

Programming 1

Lesson 06 – Arithmetic Operation



Arithmetic Operation

Arithmetic Operation

- ◆ Java supports 5 basic arithmetic operations:
 - +
 - -
 - *
 - /
 - %
- ◆ The first 4 operations are really straight forward, which is almost the same as what we have learn in primary school.

Arithmetic Operation

◆ $3 + 5$

◆ $3 * 6$

◆ $7 - 4$

◆ $3.1 + 4.2$

◆ $98 * 97$

◆ $107 * 109$

◆ $543 / 3$

Arithmetic Operation

◆ Now, let's take a look at some other examples:

- $3.1 + 4$
- $5.33 - 2$
- $7 * 4.0$
- $5 / 2$
- $9.3 / 2$
- $1 / 2 * 2$

Arithmetic Operation

- ◆ The difference between these questions and the ones on the page before is: the two operation numbers may have or may not have the same data type.
- ◆ Here we have to remember that, floating number is much more accurate than int, and Java cares about accuracy. In this case, **if you have two numbers with different data types, then Java will automatically convert the number with lower accuracy to the data type with higher accuracy.**
 - **int + double equals double**
 - **int + long equals long**
 - **byte + int = int**

Arithmetic Operation



Notice:

- char + char equals int
- char + int equals int
- char + float equals float
- boolean cannot add with other data types



If you have int / int, the result will always be int, and the decimal part will be discarded (not rounded).

Arithmetic Operation: %

- ◆ % is called **modulo**, or “**mod**” for short, which is **the remaining part after you applying division**.
- ◆ % can be calculated in two steps:
 - Step 1: $A / B = C$
 - Step 2: $A - B * C = \text{result}$
- ◆ Example:
 - $11 \% 4$: (1) $11 / 4 = 2$ (2) $11 - 4 * 2 = 3$
 - $4 \% 11$: (1) $4 / 11 = 0$ (2) $4 - 11 * 0 = 4$
 - $-7 \% 3$: (1) $-7 / 3 = -2$ (2) $-7 - 3 * (-2) = -1$
 - $7 \% -3$: (1) $7 / (-3) = -2$ (2) $7 - (-3) * (-2) = 1$

Arithmetic Operation: %

- ◆ An easy way to understand how $A \% B$ works is:
- ◆ Assume you have $\$A$ in your pocket, and you go to a grocery store, find something you like worth $\$B$, since you like it soooooo much, you want to buy as many of it as possible, and $A \% B$ equals the amount of money you have in the end in your pocket.
- ◆ For example: $13 \% 3$ can be understood as: You have $\$13$, and each bag of chips worth $\$3$, you can buy 4 bags of them, and in the end you will have $\$1$ left in your pocket.

Arithmetic Operation: %

- ◆ Then someone may ask: Why we need to learn mod?
- ◆ Well, in computer science, you might need to use mod for many algorithm:
- ◆ For example:
 - If you have an int number, and you want to know whether it is even or odd, then you can mod it by 2, if the remaining part is 0, then it is even, else if it is 1, then it is odd.
 - If you are creating a rainbow color background repeatedly with 100 lines: we can generate numbers in range [0, 99), and mod the number, and give result 0 to 6 different colors.

Arithmetic Operation: Order

- ◆ Notice: **Java can only calculate one operation at a time.**
- ◆ If you have different operations mix in one formula, you have to calculate them **one by one based on the order.**
- ◆ *** / % has higher priority than + and –**
- ◆ You can always use () to change the order
- ◆ $3.3 + 18 / 4 - 4 \% (4 + 1)$

Arithmetic Operation: Order

- ◆ Java style guide suggests to add space between binary operators (operators with 2 numbers)
- ◆ Java: $3.1 + 18 / 4 - 4 \% (4 + 1)$
- ◆ Python: $3.1 + 18/4 - 4\%(4 + 1)$

Arithmetic Operation: Hands on

- ◆ Assume you have someone's birthyear, and you want to know
 - which century was she / he born, how to calculate it?
 - Example: 1986 -> 20

 - which decade was she / he born, how to calculate it?
 - Example: 1986 -> 80

Arithmetic Operation: Hands on

- ◆ Assume you go to a restaurant, and ordered something \$6 and \$18, you have to pay 5% federal tax, and 9.95% provincial tax, and then 15% of tax based on the price with tax. How much you do have to pay in total?



Questions?