Boolean Expressions

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3B - Boolean Expressions (author: Tao Yue, state: unchanged)

Boolean expressions are used to compare two values and get a `true-or-false` answer:

```
value1 relational_operator value2
```

The following relational operators are used:

```
<  less than
>  greater than
=  equal to
<= less than or equal to
>= greater than or equal to
<> not equal to
```

You can assign Boolean expressions to Boolean variables. Here we assign a `true` expression to some_bool:

```
some_bool := 3 < 5;
```

Complex Boolean expressions are formed by using the Boolean operators:

```
not negation (~)
and conjunction (^)
or disjunction (v)
xor exclusive-or
```

`NOT` is a unary operator — it is applied to only one value and inverts it:

- `not true = false`
- `not false = true`

`AND` yields `TRUE` only if both values are `TRUE`:

- `TRUE and FALSE = FALSE`
- `TRUE and TRUE = TRUE`

`OR` yields `TRUE` if at least one value is `TRUE`:

- `TRUE or TRUE = TRUE`
- `TRUE or FALSE = TRUE`
- `FALSE or TRUE = TRUE`
- `FALSE or FALSE = FALSE`

`XOR` yields `TRUE` if one expression is `TRUE` and the other is `FALSE`. Thus:

- `TRUE xor TRUE = FALSE`
- `TRUE xor FALSE = TRUE`
- `FALSE xor TRUE = TRUE`
- `FALSE xor FALSE = FALSE`

When combining two Boolean expressions using relational and Boolean operators, be careful to use parentheses.

```
(3>5) or (650<1)
```

This is because the Boolean operators are higher on the order of operations than the relational operators:

1. `not`
2. `* / div mod and`
3. `+ - or`
4. `< > <= >= = <>`

So `3 > 5 or 650 < 1` becomes evaluated as `3 > (5 or 650) < 1`, which makes no sense, because the Boolean operator or only works on Boolean values, not on integers.

The Boolean operators (`AND, OR, NOT, XOR`) can be used on Boolean variables just as easily as they are used on Boolean expressions.

Whenever possible, don't compare two real values with the equals sign. Small round-off errors may cause two equivalent expressions to differ.

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