Implementation-Defined Behavior

The term ***implementation-defined*** will arise often enough that it's worth taking a moment to discuss it. The C standard deliberately leaves parts of the language unspecified, with the understanding that an "implementation"—the software needed to compile, link, and execute programs on a particular platform—will fill in the details. As a result, the behavior of the program may vary somewhat from one implementation to another. The behavior of the / and % operators for negative operands in C89 is an example of implementation-defined behavior.

Leaving parts of the language unspecified may seem odd or even dangerous, but it reflects C's philosophy. One of the language's goals is efficiency, which often means matching the way that hardware behaves. Some CPUs yield –1 when –9 is divided by 7, while others produce –2; the C89 standard simply reflects this fact of life.

It's best to avoid writing programs that depend on implementation-defined behavior. If that's not possible, at least check the manual carefully—the C standard requires that implementation-defined behavior be documented.

Operator Precedence and Associativity

When an expression contains more than one operator, its interpretation may not be immediately clear. For example, does `i + j * k` mean "add `i` and `j`, then multiply the result by `k`," or does it mean "multiply `j` and `k`, then add `i`"? One solution to this problem is to add parentheses, writing either `(i + j) * k` or `i + (j * k)`. As a general rule, C allows the use of parentheses for grouping in all expressions.

What if we don't use parentheses, though? Will the compiler interpret `i + j * k` as `(i + j) * k` or `i + (j * k)`? Like many other languages, C uses ***operator precedence*** rules to resolve this potential ambiguity. The arithmetic operators have the following relative precedence:

Highest:	+	-	(unary)
	*	/	%
Lowest:	+	-	(binary)

Operators listed on the same line (such as + and -) have equal precedence.

When two or more operators appear in the same expression, we can determine how the compiler will interpret the expression by repeatedly putting parentheses around subexpressions, starting with high-precedence operators and working down to low-precedence operators. The following examples illustrate the result:

`i + j * k`	is equivalent to	`i + (j * k)`
`-i * -j`	is equivalent to	`(-i) * (-j)`
`+i + j / k`	is equivalent to	`(+i) + (j / k)`

Operator precedence rules alone aren't enough when an expression contains two or more operators at the same level of precedence. In this situation, the *associativity*