EQUALITY & RELATIONAL & LOGICAL OPERATORS

zyBook 3.2, zyBook 3.4, zyBook 3.10, zyBook 3.11

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EQUALITY AND RELATIONAL OPERATORS

- Compare two expressions
- Result in boolean (true or false)
- Only use with primitive data!

Operator	Meaning	Example	Value
==	Equal to	`2 + 2 == 4`	`true`
!=	Not equal to	`3.2 != 4.1`	`true`
<	Less than	`4 < 3`	`false`
>	Greater than	`4 > 3`	`true`
<=	Less than or equal to	`2 <= 0`	`false`
>=	Greater than or equal to	`2.4 >= 1.6`	`true`

LOGICAL OPERATORS

- Conditions can be combined with logical operators

Operator	Description	Example	Result
`&&`	AND	`(2 == 3) && (-1 < 5)` `false && true`	`false`
`||`	OR	`(2 == 3) || (-1 < 5)` `false || true`	`true`
`!`	NOT	`!(2 == 3)` `!(false)`	`true`

- We use truth tables to evaluate logical operators.

p	q	!p	p && q	p || q
true	**true**	false	**true**	true
true	false	false	false	true
false	true	true	false	true
false	**false**	true	false	**false**

“EXCLUSIVE OR” VS. “INCLUSIVE OR”

- Or in natural language
  - exclusive or
  - A is true or B is true, not both
- Or in programming language
  - inclusive or
  - A is true or B is true or both A and B are true

- Example
  - 2 > 3 || 4 < 5

    false || true

    true
  - 2 < 3 || 4 < 5

    true || true

    true

DE MORGAN'S LAW

- Rules used to negate boolean tests.
- Useful when you want the opposite of an existing test.

Original Expression	Negated Expression	Simplified Expression
a && b	!(a && b)	!a || !b
a || b	!(a || b)	!a && !b

EXAMPLE – DE MORGAN'S LAW

Q: Negate (x > y) && (y > z)

! ((x > y) && (y > z))

! (x > y) || ! (y > z)

x <= y || y <= z

Q: Negate (x == y) || (x <= z)

! ((x == y) || (x <= z))

! (x == y) && ! (x <= z)

x != y && x > z

PRECEDENCE REVISITED

If two operations are at the same precedence order, evaluate from left to right with the exception of assignment operators that are evaluated right to left.

1. Parentheses: ()
2. Unary operators: +, -, !
3. Multiplicative operators: *, /, %
4. Additive operators: +, -
5. Relational operators: <, >, <=, >=
6. Equality operators: ==, !=
7. Logical AND: &&
8. Logical OR: ||
9. Assignment operators: =, +=, -=, *=, /=, %=

ONE MORE EXAMPLE

Q: Determine the truth value of

false || true && -5 / 2 + (13 + 6) < 19

false || true && -5 / 2 + 19 < 19

false || true && -2 + 19 < 19

false || true && 17 < 19

false || true && true

false || true

true

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