

# **Simple File Input And Output**

You will learn how to write to and read from text and serialized files in Java.

James Tam

## **Storing Information On Files**

Types of files

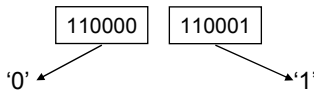
- Text files
- Binary files

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## Text Files

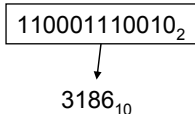
### Text files

- Every 8 bits represents a character
- e.g., '0' = 48, '1' = 49



### Binary files

- Includes all other types of files (it's a catch all term for non-binary files)
- e.g., Interpret the bit pattern as a 16 bit unsigned short



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## (You Should Now Know Why You Can Get Garbage In Text Editors)

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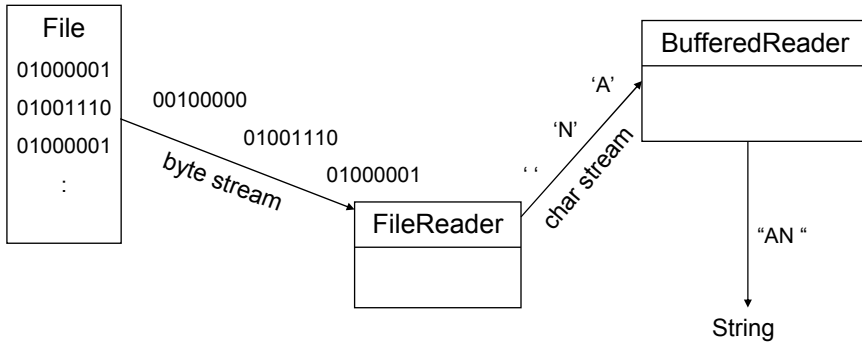
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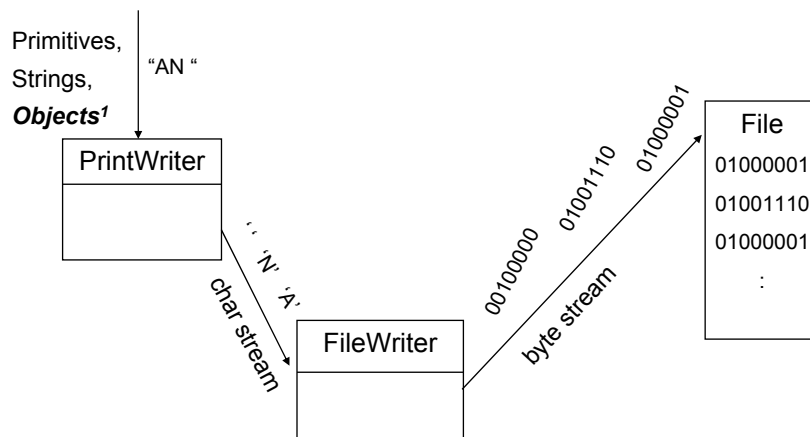
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## Reading Text Input From A File



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## Writing Text Output To A File



1 By objects we of course mean references to objects

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## An Example Of Simple Input And Output

The full example can be found in UNIX in the directory:  
`/home/coures/233/examples/fileIO/example1`

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## Class IntegerWrapper

```
public class IntegerWrapper
{
    private int num;

    public IntegerWrapper ()
    {
        num = (int) (Math.random() * 100);
    }
    public void setNum (int newValue)
    {
        num = newValue;
    }
    public int getNum ()
    {
        return num;
    }
}
```

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## Class SimpleIO

```
import java.io.*;

public class SimpleIO
{
    public static void main (String [] argv)
    {
        IntegerWrapper iw1 = new IntegerWrapper ();
        IntegerWrapper iw2 = new IntegerWrapper ();
        String filename = "data.txt";
        PrintWriter pw;
        FileWriter fw;
        BufferedReader br;
        FileReader fr;
```

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## Class SimpleIO (2)

```
try
{
    fw = new FileWriter (filename);
    pw = new PrintWriter (fw);

    System.out.println("Written to file: " + iw1.getNum());
    pw.println(iw1.getNum());
    System.out.println("Written to file: " + iw2.getNum());
    pw.println(iw2.getNum());
    fw.close();
```

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### Class SimpleIO (3)

```
fr = new FileReader(filename);
br = new BufferedReader(fr);
System.out.println("Read from file: " + br.readLine());
System.out.println("Read from file: " + br.readLine());
fr.close();
}
```

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### Class SimpleIO (4)

```
catch (IOException e)
{
    e.printStackTrace();
}
}
```

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## Reading Until The End-Of-File Is Reached

```
String filename = "data.txt";
BufferedReader br = null;
FileReader fr = null;
String temp = null;

try
{
    fr = new FileReader(filename);
    br = new BufferedReader(fr);
    temp = br.readLine ();
    while (temp != null)
    {
        :      :      :
        temp = br.readLine ();
    }
}
:      :      :
```

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## Checking For More Specific Error Types

```
String filename = null;
BufferedReader br;
FileReader fr;
boolean fileError = true;

while (fileError == true)
{
    try
    {
        System.out.print("Enter name of input file: ");
        Scanner in = new Scanner (System.in);
        in.nextLine ();

        fr = new FileReader(filename);
        br = new BufferedReader(fr);
        :      :
        fr.close ();
        fileError = false;
    }
}
```

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## Checking For More Specific Error Types (2)

```
catch (FileNotFoundException e)
{
    System.out.println("File called " + filename +
        " not in the current directory");
}
catch (IOException e)
{
    System.out.println("General file input error occurred.");
    e.printStackTrace();
}
}
```

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## Writing Objects Out To File: "The Hard Way"

The full example can be found in UNIX in the directory:  
`/home/courses/233/examples/fileIO/example2`

Each field is written out to a file individually

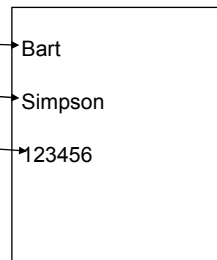
### **Student object:**

•String firstName

•String lastName

•int id

### **data.txt**



This approach is awkward because:

1. It requires knowledge of all the attributes of the class.
2. If attributes are not simple types or classes which can't be directly written to file the non-writable attribute must be broken down and written to file on a field-by basis.
3. Some attributes may have to be parsed or converted.

James Tam



## The Driver Class

```
public class Driver
{
    public static void main (String [] args)
    {
        final String FILENAME = "data.txt";
        PrintWriter pw;
        FileWriter fw;
        BufferedReader br;
        FileReader fr;
        Student aStudent = new Student("Bart", "Simpson", 123456);
        int tempNum;
        String tempLine;
```

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## The Driver Class (2)

```
try
{
    fw = new FileWriter (FILENAME);
    pw = new PrintWriter (fw);
    pw.println(aStudent.getFirstName());
    pw.println(aStudent.getLastName());
    pw.println(aStudent.getId());
    fw.close();

    fr = new FileReader(FILENAME);
    br = new BufferedReader(fr);
    aStudent.setFirstName(br.readLine());
    aStudent.setLastName(br.readLine());
    tempLine = br.readLine();
    aStudent.setId(Integer.parseInt(tempLine));
    fr.close();

    System.out.println(aStudent);
}
```

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## The Driver Class (3)

```
catch (FileNotFoundException e)
{
    e.printStackTrace();
}
catch (IOException e)
{
    e.printStackTrace();
}
catch (NumberFormatException e)
{
    e.printStackTrace();
}
}
```

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## Class Student

```
public class Student
{
    private String firstName;
    private String lastName;
    private int id;

    public Student ()
    {
        firstName = "no name";
        lastName = "no name";
        id = -1;
    }
}
```

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## Class Student (2)

```
public Student (String aFirstName,
                String aLastName,
                int anId)
{
    firstName = aFirstName;
    lastName = aLastName;
    id = anId;
}

public String getFirstName () { return firstName; }
public String getLastName () { return lastName; }
public int getId () { return id; }
```

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## Class Student (3)

```
public void setFirstName (String name) { firstName = name; }
public void setLastName (String name) { lastName = name; }
public void setId (int anId) { id = anId; }
public String toString ()
{
    String s = new String ();
    s = s +
        "First name: " + firstName + "\n" +
        "Last name: " + lastName + "\n" +
        "ID No: " + id + "\n";
    return s;
}
}
```

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## Writing Objects Out To File: A Better Way

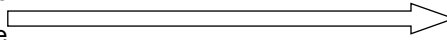
The full example can be found in UNIX in the directory:  
/home/courses/233/examples/fileIO/example3

Write all the data for the class all at once

### Student object:

- String firstName
- String lastName
- int id

Object is 'serialized' (given a serial number) on the (output) stream



### data.txt

```
Bart  
Simpson  
123456
```

Objects of a class can be serialized when the class implements the Serializable interface

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## The Driver Class

```
public class Driver  
{  
    public static void main (String [] args)  
    {  
        final String FILENAME = "data.txt";  
  
        try  
        {  
            // Write object to file.  
            ObjectOutputStream out = new ObjectOutputStream  
                (new FileOutputStream(FILENAME));  
            Student aStudent = new Student("Bart", "Simpson", 123456);  
            out.writeObject(aStudent);  
            out.close();  
            aStudent = null;  
        }  
    }  
}
```

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## The Driver Class (2)

```
ObjectInputStream in = new ObjectInputStream
    (new FileInputStream(FILENAME));
aStudent = (Student) in.readObject();
System.out.println(aStudent);
}
catch (FileNotFoundException e)
{
    e.printStackTrace();
}
catch (IOException e)
{
    e.printStackTrace();
}
catch (ClassNotFoundException e)
{
    e.printStackTrace();
}
}
}
```

James Tam

## The Student Class: Key Difference

```
public class Student implements Serializable
{
    private String firstName;
    private String lastName;
    private int id;

    public Student ()
    {
        firstName = "no name";
        lastName = "no name";
        id = -1;
    }
}
```

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## **Note: The Data File For Serialized Objects Is In Binary Form**

```
Student "John Doe"  
    firstName "John" lastName "Doe"  
    @t Bart Simpson
```

James Tam

## **Note: Many 'Container' Classes Are Serializable**

Serializable Containers:

- ArrayList
- LinkedList
- Vector
- :

The effect of having a serializable container class is that the entire container can be serialized

James Tam

## **Classes That Don't Implement The Serializable Interface**

1. The contents of the class (data) are confidential.
2. The contents of the class is meaningful only while the program runs.

James Tam

## **You Should Now Know**

How to write to files with Java classes

- FileWriter
- PrintWriter

How to reading text information from files with Java classes

- FileReader
- BufferedReader

How objects can be written to file in a serializable form.

James Tam