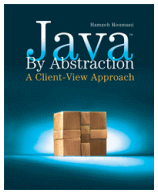

Chapter 3

Using APIs

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Outline

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3.1.1 Overall Layout

Packages	Details
	The Class section
Classes	The Field section
	The Constructor section
	The Method section

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3.1.2 Fields

Field Summary

`static double`	**PI** The `double` value that is closer than any other to *pi*, the ratio of the circumference of a circle to its diameter.

Field Detail

PI

```
public static final double PI
```

The double value that is closer than any other to pi, the ratio of the circumference of a circle to its diameter.

See Also: Constant Field Values

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3.1.3 Methods

The Math class of java.lang

Method Summary

static double	**abs** (double a) Returns the absolute value of a double value.
static int	**abs** (int a) Returns the absolute value of an int value.
static double	**pow** (double a, double b) Returns the value of the first argument raised to the power of the second argument.

The Scanner class of java.util

Method Summary

double	**nextDouble** () Scans the next token of the input as an double.
int	**nextInt** () Scans the next token of the input as an int.
String	**nextLine** () Advances this scanner past the current line and returns the input that was skipped.
long	**nextLong** () Scans the next token of the input as an long.

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Method Detail

abs

public static double abs(double a)

Returns the absolute value of a double value. If the argument is not negative, the argument is returned. If the argument is negative, the negation of the argument is returned. Special cases:

- If the argument is positive zero or negative zero, the result is positive zero.
- If the argument is infinite, the result is positive infinity.
- If the argument is NaN, the result is NaN.

Parameters:
a – the argument whose absolute value is to be determined
Returns:
the absolute value of the argument.

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Key points to remember about methods

- Methods can be "Overloaded"
- A class cannot have two methods with the same signature (even if the return is different).
- If the signatures are different, methods can have the same name
  - this situation is an example of "overloading"

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Key points to remember about methods

- "Binding with Most Specific"
- Situation: the invocation `C.m(…);`
  - `C` is a class name, `m` is the name of the method *invoked* on `C`
- During compilation, the compiler (javac) attempts to:
  1. locate the class `C`, and then
  2. locate the method `m` (that is, the method with the signature specified by the "…" in the *invocation*)

This is called binding (as in "to bind `C.m(…)`")

- If #1 fails, No Class Definition Found error is issued
- If #2 fails, "cannot find symbol" error is issued
- For #2, if more than one such m is found, the compiled picks the "most specific" one.

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3.2 A Development Walkthrough

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3.2.1 The Development Process

- Analysis — The Requirement: Input & its validation Output & its formatting
- Design
- Implementation
- Testing
- Deployment

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The Development Process

- Analysis
- Design — An algorithm (function) that determines the output given the input.
- Implementation
- Testing
- Deployment

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The Development Process

- Analysis
- Design
- Implementation — Turn the algorithm into a program
- Testing
- Deployment

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The Development Process

- Analysis
- Design
- Implementation
- Testing — Does the program meet the requirement?
- Deployment

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The Development Process

- Analysis
- Design
- Implementation
- Testing
- Deployment — Installation, porting, training, support…

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3.2.5 Input Validation

Invalid inputs are the cause of most errors in programs. Therefore, upon encountering one, a program must either:

- **Print a message and end**
- **Print a message then allow the user to retry several times or decide to abort.**
- **Trigger a runtime error; i.e. crash.**

For now, let us use the 3rd via a method in Toolbox:

```
static void crash(boolean, String)
```

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3.2.6 Assertions

A simple yet powerful tool to guard against errors that arise from misunderstandings.

Whenever you believe that some non-trivial condition is true, assert it, e.g.

```
assert payment >=0;
```

You cannot assert a validation because user input is not under your control. Hence, do not confuse assert (a Java statement) with crash (a method).

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3.3 General Characteristics of Utility Classes

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3.3.1 Memory Diagrams

Let us compile and load the program, Circle, which uses a field and a method in the Math utility class.

```
import java.util.Scanner;
import java.io.PrintStream;

public class Circle
{
   public static void main(String[] args)
   {
      Scanner input = new Scanner(System.in);
      PrintStream output = System.out;
      output.print("Enter radius: ");
      int radius = input.nextInt();
      output.println(Math.PI * Math.pow(radius, 2));
   }
}
```

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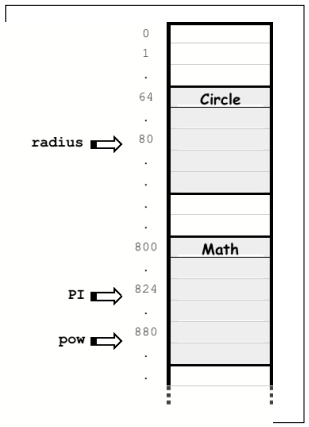
Memory Diagrams



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3.3.2 Advantages of Utility Classes

Simplicity

- To access a static field f in a class C, write: C.f
- To invoke a static method m in a class C, write C.m(…)
- There is only one copy of a static class in memory

Suitability

- A utility class is best suited to hold a groups of methods that do not hold state, e.g. java.lang.Math.
- Even in non-utility classes, static is best suited for features that are common to all instances, e.g. the MAX_VALUE field and the parseInt method of the (non-utility) class: Integer.

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3.3.3 Case Study: Dialog I/O

Two static methods in:

`javax.swing.JOptionPane`

- **To display a message:**

```
void showMessage(null, message)
```

- **To prompt for and read an input:**

```
String showInputDialog(null, prompt)
```

Note that showInputDialog returns a String. Hence, if you use it to read a number, you must invoke one of the parse methods in the corresponding wrapper class.

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