

# Lecture (11)

## Steam & Serialization (II)

---

Dr. Ahmed ElShafee

1

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

## Agenda

---

- Bridging Streams
- Stream Chaining
- Serialization

٢

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

## Bridging Streams

---

To bridge the gap between the byte and character stream classes. Use,...

***java.io.InputStreamReader*** and  
***java.io.OutputStreamWriter*** classes.

Usage:

The only purpose of these classes is to convert byte data into character based data according to a specified (or the platform default) encoding.

٣

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

## Bridging Streams (cont,..)

---

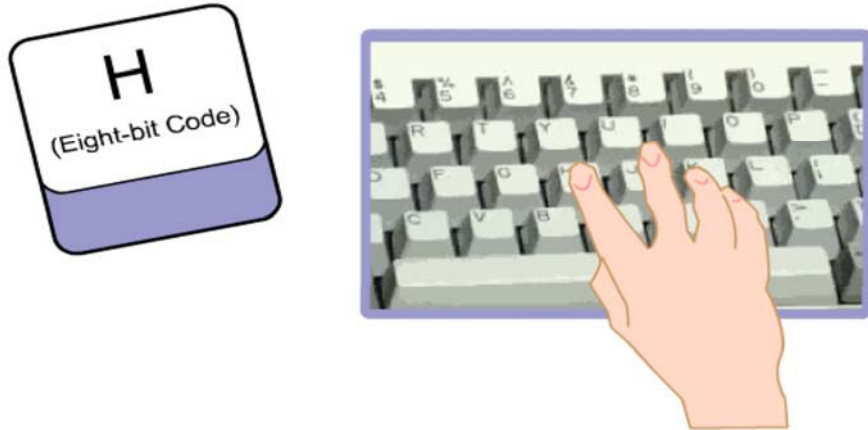
The `InputStreamReader` class is intended to wrap an `InputStream`, thereby turning the byte based input stream into a character based Reader.

The `OutputStreamWriter` class is intended to wrap an `OutputStream`, thereby turning the byte based output stream into a character based Writer.

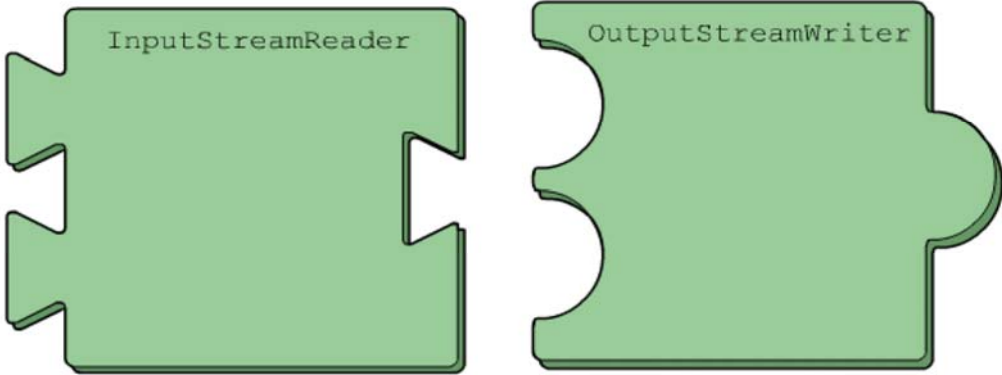
٤

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

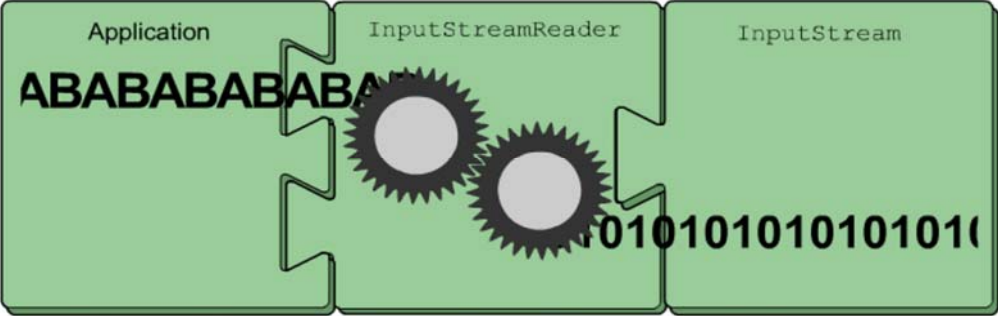
# Bridging Streams (cont,..)



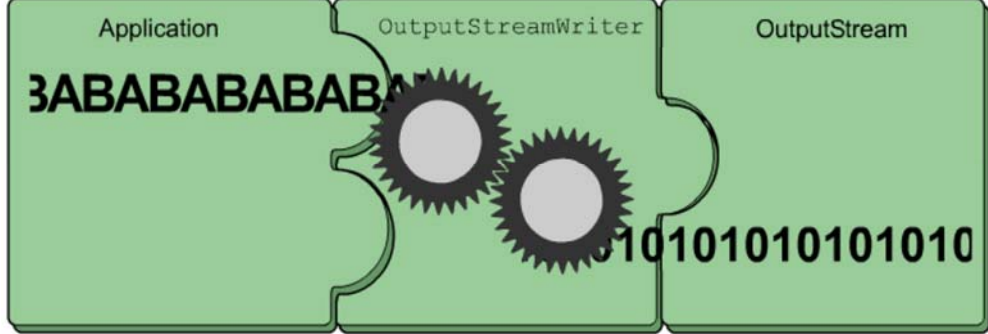
# Bridging Streams (cont,..)



# Bridging Streams (cont,..)



# Bridging Streams (cont,..)



## Bridging Streams (cont,..)

---

```
InputStream inputStream = new FileInputStream("c:\\data\\input.txt");
Reader reader = new InputStreamReader(inputStream);

int data = reader.read();
while(data != -1){
    data = reader.read();
}

reader.close();
```

9

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of  
Programming II

## Bridging Streams (cont,..)

---

```
OutputStream outputStream = new FileOutputStream("c:\\data\\output.txt");
Writer writer = new OutputStreamWriter(outputStream);

writer.write("Hello World");

writer.close();
```

10

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of  
Programming II

## Lecture1101

---

- Check lab manual

11

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of  
Programming II

## Lecture1102

---

- Check lab manual

12

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of  
Programming II

## Lecture1103

---

- Check lab manual

١٣

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

## Lecture1104

---

- Check lab manual

١٤

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

## Stream Chaining

---

Stream chaining is a way of connecting several stream classes together to get the data in the form required.

Each class performs a specific task on the data and forwards it to the next class in the chain.

The output produced by one component becomes the input to the next component in the chain.

١٥

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

## Stream Chaining (cont,..)

---

- A Reader can be combined with an InputStream.
- If you have an InputStream and want to read characters from it, you can wrap it in an InputStreamReader.
- Pass the InputStream to the constructor of the InputStreamReader like this:

```
Reader reader = new InputStreamReader(inputStream);
```

In the constructor you can also specify what character set to use to decode the text etc.

More on that in the text on InputStreamReader.

١٦

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

## Stream Chaining (cont,..)

- A Writer can be combined with an OutputStream just like Readers and InputStream's.
- Wrap the OutputStream in an OutputStreamWriter and all characters written to the Writer are passed on to the OutputStream.
- Here is how that looks:

```
Writer writer = new OutputStreamWriter(outputStream);
```

17

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

## Stream Chaining (cont,..)

### Combining Readers and Writers

- Just like with streams, Reader's and Writer's can be combined into chains to achieve more interesting IO.
- It works just like combining the Reader with InputStream's or the Writer with OutputStream's.
- For instance, you can achieve buffering by wrapping a Reader in a BufferedReader, or a Writer in a BufferedWriter.
- Here are two such examples:

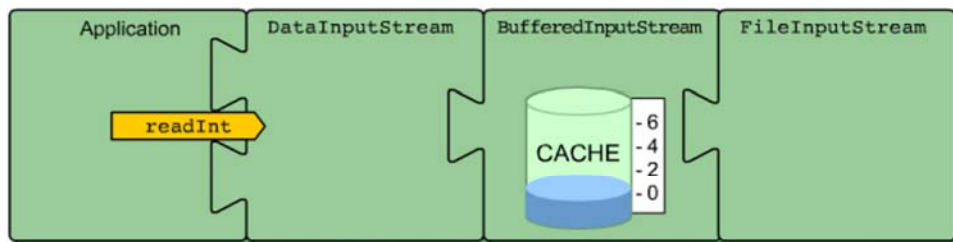
```
Reader reader = new BufferedReader(new FileReader(...));  
Writer writer = new BufferedWriter(new FileWriter(...));
```

18

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

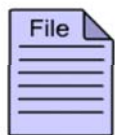
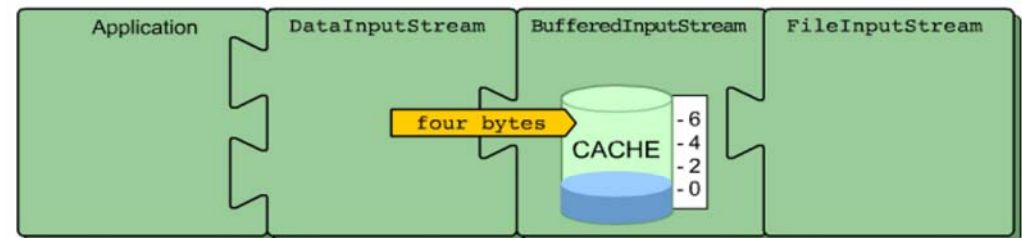
## Stream Chaining (cont,..)

### Example



When an application invokes a method like `readInt` on a `DataInputStream` object, what happens beneath the surface?

## Stream Chaining (cont,..)

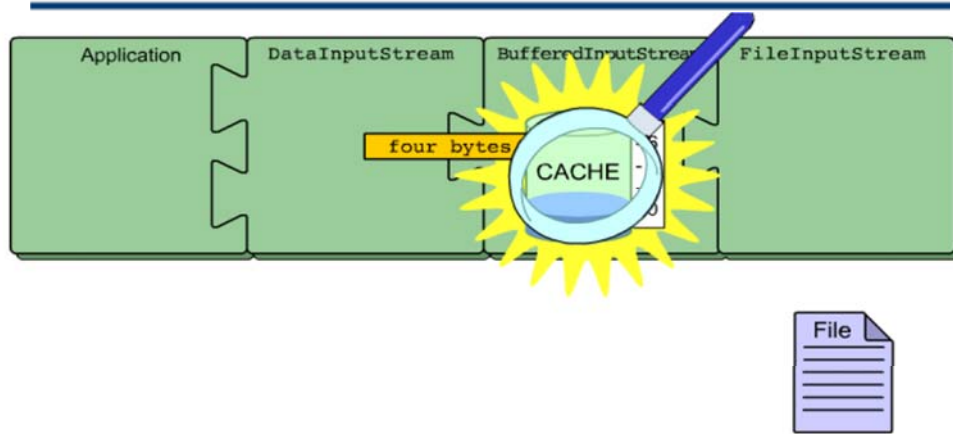


The `DataInputStream` object requests four bytes (the representation for an `int` type) from the `BufferedInputStream` object (a reference to which is contained within the `DataInputStream` object).

19

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

## Stream Chaining (cont,..)

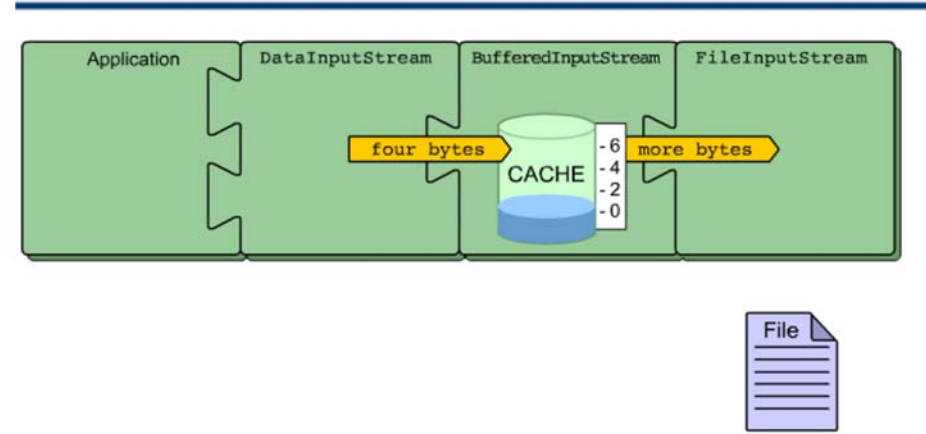


The BufferedInputStream object inspects its internal cache. If the cache does not contain four bytes of leftover data from a previous read, the BufferedInputStream object will request additional bytes from the FileInputStream object (a reference to which is contained within the BufferedInputStream object).

٢١

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

## Stream Chaining (cont,..)

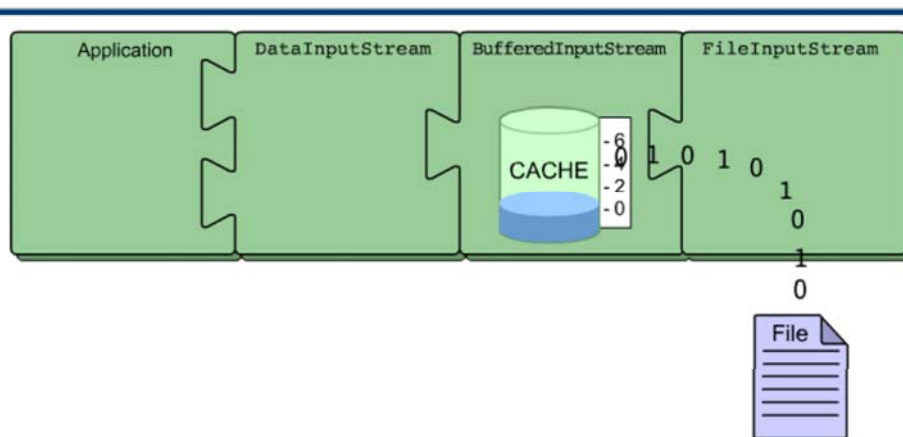


The BufferedInputStream object inspects its internal cache. If the cache does not contain four bytes of leftover data from a previous read, the BufferedInputStream object will request additional bytes from the FileInputStream object (a reference to which is contained within the BufferedInputStream object).

٢٢

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

## Stream Chaining (cont,..)

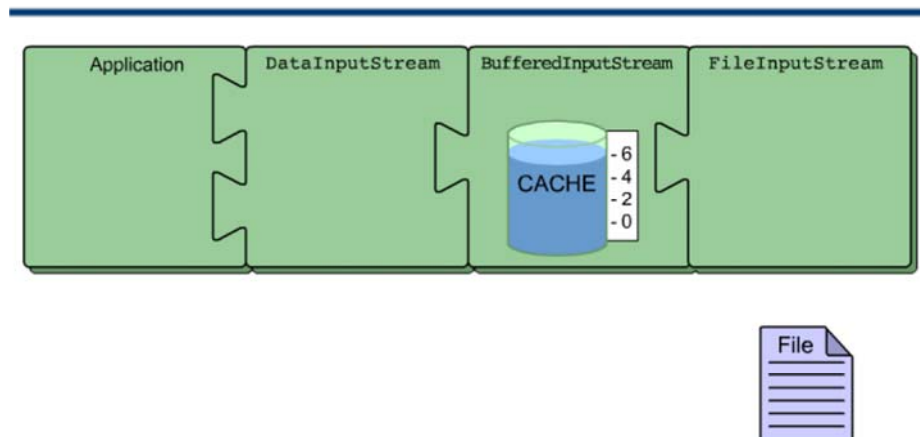


The FileInputStream object reads the requested numbers of bytes from the file and returns them to the BufferedInputStream object, which then caches the data in its internal storage buffer.

٢٣

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

## Stream Chaining (cont,..)

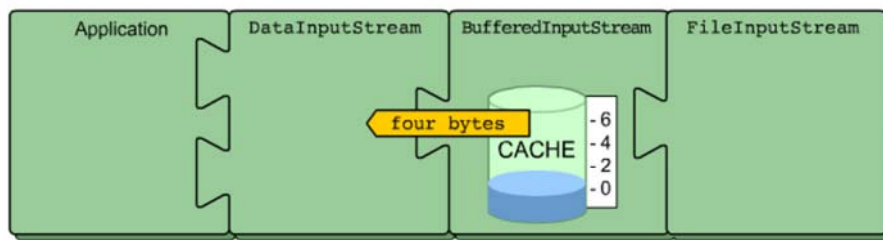


The FileInputStream object reads the requested numbers of bytes from the file and returns them to the BufferedInputStream object, which then caches the data in its internal storage buffer.

٢٤

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

## Stream Chaining (cont,..)

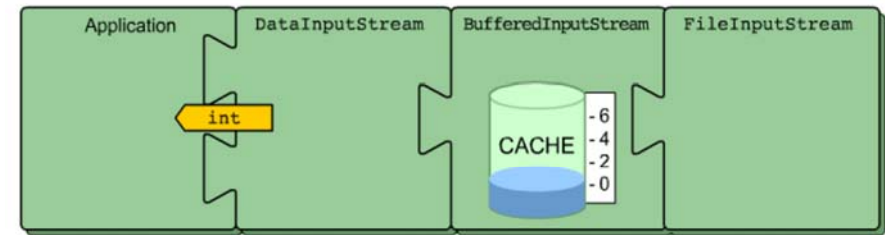


The `BufferedInputStream` object extracts the four bytes requested by the `DataInputStream` object from the cache and returns them to the calling method.

٢٥

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

## Stream Chaining (cont,..)



The `DataInputStream` object returns the four bytes to the application in the form of an `int` type.

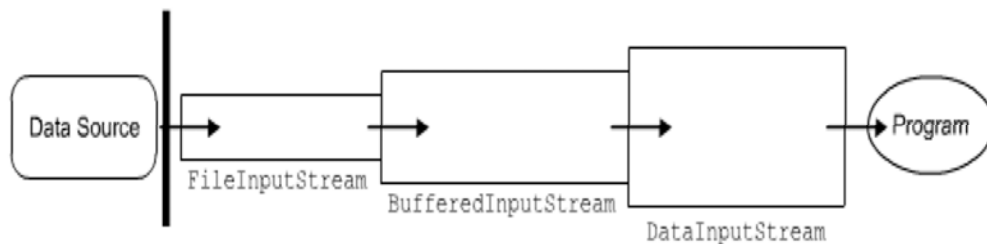
٢٦

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

## Stream Chaining (cont,..)

### InputStream Chain

```
FileInputStream theFile = new FileInputStream ( input.dat ) ;
BufferedInputStream theBuffer = new BufferedInputStream ( theFile ) ;
DataInputStream theData = new DataInputStream( theBuffer ) ;
```



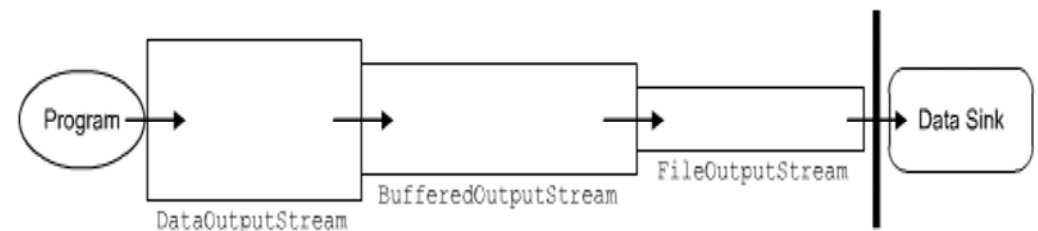
٢٧

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

## Stream Chaining (cont,..)

### OutputStream Chain

```
FileOutputStream theFile = new FileOutputStream ( "output. dat" ) ;
BufferedOutputStream theBuffer = new BufferedOutputStream theFile ) ;
DataOutputStream theData = new DataOutputStream( theBuffer ) ;
```



٢٨

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

## Lecture1105

---

- Check lab manual

٢٩

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

## Lecture1106

---

- Check lab manual

٣٠

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

## Serialization

---

Serialization is a process of writing an object to a byte stream.

Providing a way for objects to be written as a stream of bytes and then later recreated from that stream of bytes.

٣١

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

## Serialization (cont,..)

---

### ObjectInputStream

The ObjectInputStream class enables you to read Java objects from InputStream's instead of only bytes.

You wrap an InputStream in a ObjectInputStream and then you can read objects from it.

```
ObjectInputStream input = new ObjectInputStream(
    new FileInputStream("object.data"));

MyClass object = (MyClass) input.readObject();
//etc.

input.close();
```

٣٢

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II



## Serialization (cont,..)

---

For this example to work the object you read must be an instance of MyClass, and must have been serialized into the file "object.data" via an ObjectOutputStream.

٣٣

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

## Serialization (cont,..)

---

### ObjectOutputStream

The ObjectOutputStream class enables you to write Java objects to OutputStream's instead of only bytes.

You wrap an OutputStream in a ObjectOutputStream and then you can write objects to it.

```
ObjectOutputStream output = new ObjectOutputStream(  
    new FileOutputStream("object.data"));  
  
MyClass object = new MyClass();  
  
output.writeObject(object);  
//etc.  
  
output.close();
```

٣٤

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

## Serialization (cont,..)

---

This serialized object can now be read via an ObjectInputStream.

٣٥

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

## Serialization (cont,..)

---

The Serializable interface is a marker interface your classes must implement if they are to be serialized / deserialized, like shown the examples with [ObjectInputStream](#) and [ObjectOutputStream](#).

The **Serializable** interface eliminates the drawbacks of sending objects across streams.

Each object to be sent has to implement this interface

٣٦

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of Programming II

## Serialization (cont,..)

---

What is interface, and class implements?

- In its most common form, an interface is a group of related methods with empty bodies.
- A bicycle's behavior, if specified as an interface, might appear as follows:

```
interface Bicycle
{ void changeCadence(int newValue); // wheel revolutions per
  minute
  void changeGear(int newValue);
  void speedUp(int increment);
  void applyBrakes(int decrement); }
```

٣٧

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of  
Programming II

## Serialization (cont,..)

---

- To implement this interface, the name of your class would change (to a particular brand of bicycle, for example, such as ACMEBicycle), and you'd use the implements keyword in the class declaration:

```
class ACMEBicycle implements Bicycle
{ // remainder of this class implemented as before }
```

٣٨

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of  
Programming II

## Lecture1107

---

- Check lab manual

٣٩

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of  
Programming II

## Lecture1108

---

- Check lab manual

٤٠

Dr. Ahmed ElShafee, ACU Fall 2012, Fundamentals of  
Programming II

---

Thanks,  
See you next Week, isA