

## 1 Boolean Algebra

In the classical algebra, we deal with sets of numbers and operations over them. Example for sets:

- $\mathbb{N} = \{1, 2, 3, \dots\}$
- $\mathbb{Z} = \{\dots, -3, -2, -1, 0, 1, 2, 3, \dots\}$
- $\mathbb{R} = \{\dots, -1.1, \dots, -1, \dots, 0, \dots, 1, \dots, 1.1, \dots\}$

In Java, we can work with these numbers using integer or double variables.

```
int a = 1;
```

```
int b = 2 + 3;
```

The operations for this algebra include:

- $+, -, \times, \div, \dots$

In Java, we can operate over numbers using arithmetic operators.

```
int c = a + b;
```

```
int d = c * b;
```

In the Boolean algebra, we work with a new set

$$\mathbb{B} = \{true, false\}$$

which contains only two values: *true* and *false*. In Java, we can work with these values using boolean variables.

```
int a = true;
```

```
int b = 1 > 0;
```

```
int c = 1 == 1;
```

The operations over this set are three and are defined the following manner:

- AND (&&)
  - $true \ \&\& \ true = true$
  - $true \ \&\& \ false = false$
  - $false \ \&\& \ true = false$
  - $false \ \&\& \ false = false$
- OR (||)
  - $true \ || \ true = true$
  - $true \ || \ false = true$
  - $false \ || \ true = true$
  - $false \ || \ false = false$
- NOT (!)
  - $! \ true = false$
  - $! \ false = true$

In Java, we can operate over booleans using boolean operators.

```
boolean d = true && false;
```

```
boolean e = true || true;
```

```
boolean f = d && e;
```

```
boolean g = d || e;
```

## 2 Exercises

1. Write a program that takes a bi-dimensional coordinate  $(x, y)$  and outputs which quadrant it belongs to.
2. Write a classifier of triangles according to their side lengths. A triangle can be in only one of the following classes.
  - Equilateral: All sides have equal lengths.
  - Isosceles: Only two sides have equal lengths.
  - Scalene: All sides have different lengths.
3. The Brazilian electoral legislation defines the following rules for the eligibility to vote. If the citizen is
  - younger than 16, then they **may not** vote;
  - between 16 (inclusive) and 18 (exclusive) years old or older than 64 years old, then they **may** vote;
  - between 18 (inclusive) and 65 (exclusive) years old, then they **must** vote.

Now write a program that informs a citizen's eligibility to vote, based on their age.

4. The body mass index (*bmi*) is calculated according to the following formula:  $bmi = \frac{mass(Kg)}{height^2(m)}$ . Based on the result, a person is classified according to the following table:

Gender	<i>bmi</i>	Class
Male	$bmi \leq 20.7$	underweight
	$20.7 < bmi \leq 26.4$	normal
	$26.4 < bmi \leq 31.1$	overweight
	$31.1 < bmi$	obese
Female	$bmi \leq 19.1$	underweight
	$19.1 < bmi \leq 25.8$	normal
	$25.8 < bmi \leq 32.3$	overweight
	$32.3 < bmi$	obese

## 3 Summary

- Truth Tables:

OR (  )	True	False
True	True	True
False	True	False

AND (&&)	True	False
True	True	False
False	False	False

NOT (!)	
True	False
False	True

- Next Lesson: While

## 4 References

- W3C Tutorial:
  - [https://www.w3schools.com/java/java\\_booleans.asp](https://www.w3schools.com/java/java_booleans.asp)
- Exercises: <https://www.w3schools.com/java/exercise.asp>
  - Java Booleans