The values of primitive type boolean are **true** and **false**. The operators are:

! (meaning negation, of complement. !**true** is **false** and !**false** is **true**)

&& (and, or conjunction. b && c is **true** iff both b and c are **true**; otherwise it is **false**)

|| (or, or disjunction. b || c is **true** if b or c (or both) is **true**; otherwise it is **false**)

**Operator precedences**

Operator ! has highest precedence, then &&, and finally ||. There is no universal tradition for the relative precedences of && and ||, and we recommend always using parentheses when they appear next to each other in an expression, as in

(x < 5 && y == 5) || z == 2

**Short circuit evaluation**

Operations b && c and b || c are evaluated left-to-right using *short-circuit evaluation*. That means that as soon as the answer is known, evaluation stops. There are two cases to explain:

**false** && c evaluation does *not evaluate* c; it simply yields the value **false**

**true** || c evaluation *does not evaluate* c; it simply yields the value **true**

Short-circuit evaluation helps to shorten and simplify code. For example, the following expression is true iff j is not 0 and k / j is most 50; division by 0 does not occur if j is 0:

j != 0 && k / j <= 50

**Expressions with boolean values**

Relational expressions d == e, d != e, d < e, d <= e, d > e, and d >= e all evaluate to a boolean value —either **true** or **false**— and can thus be used in boolean expressions.

**Operators & and |**

Operators & and | can also be used but we recommend against their use as boolean operations. They are *bitwise* operations, and we do not discuss them. Short-circuit evaluation is not used for them.

**Comparison with other languages**

Some languages, e.g. C, use integers as booleans; 0 represents **false** and any other integer represents **true**. This does not work in Java.

**The marks of a boolean tyro**

A *tyro* is a beginner, a novice. It is pronounced *tīrō*, like *gyro* in the word *gyroscope*. It has nothing to do with *gyro,* that Greek fast food delicacy, wrapped in pita bread.

There’s nothing wrong with being a boolean tyro. We were all boolean tyros once. But tyros sometimes don’t want other to know they are tyros. If you don’t, stay away from the following two marks of a boolean tyro. First, if you have a boolean variable isFemale, don’t write:

**if** (isFemale == **true**) …

Instead write:

**if** (isFemale) …

You see, the two expressions isFemale == **true** and isFemale evaluate to the same value; they are equal. In the same way, instead of isFemale == **false**, write !isFemale .

The second mark of a boolean tyro is the use of if-statements like the following:

**if** (isFemale) **return** **true**;  
 **else** **return** **false**;

This statement returns true if isFemale is true and false if it is not. So why not just write:

**return** isFemale;

Similarly, instead of:

**if** (atHome || atWork) b= **true**;  
 **else** b= **false**;

write: b= atHome || atWork;