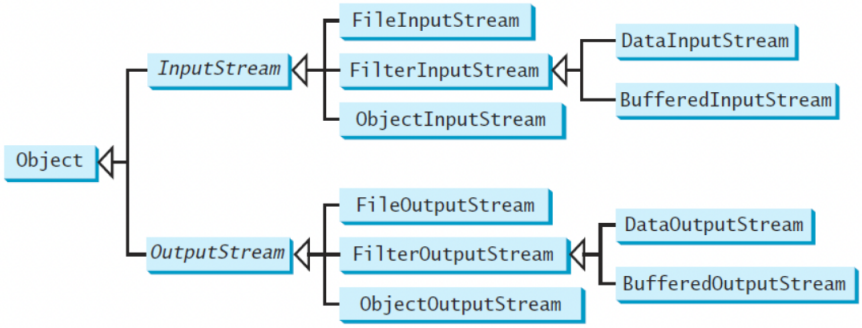
1 I/O and Regular Expressions

- Input and Output (I/O)
  - Input sources include:
    - Keyboard
    - File
    - Network
  - Output destinations include:
    - Console
    - File
    - Network
- Input and Output Streams
  - Java handles inputs and outputs using streams



- Standard I/O
  - **System.in**
    - Object of type **InputStream**
    - Typically refers to the keyboard
    - Reading data could be done using the **Scanner** class. Its methods include:
      - **String next()**
      - **int nextInt()**
      - **String nextLine()**
      - **double nextDouble()**
  - **System.out**
    - Object of type **PrintStream**
    - Typically refers to the console
- The **File** class
  - Contains methods for obtaining the properties of a file/directory and for renaming and deleting a file/directory
  - Files could be specified using absolute or relative names
  - Constructing a **File** instance does not create a file on the machine
  - Methods include:
    - **boolean createNewFile()**
    - **boolean delete()**
    - **boolean exists()**
    - **boolean isDirectory()**
    - **File [] listFiles()**
- File I/O
  - Reading could be done using the **Scanner** class
    - e.g. **Scanner input = new Scanner(new File(filename));**
  - Writing could be done using the **FileWrite** class
    - e.g. **FileWriter output = new FileWriter(filename, append);**

- Regular Expressions
  - A regular expression (abbreviated regex) is a string that describes a pattern for matching a set of strings.
  - Regular expressions provide a simple and effective way to validate user input
    - e.g. phone numbers
  - Java supports regular expressions using the **java.util.regex** package
  - The **Pattern** class can be used to define the pattern
    - The **compile** method takes a string representing the regular expression as an argument and compiles it into a pattern
  - The **Matcher** class can be used to search for the pattern. Its methods include:
    - **boolean find()**
    - **boolean matches()**
  - Example

```
Pattern pattern = Pattern.compile("H.*d");
Matcher matcher = pattern.matcher("Hello World");
System.out.println(matcher.matches());
```

- Commonly Used Regular Expressions

Regular Expression	*Matches*	*Example*
`.`	any single character	`Java` matches `J..a`
`(ab|cd)`	`ab` or `cd`	`ten` matches `t(en|im)`
`[abc]`	`a`, `b`, or `c`	`Java` matches `Ja[uvwx]a`
`[^abc]`	any character except `a`, `b`, or `c`	`Java` matched `Ja[^ars]a`
`[a-z]`	`a` through `z`	`Java` matches `[A-M]av[a-d]`
`[^a-z]`	any character except `a` through `z`	`Java` matches `J]av[^b-d]`
`[a-e[m-p]]`	`a` through `e` or `m` through `p`	`Java` matches `[A-G[I-M]]av[a-d]`
`[a-e&&[c-p]]`	intersection of `a-e` with `c-p`	`Java` matches `[A-P&&[I-M]]av[a-d]`
`\d`	a digit, same as `[0-9]`	`Java2` matches "`Java[\\d]`"
`\D`	a non-digit	`$Java` matches "`[\\D][\\D]ava`"
`\w`	a word character	`Java1` matches "`[\\w]ava[\\w]`"
`\W`	a non-word character	`$Java ` matches "`[\\W][\\w]ava`"
`\s`	a whitespace character	"`Java 2`" matches "`Java\\s2`"
`\S`	a non-whitespace character	`Java` matches "`[\\S]ava`"
p`*`	zero or more occurrences of pattern *p*	`aaaabb` matches "`a*bb`" `ababab` matches "`(ab)*`"
p`+`	one or more occurrences of pattern *p*	`a` matches "`a+b*`" `able` matches "`(ab)+.*`"
p`?`	zero or one occurrence of pattern *p*	`Java` matches "`J?Java`" `Java` matches "`J?ava`"
p`{`*n*`}`	exactly `n` occurrences of pattern *p*	`Java` matches "`J{1}.*`" `Java` does not match "`.{2}`"
p`{`*n*`,}`	at least `n` occurrences of pattern *p*	`aaaa` matches "`a{1,}`" `a` does not match "`a{2,}`"
p`{`*n*`, `*m*`}`	between `n` and `m` occurrences (inclusive)	`aaaa` matches "`a{1,9}`" `abb` does not match "`a{2,9}bb`"