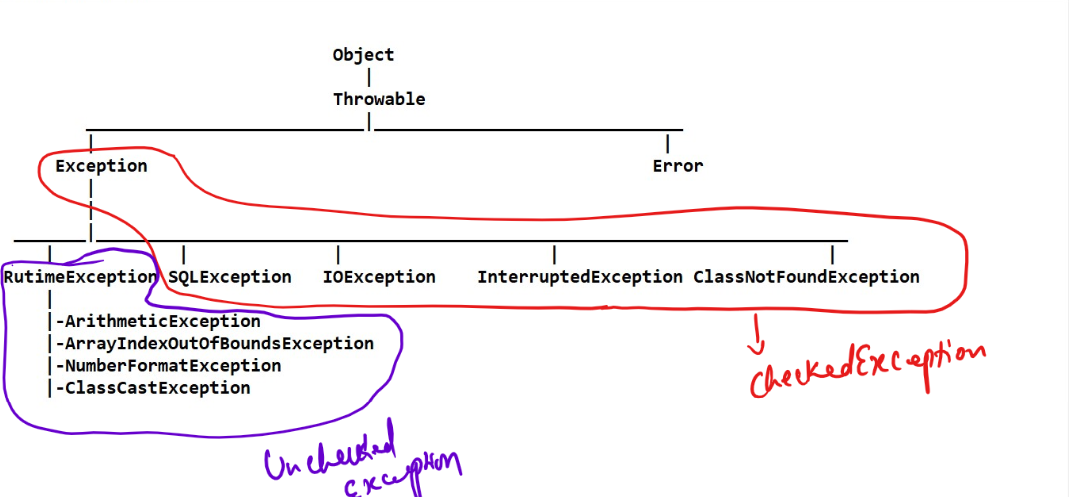
catch block: you can handle the exception thrown by try block, you can have more than one catch block

finally block: It is definitely executed regardless of exception handled or not

throw: manually create the exception like custom exception

throws: it is to propagate the exception to the caller instead of handling it

Exception hierarchy



RuntimeException & their subclasses are unchecked exception, compiler doesn’t force you to handle

Exception & their subclasses except RuntimException are checked exceptions, compiler forces you to handle.

Custom Exception:

You can extend any of the exception class to create your own exception, but if you want to create a checked exception you can extend Exception, however if you want to create unchecked exception you can extends RuntimeException

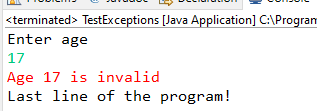
class Xyz extends Exception { } // checked exception

class Xyz extends RuntimeException { } // unchecked exception

Custom exceptions must be generated using throw keyword & you can handle it using try - catch block



Output:



File Handling

Java provides inbuilt API’s to work with file system, where you can read/write stream of data from simple to complex type of data you can main.

There are 2 types of streams

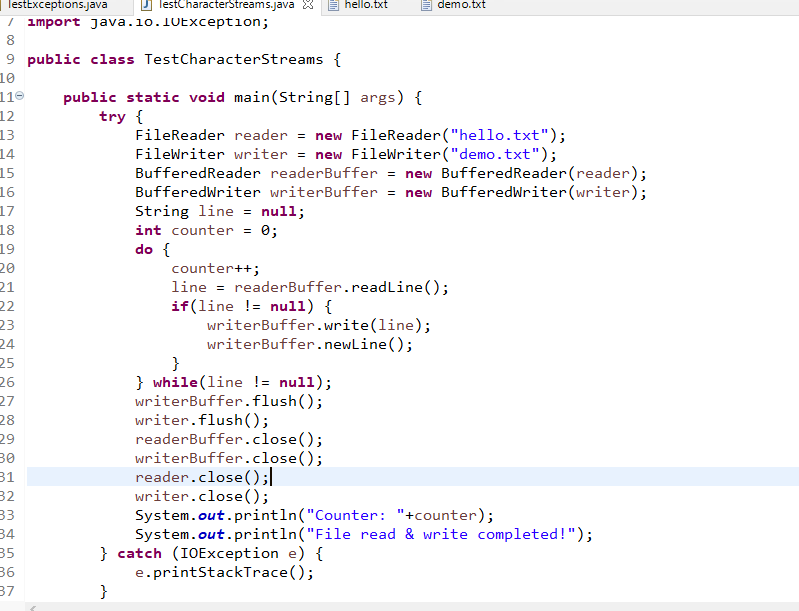
* 1. Byte streams : Read/Write binary data
  2. Character Streams: Read/Write character data/text data

We have set of API’s to work with Bytestreams

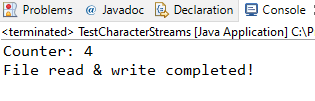
* 1. FileInputStream & FileOutputStream
  2. ObjectInputStream & ObjectOutputStream

We have set of API’s to work with Characterstreams

1. FileReader & FileWriter
2. BufferedReader & BufferedWriter



Output:



Serialization:

Serialization is nothing but writing the object to the file system, reading the object from the file system is known as deserialization.

By default not all objects can be serialized, you need to implement a marker interface called Serializable.

Serializable: It is a marker interface which will not have any methods, but adds a type to the object that implements, while writing the object the method would check if the object is of serializable type to write, if not it raises exception.

class User implements Serializable { }

Now User is of type Serializable & write method can successfully write the object to the file

class Employee { }

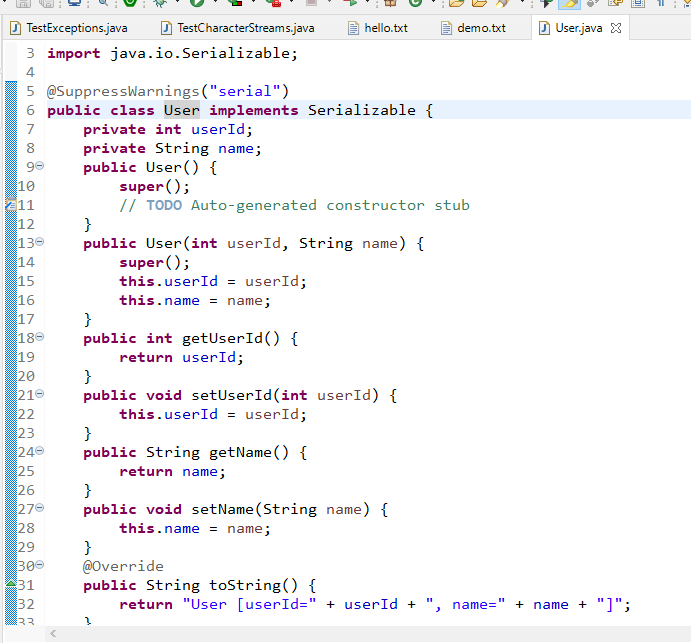
Now Employee class is not of type Serializable & write method can’t write Employee instance to the file.

We have 2 classes to perform serialization & deserialization

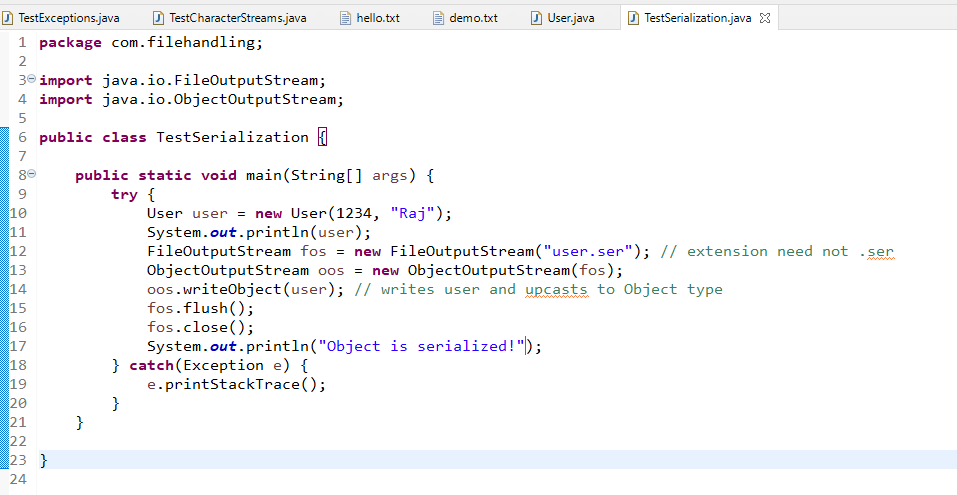
ObjectOutputStream: To write object, uses writeObject(Object) to write

ObjectInputStream: To read object, uses readObject() to read returns Object

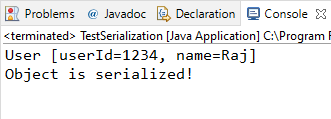
User.java



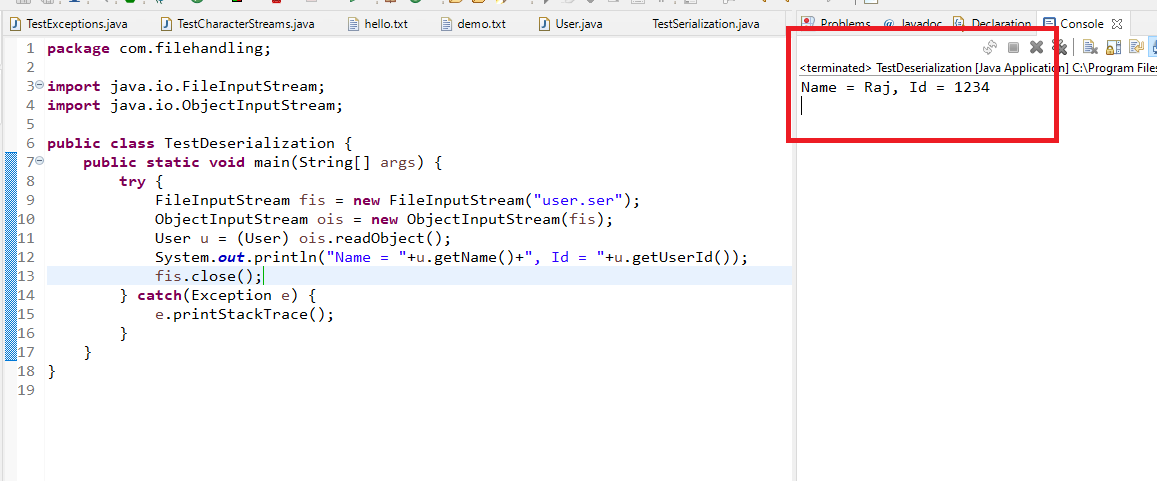
TestSerialization.java



Output:



TestDeserialization.java



Activity:

1. Demonstrate your understanding of the below concepts by writing necessary classes and methods

* Single try ... catch ... finally block
* Multiple catch blocks
* Nested try-catch blocks
* Usage of throw and throws keywords.

1. Create a checked exception UserNotFoundException. Override all the constructors from the super class
2. Create a User class with id, name and age properties, generate setters, getters, constructors, toString
3. Store some user objects in an array in a separate class from the main class and have a method called searchUser(int id) which accepts id as parameter, it must use throws to propagate UserNotFoundException if the passed id is not present in the array of users
4. From the main call searchUser(id) and pass the id, if id is present in the array of users, then it must print the user data, else it must throw exception that message must be printed in the catch block

Layered architecture

Whenever you develop any big applications, you need to separate Presentation, Navigation, Service and Database logics and use interface based approach to create a loosely coupled applications.

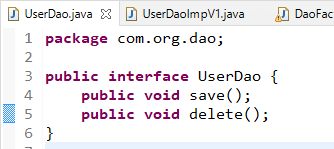
Loosely coupled: When you do changes in one place you don’t have to change the code in others machine, it can be achieved through some design patterns like factory pattern or singleton design pattern.

Factory pattern: It is a design pattern which takes care of creating the object by completely abstracting the object creation.

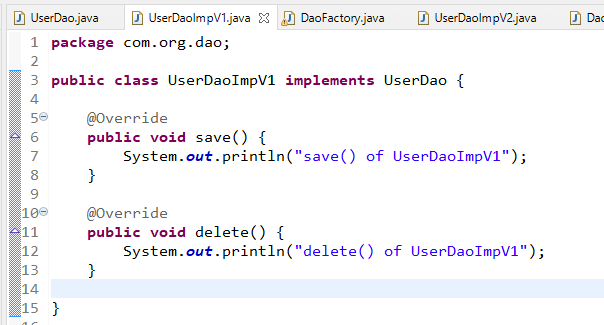
Note: It can return different implementations of same type based on some conditions

Singleton pattern: It is a type of factory pattern which creates only one instance of a class

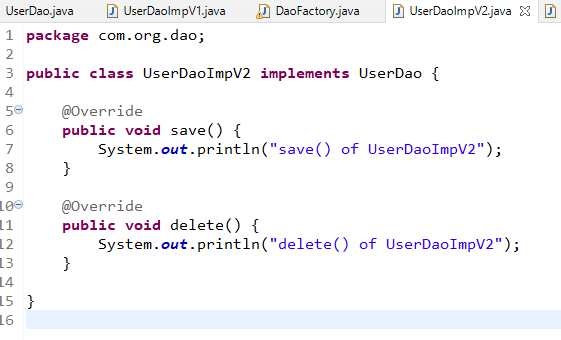
UserDao.java



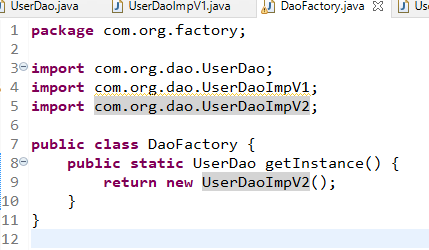
UserDaoImpV1.java



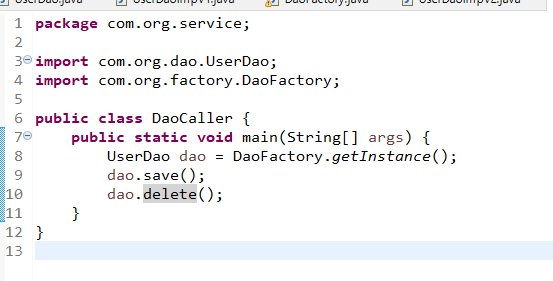
UserDaoImpV2.java



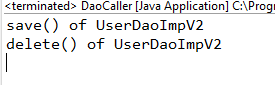
DaoFactory.java



DaoCaller.java



Output:



The above code is using interface & factory pattern to create a loosely coupled code, when you change the implementation the caller doesn’t need to change the code

Collection Framework

It provides set of API’s to order to maintain data (from simple to complex), the API’s maintains data in different way based on the requirement you can choose the one you need.

It is dynamic in nature whose size is not fixed and it uses Generics to maintain particular type of data.

Collection has an interface called Collection which provides methods to maintain data like add(), remove(), size(), isEmpty() and so on

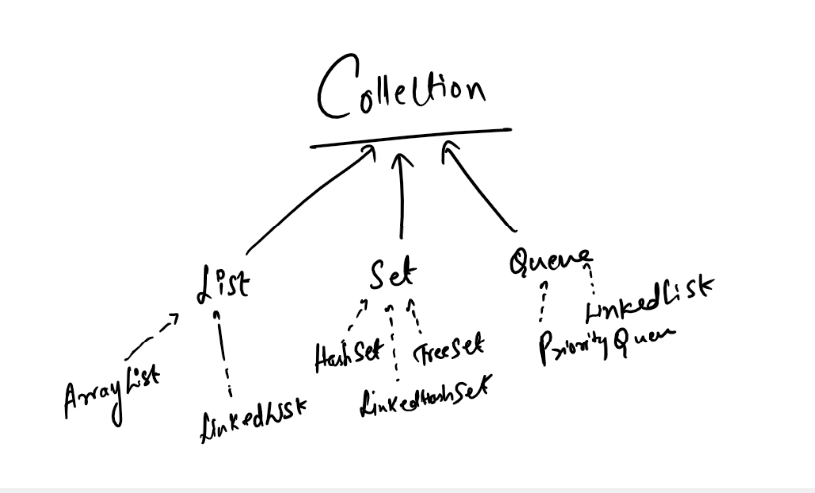
These methods are implemented by many classes like LinkedList, ArrayList, HashSet, LinkedHashSet, TreeSet, PriorityQueue and so on.

Since when you want to maintain data you may sometimes prefer unique data no duplicates, data in sequential order, random order, sorted order, First In First Out, data supporting duplicates, data supports index based access the Collection itself divided into 3 interfaces which are sub-interface of Collection

* 1. List: Supports duplicates & index based access
  2. Set: Supports only unique elements
  3. Queue: Supports First In First Out & Last in Last Out based access

All these 3 interfaces are implemented by specific classes which are

1. List
   1. ArrayList
   2. LinkedList
2. Set
   1. HashSet
   2. LinkedHashSet
   3. TreeSet
3. Queue
   1. PriorityQueue
   2. LinkedList (It implements List & Queue)



ArrayList: Stores elements in contiguous memory address, here retrieval will be faster whereas add and remove is slower

LinkedList: Stores elements in non-contiguous memory address, here add & remove is faster & retrieval will be slower

Both of them supports duplicates

LinkedList also implements Queue, hence it supports methods to perform First in First out, the methods are add() to store item, poll() is to remove item in first in first out

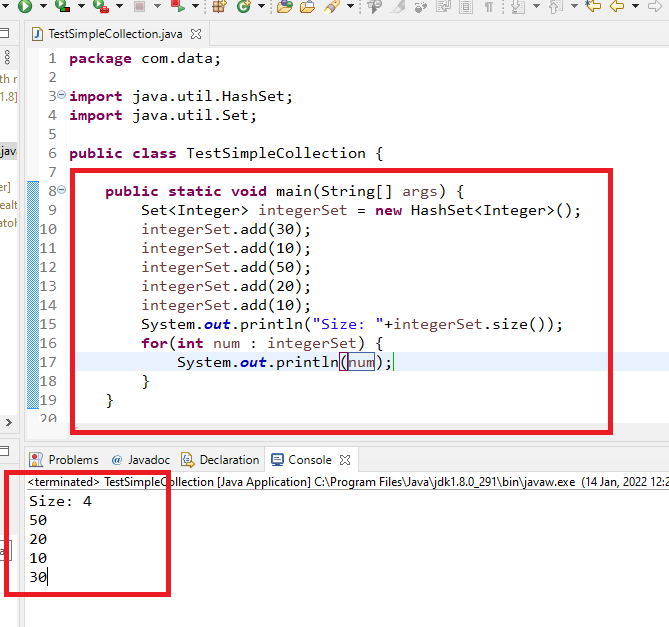
PrirorityQueue: It removes the elements in sorted order, based on priority it removes the elements, it also supports duplicates

Set: It only supports unique elements

HashSet: It maintains elements in random order whereas the elements can be retrieved faster as it uses hash algorithm i.e., based on a particular key it can search the item.

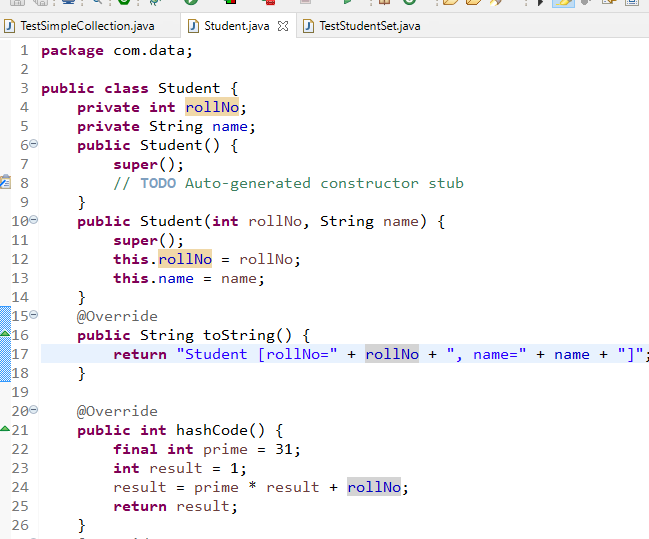
LinkedHashSet: It maintains elements in insertion order, It is like First Come First Serve

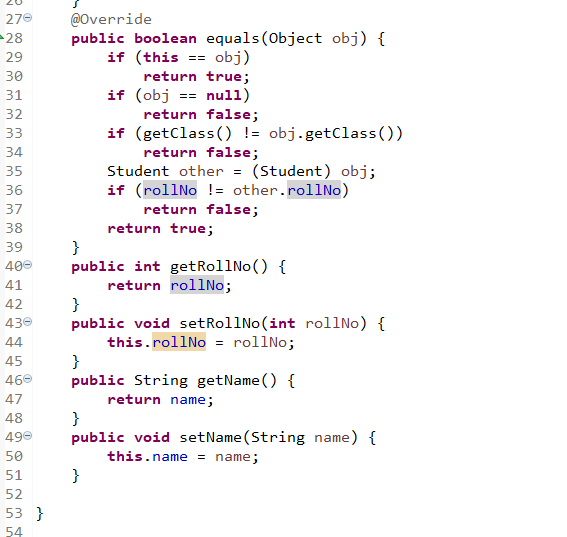
TreeSet: It maintains elements in sorted order



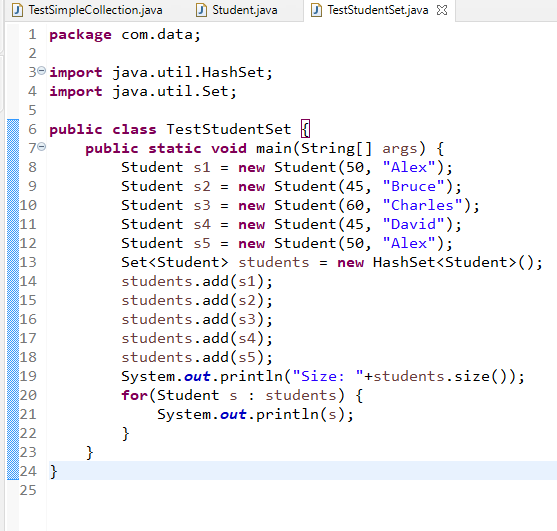
You usually maintain complex types like Customer, User, Employee, Product & so on instead of simple types like int, String

Student.java





TestStudentSet.java



Output:

