Serialization

CSI 203: Object Oriented Programming

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Serialization

- **Serialization in java** is a mechanism of *writing the state of an object into a byte stream*.
- It is mainly used
  - to store/persist object’s state
  - travel object's state on the network (known as marshaling).

Deserialization

- Deserialization is the process of **reconstructing the object** from the serialized state. It is the reverse operation of serialization.

Steps for Serialization/Deserialization

- Mark the class Serializable
- Use ObjectOutputStream to serialize the object
- Use ObjectInputStream to deserialize the object

Mark the Class Serializable

- To make a object serializable, two conditions must be met:
  - The class must implement the java.io.Serializable interface.
    - Serializable is a marker interface (has no body). It is just used to "mark" java classes which support a certain capability.
  - All of the fields in the class must be serializable. If a field is not serializable, it must be marked **transient**.
- Example:

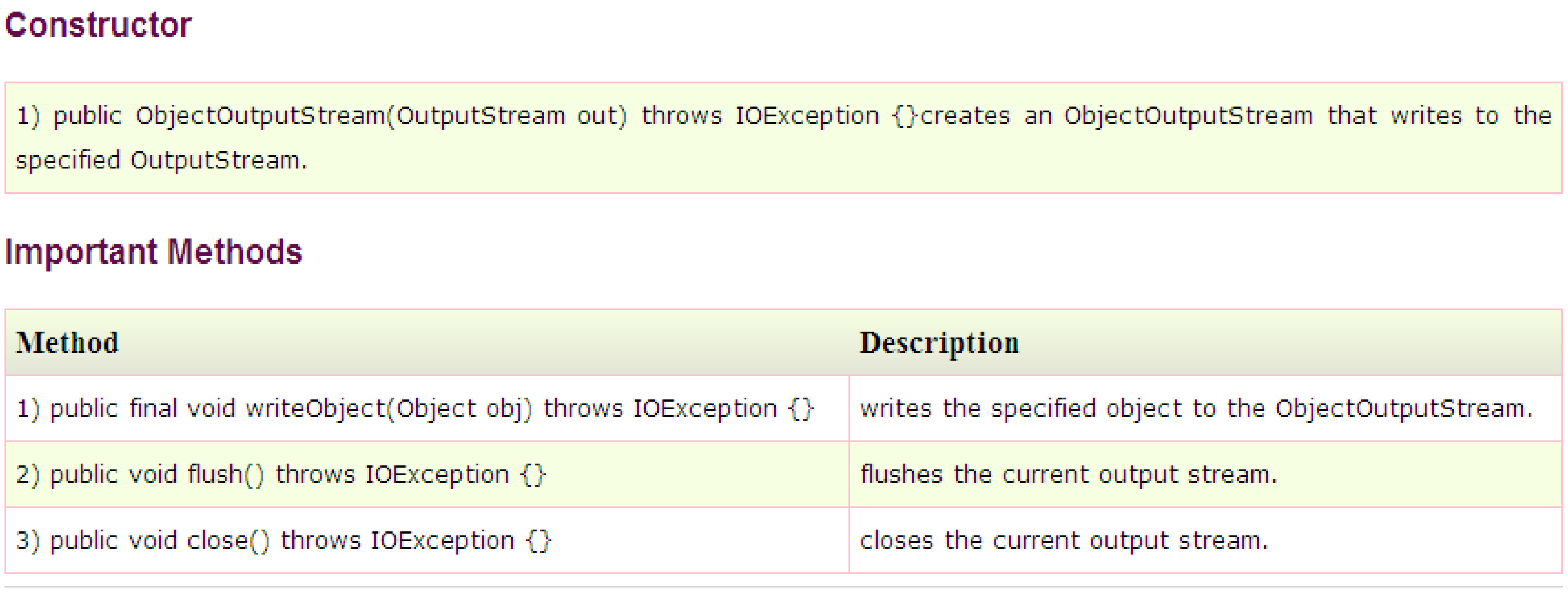
```
import java.io.Serializable;
public class Student implements Serializable{
 int id;
 String name;
 public Student(int id, String name) {
  this.id = id;
  this.name = name;
 }
}
```

Mark the Class Serializable

- Once a class implement Serializable interface
  - all primitive attributes are marked as Serializable
  - To make the Reference type attributes serializable, those classes must be made serializable as well
    - **Note: All the objects within an object must be Serializable.**
  - Child class inherits the parent's property. So, all its sub classes will also be serializable.
  - If there is any static data member in a class, it will not be serialized because static is the part of class not object.
  - In case of array or collection, all the objects of array or collection must be serializable. If any object is not serialiizable, serialization will be failed.

Class Use for Serialization

- **ObjectOutputStream** - stream that contains the methods for serializing



Constructor

1) public ObjectOutputStream(OutputStream out) throws IOException {}creates an ObjectOutputStream that writes to the specified OutputStream.

Important Methods

Method	Description
1) public final void writeObject(Object obj) throws IOException {}	writes the specified object to the ObjectOutputStream.
2) public void flush() throws IOException {}	flushes the current output stream.
3) public void close() throws IOException {}	closes the current output stream.

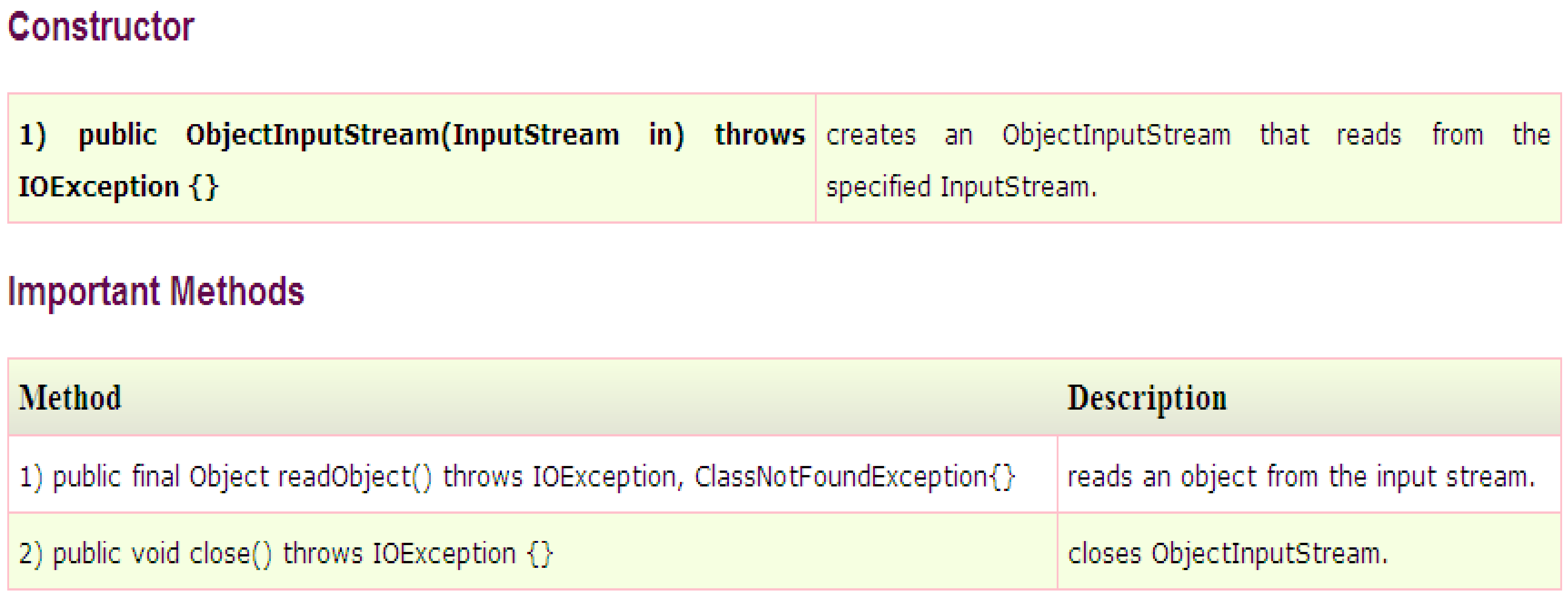
Example code to Serialize

```
import java.io.*;
class Persist{
 public static void main(String args[]) {
 try{
         Student s1 =new Student(211,"ravi");
         FileOutputStream fout=new FileOutputStream("f.txt");
         ObjectOutputStream out=new ObjectOutputStream(fout);

         out.writeObject(s1);
         out.flush();
         System.out.println("success");
       }
       Catch(Exception e){
           System.out.println(e.getMessage());
       }
 }
}
```

Class Use for De-serialization

- **ObjectInputStream** -stream that contains the methods for deserializing an object.



Constructor

1) public ObjectInputStream(InputStream in) throws IOException {}	creates an ObjectInputStream that reads from the specified InputStream.

Important Methods

Method	Description
1) public final Object readObject() throws IOException, ClassNotFoundException{}	reads an object from the input stream.
2) public void close() throws IOException {}	closes ObjectInputStream.

Example code to Deserialize

```
import java.io.*;
class Depersist{
 public static void main(String args[]) {
    try{
         ObjectInputStream in=new ObjectInputStream(new FileInputStream("f.txt"));
         Student s=(Student)in.readObject();
         System.out.println(s.id+" "+s.name);
         in.close();
     }
     catch(Exception e){
               System.out.println(e.getMessage());
     }
 }
}
```

Java Serialization with Inheritance

- Parent class properties are inherited to subclasses so if parent class is Serializable, subclass would also be.
- Now you can serialize the Student class object that extends the Person class which is Serializable.

Example

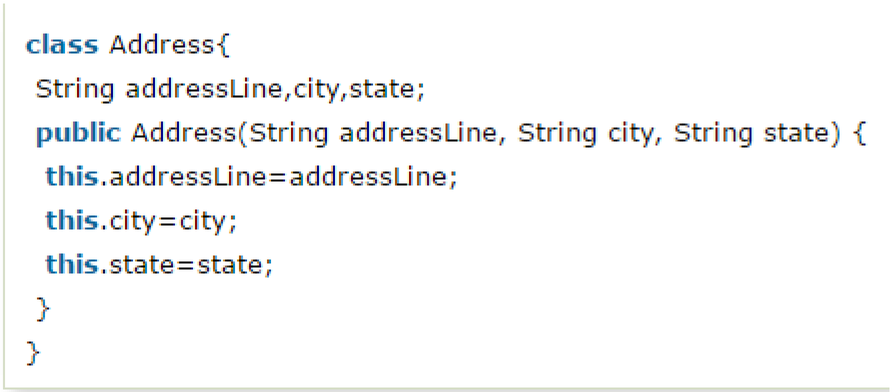
```
import java.io.Serializable;
class Person implements Serializable{
 int id;
 String name;
 Person(int id, String name) {
  this.id = id;
  this.name = name;
 }
}
```

```
class Student extends Person{
 String course;
 int fee;
 public Student(int id, String name, String course, int fee) {
  super(id,name);
  this.course=course;
  this.fee=fee;
 }
}
```

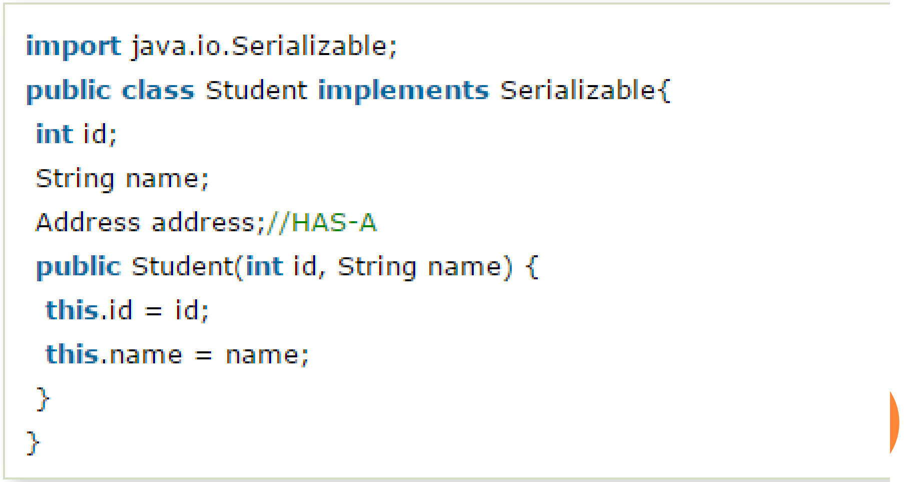
JAVA SERIALIZATION WITH AGGREGATION (HAS-A RELATIONSHIP)

- If a class has a reference of another class, all the references must be Serializable otherwise serialization process will not be performed. In such case, *NotSerializableException* is thrown at runtime.
- Since Address is not Serializable, you can not serialize the instance of Student class.

Example



```
class Address{
 String addressLine,city,state;
 public Address(String addressLine, String city, String state) {
  this.addressLine=addressLine;
  this.city=city;
  this.state=state;
 }
}
```



```
import java.io.Serializable;
public class Student implements Serializable{
 int id;
 String name;
 Address address;//HAS-A
 public Student(int id, String name) {
  this.id = id;
  this.name = name;
 }
}
```

Java Transient Keyword

- If you **don't want to serialize** any data member of a class, you can mark it as transient.
- Let’s say I have declared a class as Student, it has three data members id, name and age. If you serialize the object, all the values will be serialized but I don't want to serialize one value, e.g. age then we can declare the age data member as transient.
- If you deserialize the object, you will get the **default** value for transient variable.

Example with Transient

```
import java.io.Serializable;
public class Student implements Serializable{
    int id;
    String name;
    transient int age;//Now it will not be serialized
    public Student(int id, String name,int age) {
        this.id = id;
        this.name = name;
        this.age=age;
    }
}
```

Example with Transient

- Code to Serialize

```
import java.io.*;
class PersistExample{
 public static void main(String args[])throws Exception{
       Student s1 =new Student(211,"ravi",22);//creating object
       //writing object into file
       FileOutputStream f=new FileOutputStream("f.txt");
       ObjectOutputStream out=new ObjectOutputStream(f);
       out.writeObject(s1);
       out.flush();

       out.close();
       f.close();
       System.out.println("success");
 }
}
```

- Output

Example with Transient

- Code to De-Serialize

```
import java.io.*;
class DePersist{
    public static void main(String args[])throws Exception{
     ObjectInputStream in=new ObjectInputStream(new FileInputStream("
     f.txt"));
     Student s=(Student)in.readObject();
     System.out.println(s.id+" "+s.name+" "+s.age);
     in.close();
    }
}
```

- Output
  - 211 ravi 0
  - Notice age is set to 0 as it was marked transient.