http://introcs.cs.princeton.edu/java/stdlib/

**Standard libraries.**

Below is a table of the input and output libraries that we use throughout the textbook and beyond.

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| **§** | **PROGRAM** | **DESCRIPTION / JAVADOC** |
| [1.5](http://introcs.cs.princeton.edu/java/15inout/index.php#1.5) | [StdIn.java](http://introcs.cs.princeton.edu/java/stdlib/StdIn.java.html) | [read numbers and text from standard input](http://introcs.cs.princeton.edu/java/stdlib/javadoc/StdIn.html) |
| [1.5](http://introcs.cs.princeton.edu/java/15inout/index.php#1.5) | [StdOut.java](http://introcs.cs.princeton.edu/java/stdlib/StdOut.java.html) | [write numbers and text to standard output](http://introcs.cs.princeton.edu/java/stdlib/javadoc/StdOut.html) |
| [1.5](http://introcs.cs.princeton.edu/java/15inout/index.php#1.5) | [StdDraw.java](http://introcs.cs.princeton.edu/java/stdlib/StdDraw.java.html) | [draw geometric shapes in a window](http://introcs.cs.princeton.edu/java/stdlib/javadoc/StdDraw.html) |
| [1.5](http://introcs.cs.princeton.edu/java/15inout/index.php#1.5) | [StdAudio.java](http://introcs.cs.princeton.edu/java/stdlib/StdAudio.java.html) | [create, play, and manipulate sound](http://introcs.cs.princeton.edu/java/stdlib/javadoc/StdAudio.html) |
| [2.2](http://introcs.cs.princeton.edu/java/22library/index.php#2.2) | [StdRandom.java](http://introcs.cs.princeton.edu/java/stdlib/StdRandom.java.html) | [generate random numbers](http://introcs.cs.princeton.edu/java/stdlib/javadoc/StdRandom.html) |
| [2.2](http://introcs.cs.princeton.edu/java/22library/index.php#2.2) | [StdStats.java](http://introcs.cs.princeton.edu/java/stdlib/StdStats.java.html) | [compute statistics](http://introcs.cs.princeton.edu/java/stdlib/javadoc/StdStats.html) |
| [2.2](http://introcs.cs.princeton.edu/java/22library/index.php#2.2) | [StdArrayIO.java](http://introcs.cs.princeton.edu/java/stdlib/StdArrayIO.java.html) | [read and write 1D and 2D arrays](http://introcs.cs.princeton.edu/java/stdlib/javadoc/StdArrayIO.html) |
| [3.1](http://introcs.cs.princeton.edu/java/31datatype/index.php#3.1) | [In.java](http://introcs.cs.princeton.edu/java/stdlib/In.java.html) | [read numbers and text from files and URLs](http://introcs.cs.princeton.edu/java/stdlib/javadoc/In.html) |
| [3.1](http://introcs.cs.princeton.edu/java/31datatype/index.php#3.1) | [Out.java](http://introcs.cs.princeton.edu/java/stdlib/Out.java.html) | [write numbers and text to files](http://introcs.cs.princeton.edu/java/stdlib/javadoc/Out.html) |
| [3.1](http://introcs.cs.princeton.edu/java/31datatype/index.php#3.1) | [Draw.java](http://introcs.cs.princeton.edu/java/stdlib/Draw.java.html) | [draw geometric shapes](http://introcs.cs.princeton.edu/java/stdlib/javadoc/Draw.html) |
| [3.1](http://introcs.cs.princeton.edu/java/31datatype/index.php#3.1) | [Picture.java](http://introcs.cs.princeton.edu/java/stdlib/Picture.java.html) | [process digital images](http://introcs.cs.princeton.edu/java/stdlib/javadoc/Picture.html) |
| [3.2](http://introcs.cs.princeton.edu/java/32class/index.php#3.2) | [Stopwatch.java](http://introcs.cs.princeton.edu/java/stdlib/Stopwatch.java.html) | [measure running time](http://introcs.cs.princeton.edu/java/stdlib/javadoc/Stopwatch.html) |
| [–](http://introcs.cs.princeton.edu/java/15inout/index.php#%E2%80%93) | [BinaryStdIn.java](http://introcs.cs.princeton.edu/java/stdlib/BinaryStdIn.java.html) | [read bits from standard input](http://introcs.cs.princeton.edu/java/stdlib/javadoc/BinaryStdIn.html) |
| [–](http://introcs.cs.princeton.edu/java/15inout/index.php#%E2%80%93) | [BinaryStdOut.java](http://introcs.cs.princeton.edu/java/stdlib/BinaryStdOut.java.html) | [write bits to standard output](http://introcs.cs.princeton.edu/java/stdlib/javadoc/BinaryStdOut.html) |
| [–](http://introcs.cs.princeton.edu/java/15inout/index.php#%E2%80%93) | [BinaryIn.java](http://introcs.cs.princeton.edu/java/stdlib/BinaryIn.java.html) | [read bits from files and URLs](http://introcs.cs.princeton.edu/java/stdlib/javadoc/BinaryIn.html) |
| [–](http://introcs.cs.princeton.edu/java/15inout/index.php#%E2%80%93) | [BinaryOut.java](http://introcs.cs.princeton.edu/java/stdlib/BinaryOut.java.html) | [write bits to files](http://introcs.cs.princeton.edu/java/stdlib/javadoc/BinaryOut.html) |
| [–](http://introcs.cs.princeton.edu/java/stddraw3d/index.php#%E2%80%93) | [StdDraw3D.java](http://introcs.cs.princeton.edu/java/stdlib/StdDraw3D.java.html) | [3D graphics](http://introcs.cs.princeton.edu/java/stdlib/javadoc/StdDraw3D.html) |

**Using the standard libraries.**

The file [stdlib.jar](http://introcs.cs.princeton.edu/java/stdlib/stdlib.jar) bundles together all of our standard libraries into one file. There are a number of ways to access the libraries:

* *Current directory.* The easiest (but not the sanest) way to use the standard libraries to download stdlib.jar and unjar it in your current working directory.

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| % jar xf stdlib.jar |

Alternatively, you can download the individual .java files you need (such as StdIn.java) and put them in the same directory as the program you are writing. Then, compile and execute as usual.

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| % javac MyProgram.java  % java  MyProgram |

This approach has the drawback that you need a copy of each .java file you need in each directory where you need it.

* *Classpath.* Put stdlib.jar in the same directory as the program you are writing (but do not unjar it). Then, compile and execute as follows:

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| OS X / Linux  ------------  % javac -cp .:stdlib.jar MyProgram.java  % java  -cp .:stdlib.jar MyProgram  Windows  ------------  % javac -cp .;stdlib.jar MyProgram.java  % java  -cp .;stdlib.jar MyProgram |

The -cp flag sets the *classpath*. The . tells Java to look in the current directory for .java and .class files (such as MyProgram.java and MyProgram.class). The stdlib.jar tells Java to also look in the .jar file. On OS X, the : separates directories in the classpath; on Windows the ; separates directories.

* *Configure your IDE.* You can configure your IDE to automatically include stdlib.jar in the classpath. In DrJava, it is *Preferences -> Extra Classpath -> Add*.

**Standard input and standard output.**

[StdIn.java](http://introcs.cs.princeton.edu/java/stdlib/StdIn.java.html) and [StdOut.java](http://introcs.cs.princeton.edu/java/stdlib/StdOut.java.html) are libraries for reading in numbers and text from standard input and printing out numbers and text to standard output. Our versions have a simpler interface than the corresponding Java ones (and provide a few tecnical improvements). [Average.java](http://introcs.cs.princeton.edu/java/15inout/Average.java.html) reads in a sequence of real numbers from standard input and prints their average on standard output.

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| % java Average  10.0 5.0 6.0 3.0 7.0 32.0  3.14 6.67 17.71  <Ctrl-d>  Average is 10.05777777777778 |

[In.java](http://introcs.cs.princeton.edu/java/stdlib/In.java.html) and [Out.java](http://introcs.cs.princeton.edu/java/stdlib/Out.java.html) are object-oriented versions that support multiple input and output streams, including reading from a file or URL and writing to a file. [Wget.java](http://introcs.cs.princeton.edu/java/31datatype/Wget.java.html) reads in data from the URL specified on the command line and save it in a file with the same name.

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| % java Wget http://www.cs.princeton.edu/IntroProgramming/datafiles/codes.csv  % more codes.csv  United States,USA,00  Alabama,AL,01  Alaska,AK,02  ... |

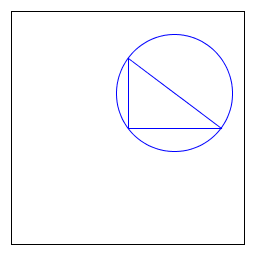
**Binary standard input and standard output.**

[BinaryStdIn.java](http://introcs.cs.princeton.edu/java/stdlib/BinaryStdIn.java.html) and [BinaryStdOut.java](http://introcs.cs.princeton.edu/java/stdlib/BinaryStdOut.java.html) are the analogs for binary data. [Copy.java](http://introcs.cs.princeton.edu/java/stdlib/Copy.java.html) reads a binary file from standard input and writes it to standard output.

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| % java Copy < mandrill.jpg > copy.jpg  % diff mandrill.jpg copy.jpg |

**Standard drawing.**

[StdDraw.java](http://introcs.cs.princeton.edu/java/stdlib/StdDraw.java.html) is an easy-to-use library for drawing geometric shapes, such as points, lines, and circles. [RightTriangle.java](http://introcs.cs.princeton.edu/java/15inout/RightTriangle.java.html) draws a right triangle and a circumscribing circle.

  % java RightTriangle  


[BouncingBall.java](http://introcs.cs.princeton.edu/java/15inout/BouncingBall.java.html) illustrates how to produce an animation using standard drawing.

[Draw.java](http://introcs.cs.princeton.edu/java/stdlib/Draw.java.html) is an object-oriented versions that support drawing in multiple windows.

**Standard audio.**

[StdAudio.java](http://introcs.cs.princeton.edu/java/stdlib/StdAudio.java.html) is an easy-to-use library for synthesizing sound. [Tone.java](http://introcs.cs.princeton.edu/java/15inout/Tone.java.html) reads in a frequency and duration from the command line, and it sonifies a sine wave of the given frequency for the given duration.

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| % java Tone 440.0 3.0 |

**Image processing.**

[Picture.java](http://introcs.cs.princeton.edu/java/stdlib/Picture.java.html) is an easy-to-use library for image processing. [Scale.java](http://introcs.cs.princeton.edu/java/31datatype/Scale.java.html) takes the name of a picture file and two integers (width w and height h) as command-line arguments and scales the image to w-by-h.

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| |  | | --- | | **% java Scale mandrill.jpg 298 298** |   298-by-298 | |  | | --- | | **% java Scale mandrill.jpg 200 200** |   200-by-400 | |  | | --- | | **% java Scale mandrill.jpg 200 400** |   200-by-400 |

**Q + A**

**Q.** Can I use your code in my project?

**A.** Our libraries stdlib.jar and algs4.jar are released under the [GNU General Public License, version 3 (GPLv3)](http://www.gnu.org/copyleft/gpl.html). If you wish to license the code under different terms, please contact our publisher to discuss.

**Q.** If I use a named package to structure my code, the compiler can no longer access the libraries in stdlib.jar. Why not?

**A.** The libraries in stdlib.jar are in the "default" package. In Java, you can't access classes in the default package from a named package. If you need to use our libraries with a named package, you can use the packaged version [stdlib-package.jar](http://introcs.cs.princeton.edu/java/stdlib/stdlib-package.jar).

*Warning:* if you are taking Princeton COS 126, you must use the default package verison of our libraries to facilitate grading.