OOP using Java

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Agenda

- Interfae
- Marker Interface
- Date/LocalDate/Calender
- Exception Handling

Interface

- In Java, an interface is a blueprint or template of a class. It is much similar to the Java class but the only difference is that it has abstract methods and static constants.
- The methods in interfaces do not contain any body.
- An interface in Java is a mechanism which we mainly use to achieve abstraction and multiple inheritances in Java.
- An interface provides a set of specifications that other classes must implement.
- We can implement multiple Java Interfaces by a Java class.
- All methods of an interface are implicitly public and abstract.
- The word abstract means these methods have no method body, only method signature.
- An interface can inherit or extend multiple interfaces.
- We can implement more than one interface in our class.

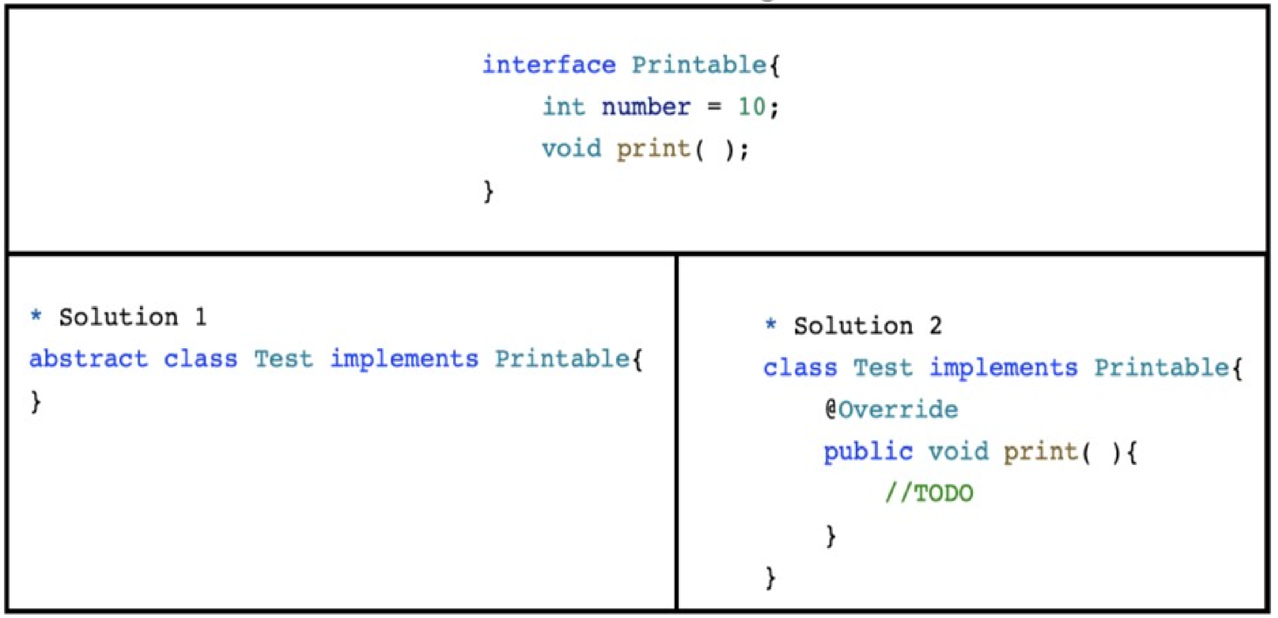
Interface

- If"is-a" relationship is not exist between super type and sub type and if we want same method design in all the sub types then super type must interface.
- Using interface, we can group instances of unrelated type together.
- Interface can extend more than one interfaces.
- We can not define constructor inside interface.
- By default methods of interface are abstract.
- **Hint :** In case of inheritance if state is not involved in super type then it should be interface.
- Unlike a class, you cannot instantiate or create an object of an interface.
- All the methods in an interface should be declared as abstract.
- An interface does not contain any constructors, but a class can.
- An interface cannot contain instance fields.
- It can only contain the fields that are declared as both static and final.
- An interface can not be extended or inherited by a class; it is implemented by a class.
- An interface cannot implement any class or another interface.

Interface

- Set of rules are called specification/standard.
- It is a contract between service consumer and service provider.
- If we want to define specification for the sub classes then we should define interface.
- Interface is non primitive type which helps developer:
- To build/develop trust between service provider and service consumer.
- To minimize vendor dependency.
- interface is a keyword in Java.
- If we want to implement rules of interface then we should use implements keyword.
- It is mandatory to override, all the abstract methods of interface otherwise sub class can be considered as abstract.

Interface

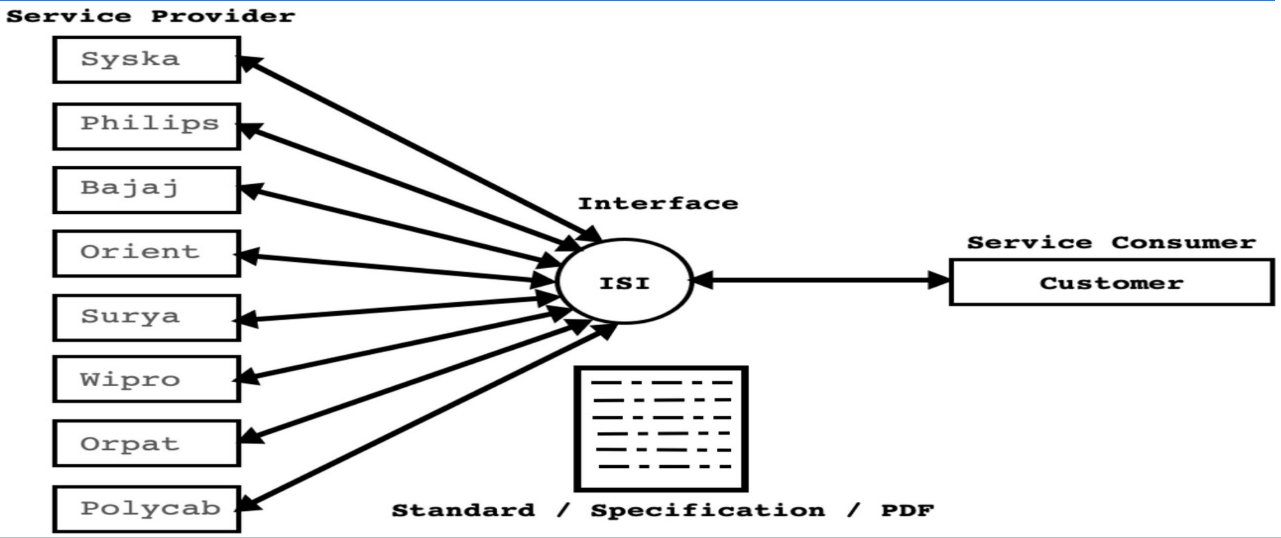


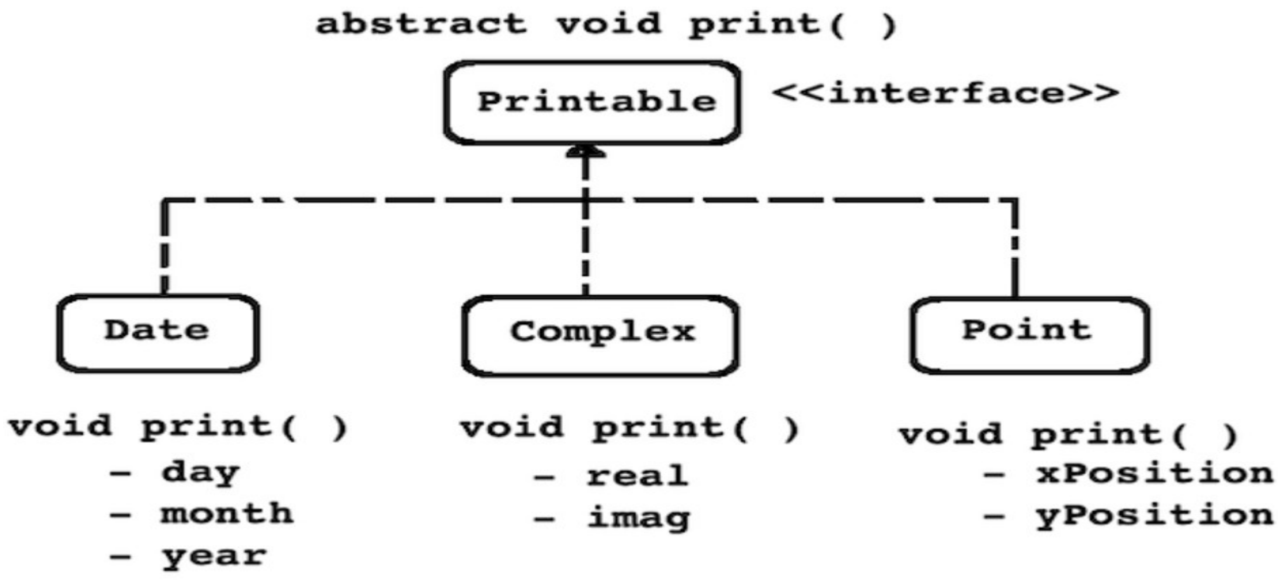
```
interface Printable{
    int number = 10;
    void print( );
}
```

```
* Solution 1
abstract class Test implements Printable{
}
```

```
* Solution 2
class Test implements Printable{
    @Override
    public void print( ){
        //TODO
    }
}
```

- If we want to implement rules of interface then we should use implements keyword.
- It is mandatory to override, all the abstract methods of interface otherwise sub class can be considered as abstract.

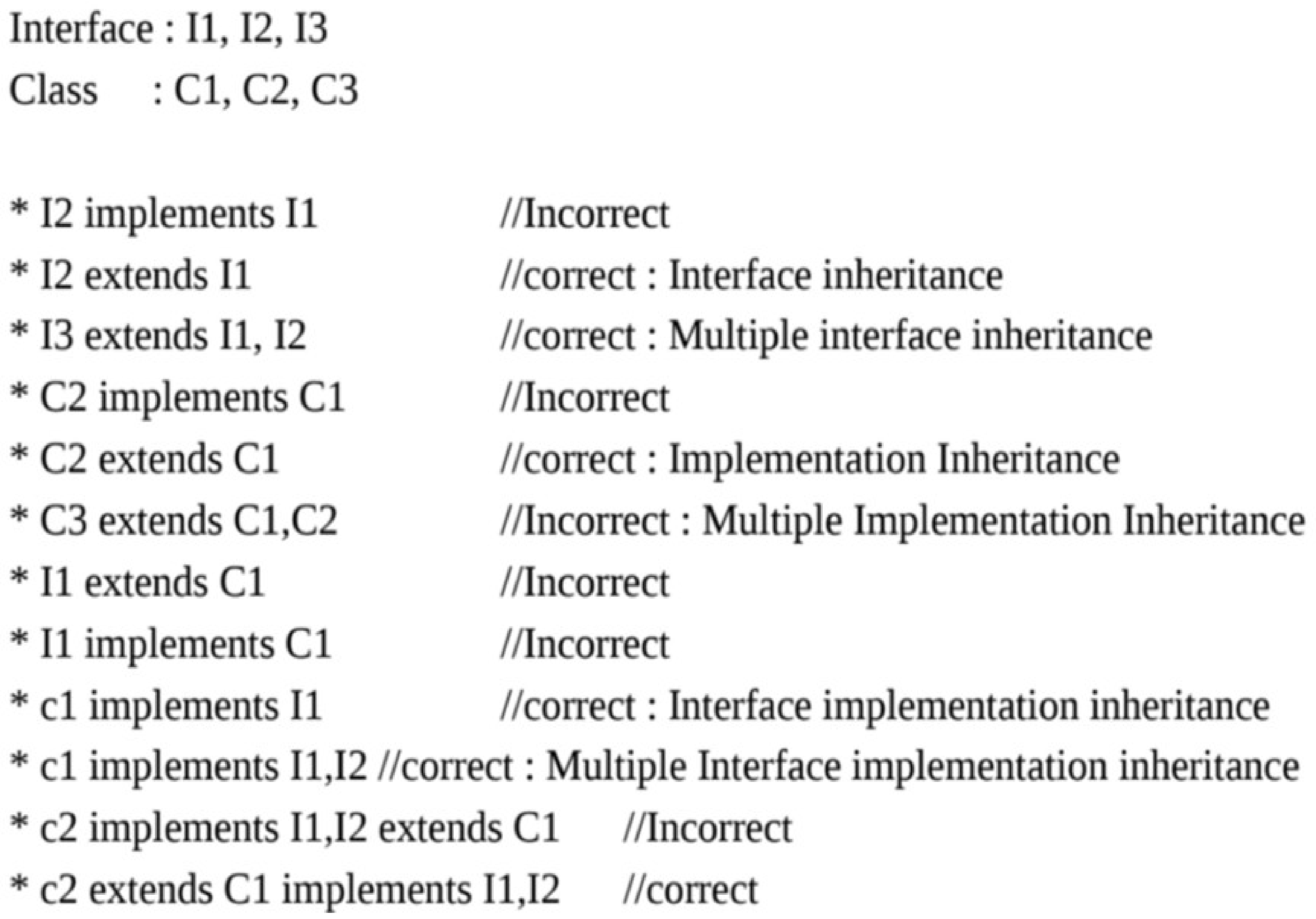




```
Printable[] arr = new Printable[ 3 ];
arr[ 0 ] = new Date( ); //Upcasting
arr[ 1 ] = new Complex( ); //Upcasting
arr[ 2 ] = new Point( ); //Upcasting
```

Types of Interface Inheritance

- During inheritance if super type and sub type is interface then it is called as interface inheritance.
- Types of interface inheritance
  1. Single Inheritance
  2. Multiple Inheritance
  3. Hierarchical Inheritance
  4. Multilevel Inheritance



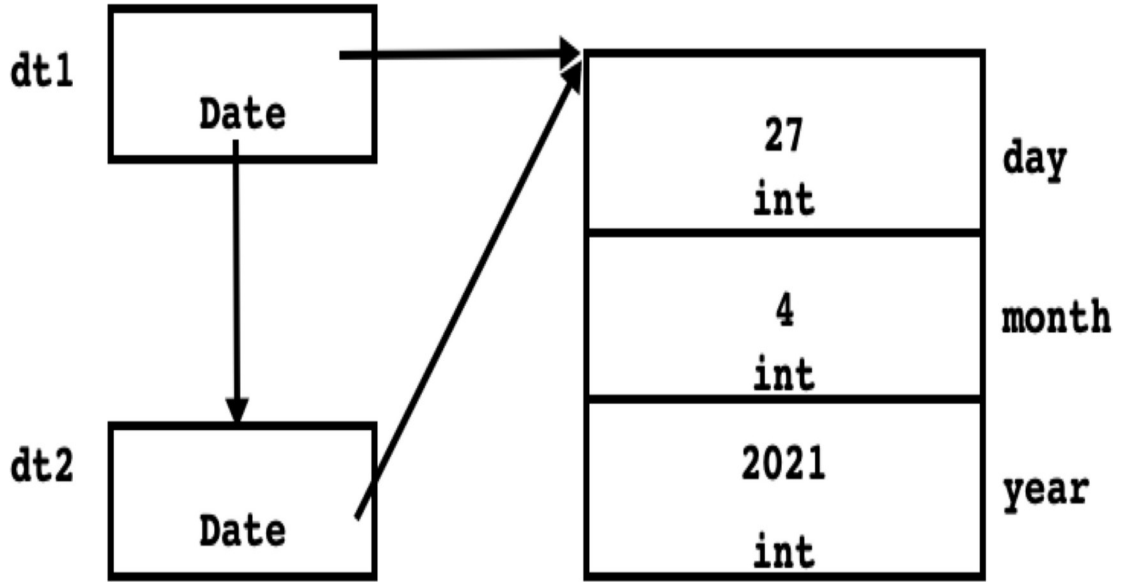
```
Interface : I1, I2, I3
Class     : C1, C2, C3

* I2 implements I1              //Incorrect
* I2 extends I1                 //correct : Interface inheritance
* I3 extends I1, I2             //correct : Multiple interface inheritance
* C2 implements C1              //Incorrect
* C2 extends C1                 //correct : Implementation Inheritance
* C3 extends C1,C2              //Incorrect : Multiple Implementation Inheritance
* I1 extends C1                 //Incorrect
* I1 implements C1              //Incorrect
* c1 implements I1              //correct : Interface implementation inheritance
* c1 implements I1,I2 //correct : Multiple Interface implementation inheritance
* c2 implements I1,I2 extends C1      //Incorrect
* c2 extends C1 implements I1,I2      //correct
```

Marker Interface

- An interface which do not contain any member is called marker interface. In other words, empty interface is called as marker interface.
- Marker interface is also called as tagging interface.
- If we implement marker interface then Java compiler generates metadata for the JVM, which help JVM to clone/serialize or marshal state of object.
- Example:
  - java.lang.Cloneable
  - java.util.EventListener
  - java.util.RandomAccess
  - java.io.Serializable
  - java.rmi.Remote

Cloneable Interface Implementation

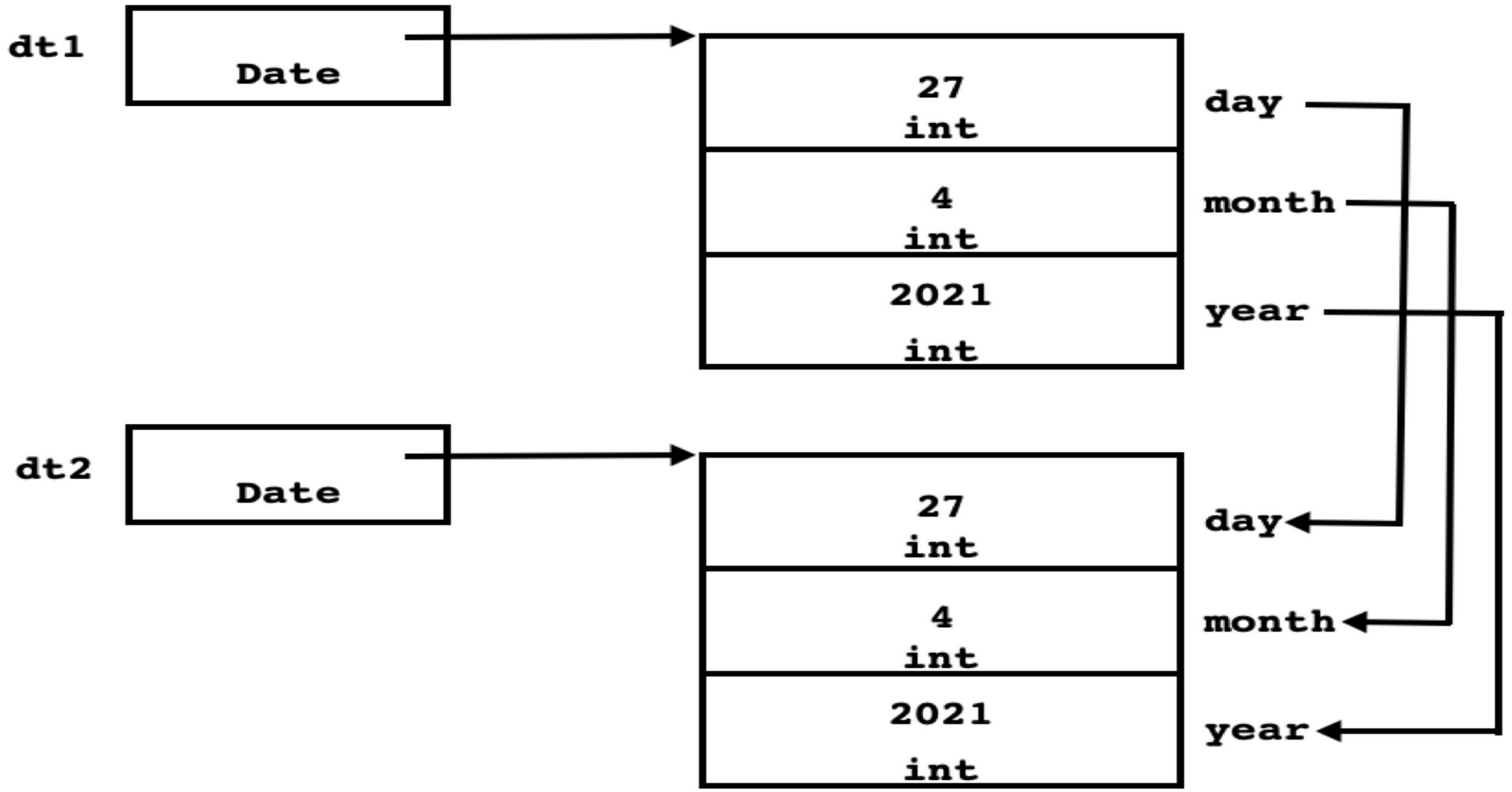
- Date dt1 = new Date(27, 4, 2021);
- Date dt2 = dt1;   //Shallow Copy Of References



- If we want to create new instance from existing instance then we should use clone method.
- clone( ) is non final native method of java.lang.Object class.
- Inside clone() method, if we want to create shallow copy instance then we should use super.clone( ) method.
- Cloneable is interface declared in java.lang package.
- Without implementing Cloneable interface, if we try to create clone of the instance then clone() method throws CloneNotSupportedException.

Cloneable Interface Implementation

- Date dt1 = new Date(27, 4, 2021);
- Date dt2 = dt1.clone( ); //Shallow Copy Of Instance



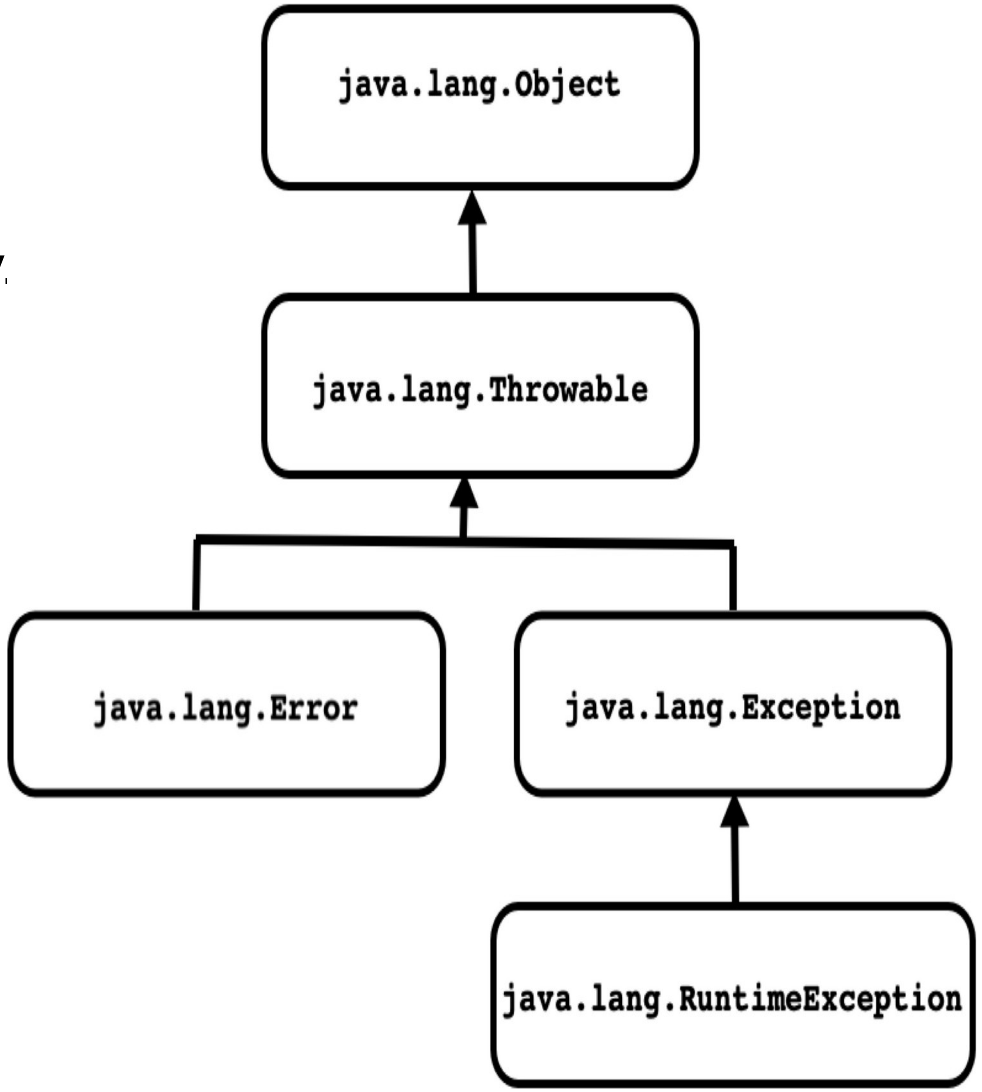
Date/Calender/LocalDate

- Date and Calender class are in java.util package
- LocalDate is in java.time package
- Date class methods are deprecated and is recommended to use Calender class.
- LocalDate class is immutable class and threadsafe
- We can get the instance of Calender class and LocalDate class as below
- Calender calender = Calender.getInstance();
- LocalDate localDate = LocalDate.of(1,1,2000);

Exception Handling

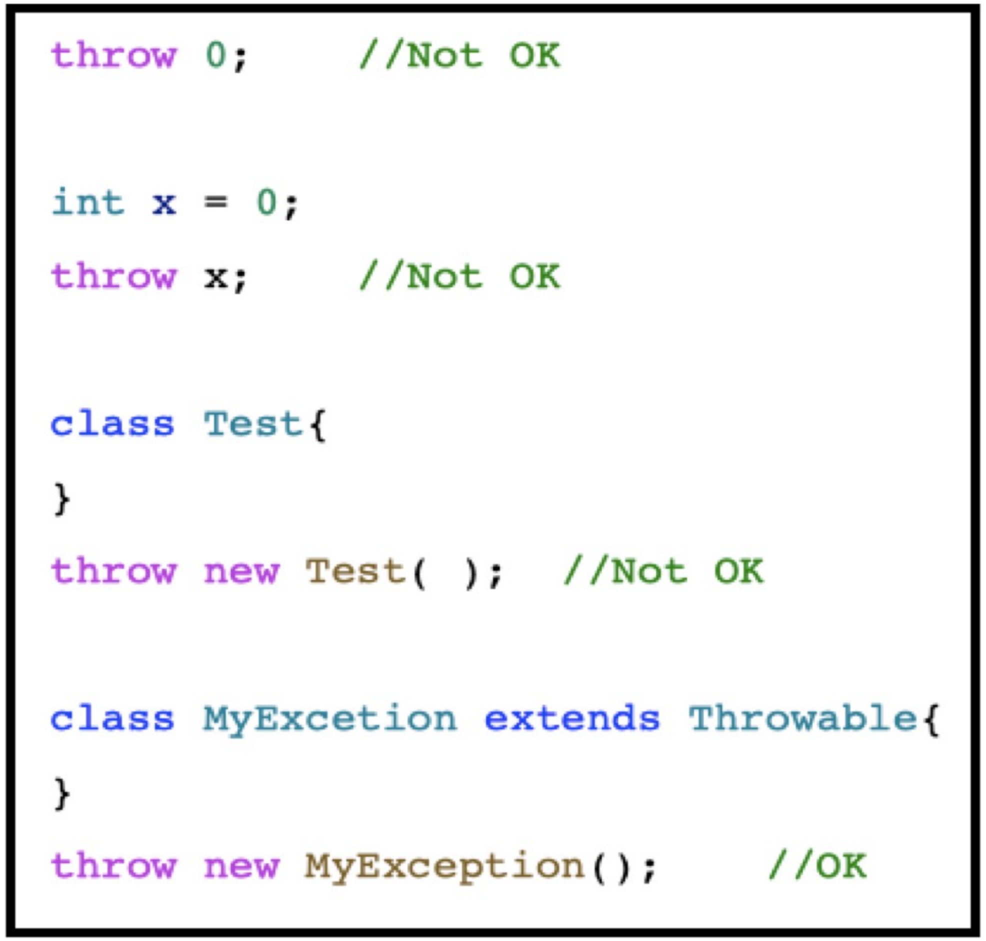
- **Why we should handle exception**
  - To handle all runtime errors at single place.
  - It helps developer to reduces maintenance.
  - To avoid resource leakage/manage OS resources carefully

- **How can we handle exception in Java?**
  - try
  - catch
  - throw
  - throws
  - finally



Throwable

- It is a class declared in java.lang package.
- The Throwable class is the super class of all errors and exceptions in the Java language.
- Only instances that are instances of Throwable class (or one of its subclasses) are thrown by the Java Virtual Machine or can be thrown by the Java throw statement.



```
throw 0;     //Not OK


int x = 0;

throw x;     //Not OK


class Test{

}

throw new Test( );   //Not OK


class MyExcetion extends Throwable{

}

throw new MyException();     //OK
```

Error

- java.lang.Error is a sub class of Throwable class.
- It gets generated due to environmental condition/Runtime environment (For Example, problem in RAM/JVM, Crashing HDD etc.).
- We can not recover from error hence we should not try to catch error.
- But can write try-catch block to handle error.
- **Example:**
  - VirtualMachineError
  - OutOfMemoryError
  - InternalError
  - StackOverflowError

Exception

- java.lang.Exception is a sub class of Throwable class.
- Exception gets generated due to application.
- We can recover from exception hence it is recommended to write try-catch block to handle exception in Java.
- **Example:**
  - NumberFormatException
  - NullPointerException
  - NegativeArraySizeException
  - ArrayIndexOutOfBoundsException
  - ArrayStoreException
  - IllegalArgumentException
  - ClassCastException

Types Of Exception

- **Unchecked Exception :**
  - java.lang.RuntimeException and all its sub classes are considered as unchecked exception.
  - It is not mandatory to handle unchecked exception.
  - **Example:**
    - NullPointerException
    - ClassCastException
    - ArrayIndexOutOfBoundsException
  - During the execution of arithmetic operation, if any exceptional situation occurs then JVM throws ArithmeticException.

- **Checked Exception :**
  - java.lang.Exception and all its sub classes except java.lang.RuntimeException are considered as checked exception.
  - It is mandatory to handle checked exception.
  - Example:
  - java.lang.CloneNotSupportedException
  - java.lang.InterruptedException

Thank you!

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