Chapter 14: File I/O

Reading data from/writing data to files

TAO Yida

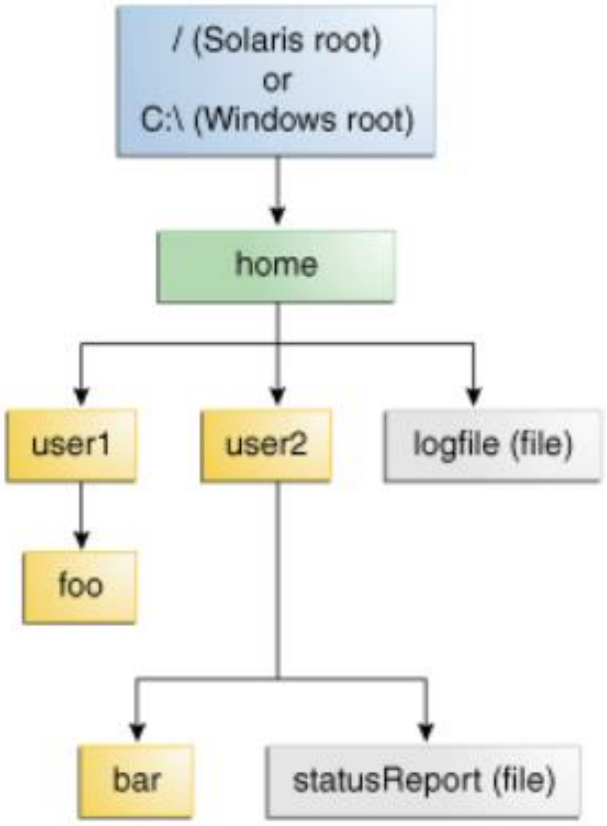
taoyd@sustech.edu.cn

Why File I/O?

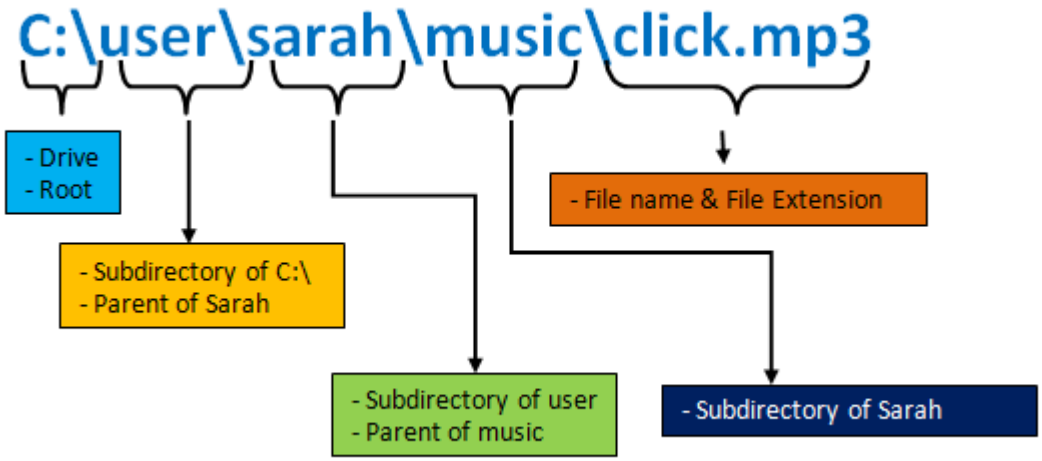
- Objects created in Java programs live in memory; they are removed by the garbage collector once they are not used anymore
- What if we want to persist the objects?

Locating a File

- File paths specify the location of individual files or directories



Sample Directory Structure

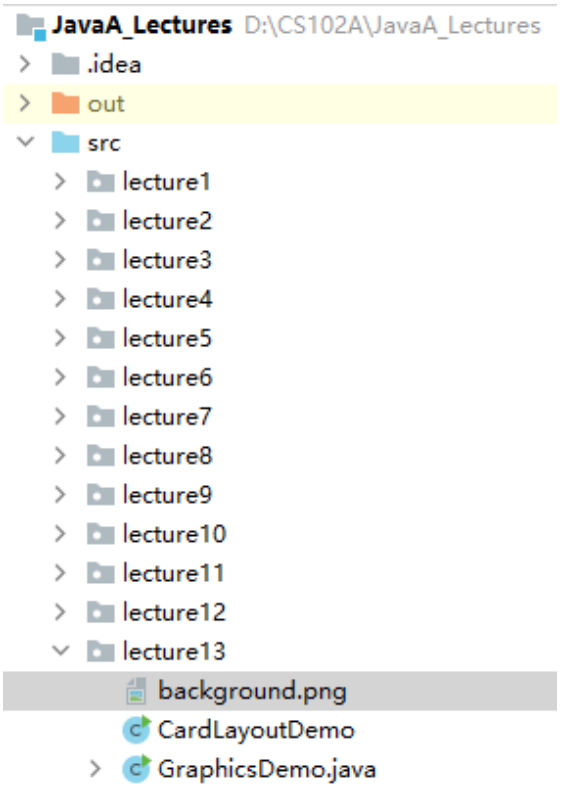


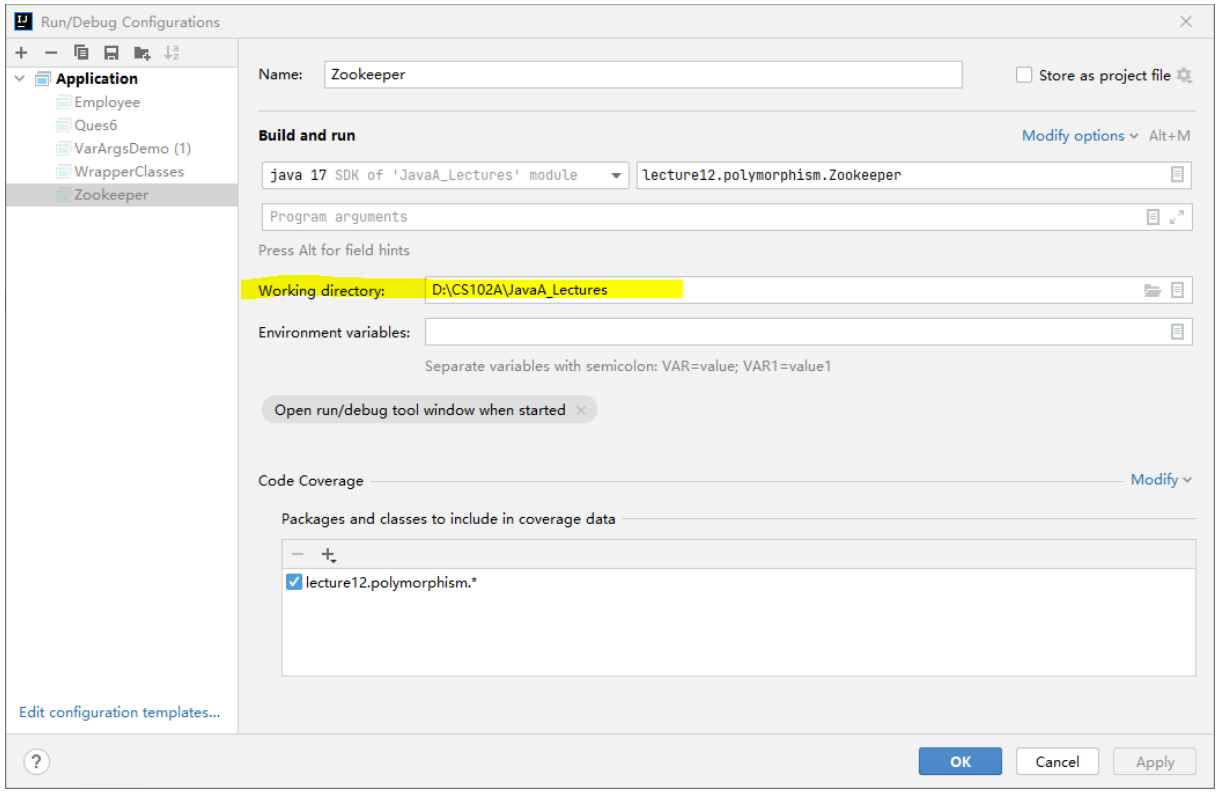
Locating a File

- Two types of paths
  - Absolute path: specifying the location of a file or directory from the root directory, i.e., a complete path (e.g., `D:\CS101\22Fall\lecture1.ppt`)
  - Relative path: the path related to the current working directory (e.g., `22Fall\lecture1.ppt` if the working directory is `D:\CS101`)

```
java.io.FileNotFoundException: D:\JavaPractice.txt (The system cannot find the path specified)
        at java.io.FileInputStream.open(Native Method)
        at java.io.FileInputStream.<init>(FileInputStream.java:120)
        at Proc.prac1.main(prac1.java:14)
```

Locating a File





Creating a File/Path Object

- Using `java.io.File` using String as absolute/relative path

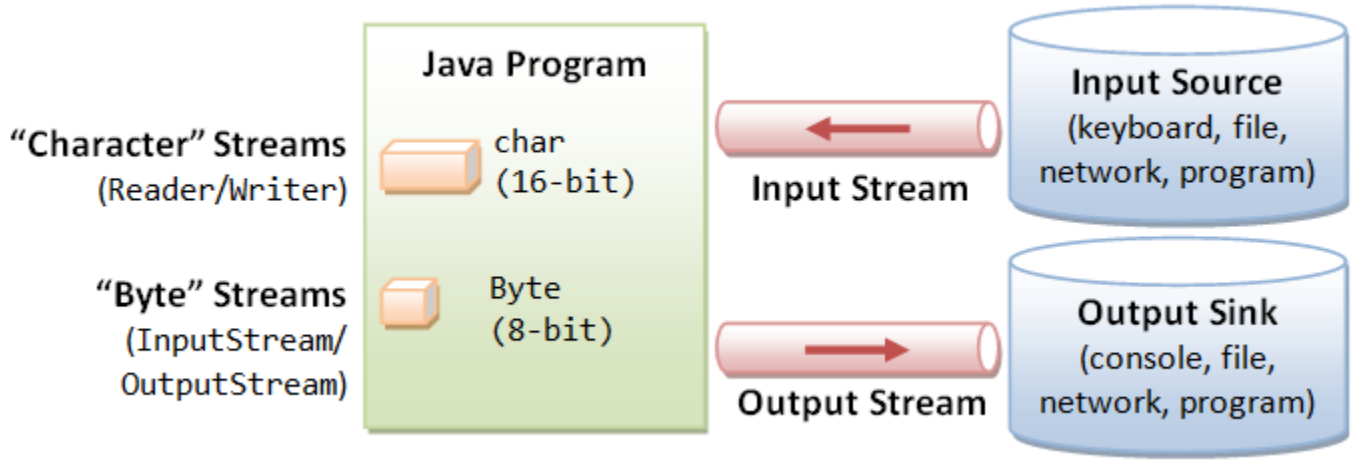
```
File text = new File("C:/temp/test.txt");
```

- Using `java.nio.Path` and `java.nio.Paths`

```
Path p1 = Paths.get("resources");
Path p2 = Paths.get(args[0]);
```

Reading/Writing data from/to a file

- Read/write by bytes
- Read/write by characters
- Read/write by lines



https://www3.ntu.edu.sg/home/ehchua/programming/java/j5b_io.html

Reading/Writing data from/to a file

- Read/write by bytes

  `java.io.FileInputStream.read()`
  `java.io.FileOutputStream.write(…)`

- Read/write by characters

  `java.io.FileReader.read()`
  `java.io.FileWriter.write(…)`

- Read/write by lines

  `java.io.BufferedReader.readLine()`
  `java.nio.file.Files.readAllLines()`
  `java.io.BufferedWriter.write(…)`
  `java.nio.file.Files.write(…)`

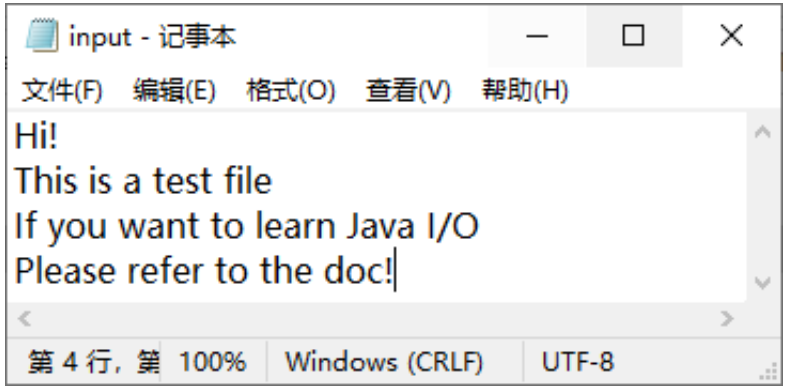
Reading lines from a file

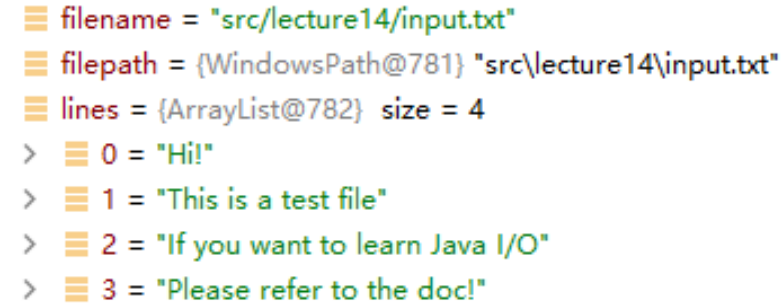
```java
import java.io.IOException;
import java.nio.file.Files;
import java.nio.file.Path;
import java.nio.file.Paths;
import java.util.List;

public class IODemo {

    public static void readFileByLines() throws IOException {
        String filename = "src/lecture14/input.txt";
        Path filepath = Paths.get(filename);
        List<String> lines = Files.readAllLines(filepath);

        for(String l: lines){
            System.out.println(l);
        }
    }
```





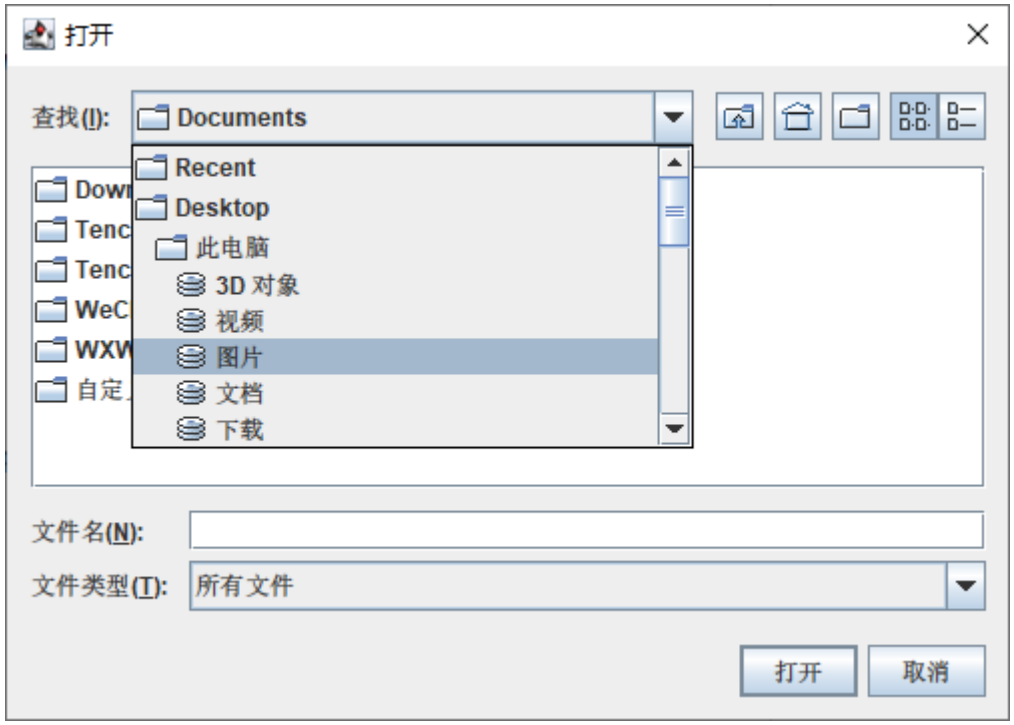
Writing data to a file

```java
public static void writeToFileByLines() throws IOException {
    List<String> data = new ArrayList<>();
    data.add("Hello ");
    data.add("World!");
    data.add("Let's learn Java!");
    Path outputPath = Paths.get( first: "src/lecture14/output.txt");
    Files.write(outputPath, data);
}
```

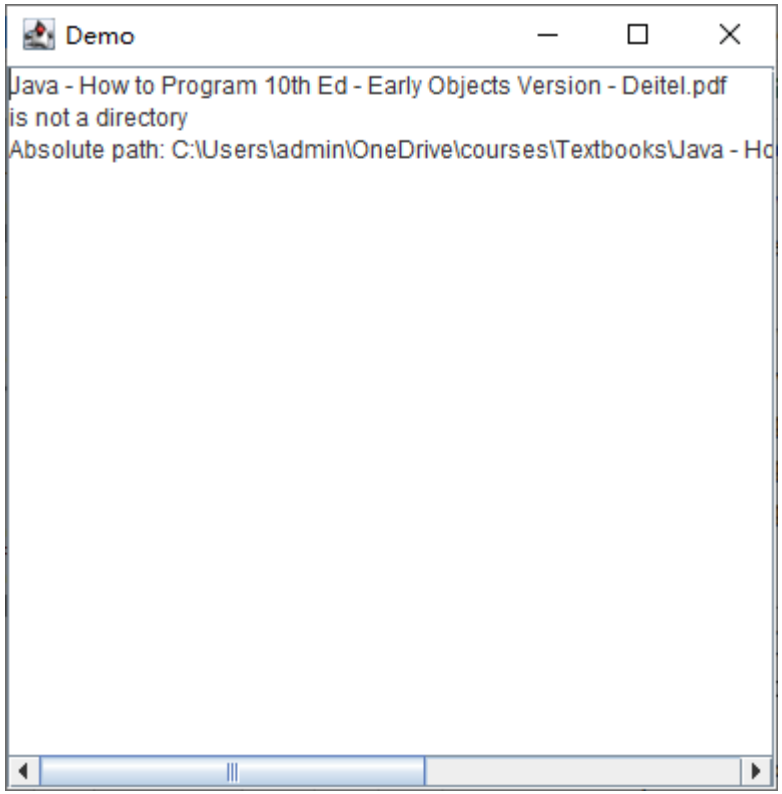
Opening Files with `JFileChooser`

Demo

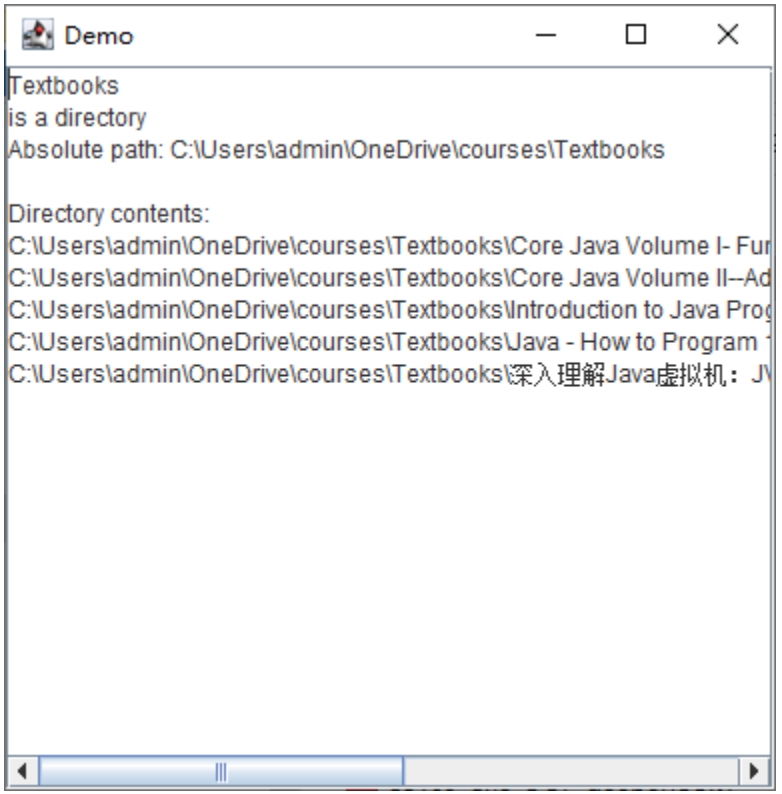
JFileChooser allows users to browse the file system and select files or directories



Demo

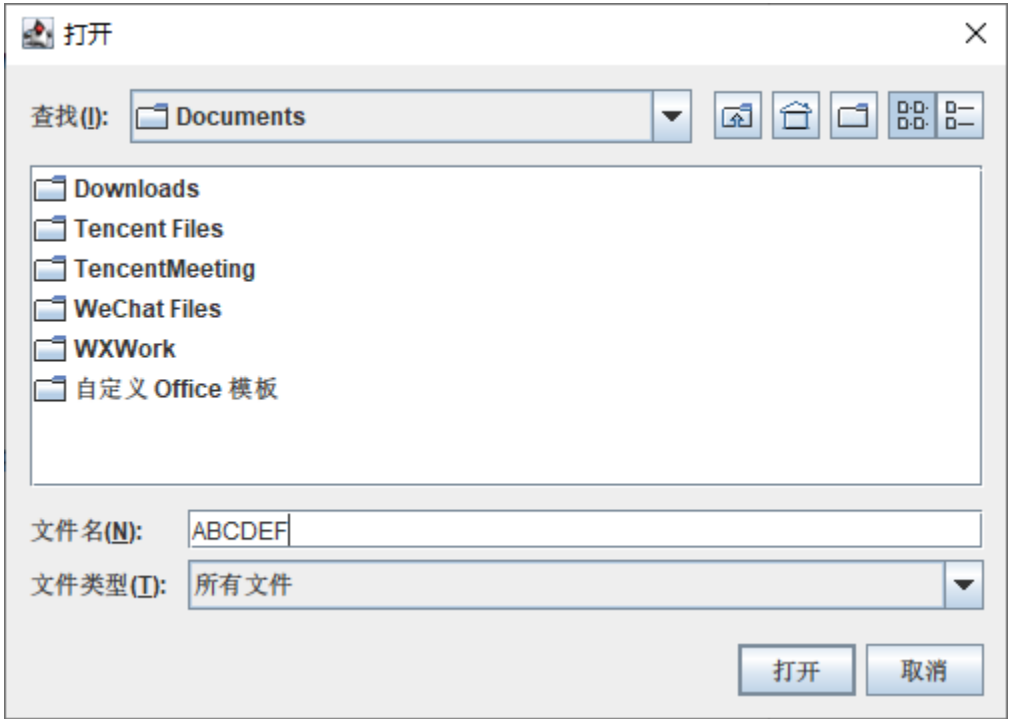


A file is chosen.



A directory is chosen.

Demo


打开
查找(I):
Documents
Downloads
Tencent Files
TencentMeeting
WeChat Files
WXWork
自定义 Office 模板
文件名(N):
ABCDEF
文件类型(T):
所有文件
打开
取消


ERROR
ABCDEF doesn't exist.
确定

Window

```
public class FileChooserDemo extends JFrame {
    // display file contents
    private final JTextArea outputArea;

    public FileChooserDemo() throws IOException {
        super( title: "Demo");

        outputArea = new JTextArea();
        // output is scrollable
        add(new JScrollPane(outputArea));

        analyzePath();
    }
```

```
public static void main(String[] args) throws IOException {
    FileChooserDemo app = new FileChooserDemo();
    app.setSize( width: 400, height: 400);
    app.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
    app.setVisible(true);
}
```

File Chooser Dialog

```
private Path getFileOrDirectory(){
    JFileChooser fileChooser = new JFileChooser();
    fileChooser.setFileSelectionMode(JFileChooser.FILES_AND_DIRECTORIES);

    int result = fileChooser.showOpenDialog( parent: this);

    if(result == JFileChooser.CANCEL_OPTION){
        System.exit( status: 1);
    }

    // return Path representing the selected file
    return fileChooser.getSelectedFile().toPath();
}
```

Display file or directory content in TextArea

```
public void analyzePath() throws IOException {
    Path path = getFileOrDirectory();
    if(Files.exists(path)){
        // gather file or directory information
        StringBuilder builder = new StringBuilder();
        builder.append(String.format("%s%n", path.getFileName()));
        builder.append(String.format("%s a directory%n", Files.isDirectory(path)?"is":"is not"));
        builder.append(String.format("Absolute path: %s%n",path.toAbsolutePath()));

        // output directory listing
        if(Files.isDirectory(path)){
            builder.append(String.format("%nDirectory contents:%n"));

            DirectoryStream<Path> directoryStream = Files.newDirectoryStream(path);
            for(Path p:directoryStream){
                builder.append(String.format("%s%n",p));
            }
        }

        outputArea.setText(builder.toString()); // display
    }
    else{
        JOptionPane.showMessageDialog( parentComponent: this,  message: path.getFileName()+" doesn't exist.",
                title: "ERROR", JOptionPane.ERROR_MESSAGE);
    }
}
```