Programming4kids
Division and Modulus

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Multiples (مضاعفات)

- 4 * 1 = 4, 4 * 2 = 8, 4*3 = 12, 4*4 = 16, 4 * 5 = 20, 4*6 = 24, …
- So for 4: 4, 8, 12, 16, 20, 24, 28, 32
- For 5: 5, 10, 15, 20, 25, 30, 35, 40, …
- What is the biggest multiple of 5 less than 30? 25

Division: Integer and fraction parts

- $6 / 2 = 3$
- $12 / 2 = (6+6)/2 = 6/2 + 6/2 = 3 + 3 = 6$
- $20 / 2 = (12 + 8)/2 = 6 + 4 = 10$
- $21 / 2 = (20 + 1)/2 = 10+0.5 = 10.5$ (integer part = 10, fraction part = 0.5)
- $25 / 5 = 5$
- $26 / 5 = 25/5 + \frac{1}{5} = 5.2$
- $27 / 5 = 25/5 + \frac{2}{5} = 5.4$
- $28 / 5 = 25/5 + \frac{3}{5} = 5.6$
- $29 / 5 = 25/5 + \frac{4}{5} = 5.8$
- $30 / 5 = 30/5 = 6$

Division in C++

```cpp
06_1.cpp ⌧
 1  #include<iostream>
 2  using namespace std;
 3
 4⊖ int main() {
 5      cout << 25 / 5 << "\n";
 6      cout << 26 / 5 << "\n";
 7      cout << 27 / 5 << "\n";
 8      cout << 28 / 5 << "\n";
 9      cout << 29 / 5 << "\n";
10      cout << 30 / 5 << "\n";
11      cout << 31 / 5 << "\n";
12      cout << "******\n";
13      cout << 25 / 5.0 << "\n";
14      cout << 26 / 5.0 << "\n";
15      cout << 27.0 / 5 << "\n";
16      cout << 28.0 / 5.0 << "\n";
17      cout << 29.0 / 5.0 << "\n";
18      cout << 30.0 / 5.0 << "\n";
19      cout << 31.0 / 5 << "\n";
20
21      return 0;
22  }
23
```

```
Console ⌧

<terminated> z
5
5
5
5
5
6
6
******
5
5.2
5.4
5.6
5.8
6
6.2
|
```

- If both numbers are integers, only integer part is result
  - Fraction is ignored
  - E.g. 27/5 = 5.4 ⇒ 5
- If any of numbers in double style, then normal math
  - 27/5 ⇒ 5.4

Division by 10s

```cpp
06_2.cpp

1  #include<iostream>
2  using namespace std;
3
4  int main() {
5      int num = 12345;
6
7      cout<<num/10<<"\n";
8      cout<<num/100<<"\n";
9      cout<<num/1000<<"\n";
10     cout<<num/10000<<"\n";
11     cout<<num/100000<<"\n";
12
13     cout<<"*********\n";
14
15     cout<<num/10.0<<"\n";
16     cout<<num/100.0<<"\n";
17     cout<<num/1000.0<<"\n";
18     cout<<num/10000.0<<"\n";
19     cout<<num/100000.0<<"\n";
20
21
22     return 0;
23 }
```

```
Console ✕

<terminated> zte
1234
123
12
1
0
*********
1234.5
123.45
12.345
1.2345
0.12345
```

- Dividing by 10 removes last digit
- Dividing by 100 remove last 2 digits and so on
- Notice num/1000 is same as num/10/10/10

Even and odd (زوجي وفردي)

- Even number is divisible by 2   (قابلية القسمة)
  - E.g. 2, 4, 6, 8, 10, 12, …
  - 8/2 = 4 ⇒ Even
  - So always **number.0**
- Odd number is not divisible by 2
  - E.g. 1, 3, 5, 7, 11, …
  - Let's divide them by 2
  - ½ = 0.5
  - 3/2 = 1.5
  - So 0.5   1.5   2.5   3.5   4.5   5.5
  - Like 0.5 + (1, 2, 3, 4, 5….)
  - So always **number.5**

# Conversions

```cpp
#include<iostream>
using namespace std;

int main() {
    // 8/3 = 2.6666666666666 ..... 6666
    double num = 8/3.0;

    cout<<num<<"\n";

    int res = (int)num; // casting
    cout<<res<<"\n";

    char ch = 'a';
    int ch_value = (int)ch;

    cout<<ch_value<<"\n";

    cout<<(int)'a'<<" "<<(int)'z'<<"\n";
    cout<<(int)'A'<<" "<<(int)'Z'<<"\n";

    return 0;
}
```

Console ⊠   Problems   Tasks   Properties
<terminated> ztemp [C/C++ Application] /home/moust
2.66667
2
97
97 122
65 90

- We can convert double to integer
  - The fraction part will be removed
- Notice also chars canverted to integer
  - Every letter has a number
  - E.g. small 'a' is 97
  - Notice why 'A' is smaller than 'a'
- To convert using (int)something

Modulus operation (باقي القسمة)
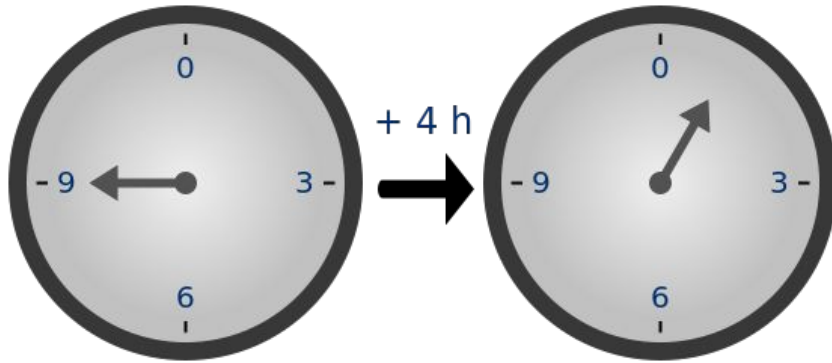
- Let's use **12-hour Clock Cycle**
- If it is 9 now, what time:
- after 12 h? Still 9
- after 4 h? 1
- after 16 (4 + 12) h? 1
- after 17 (5 + 12) h? 2
- after 29 (5 + 2*12) h? 2
- before 24 (2*12) h? 9
- before 25 (1+2*12) h? 8
- **Every multiple of 12 is useless**

Modulus operation

- a modulus n = a % n = finds the remainder after division by n:
- let a = 27, n = 12, then r = a % n?
- 27 / 12 = (2*12 + 3)/12 = 2 + **3**/12 = 2.25 (العدد العشري)
  - 2 = Integer division part = called the quotient (الجزء الصحيح)
    - Means we have maximum 2 multiples of 12 (2*12 = 24 <= 27)
  - 0.25 = fractional part (الجزء العشري)
  - 3 (remainder) of division = 27 - 24 = (باقي القسمة)
- 27 % 12 = 3 ⇒ Remainder of division (must be < 12)

Modulus operation

- 25 / 5 = 25/5 + 0/5 = 5
- 26 / 5 = 25/5 + $\frac{1}{5}$ = 5.2
- 27 / 5 = 25/5 + $\frac{2}{5}$ = 5.4
- 28 / 5 = 25/5 + $\frac{3}{5}$ = 5.6
- 29 / 5 = 25/5 + $\frac{4}{5}$ = 5.8
- 30 / 5 = 30/5 + 0/5 = 6

- 25 % 5 = 0
- 26 % 5 = 1
- 27 % 5 = 2
- 28 % 5 = 3
- 29 % 5 = 4
- 30 % 5 = 0
- Answer must be < 5

Modulus operation

- let a = 27, n = 7, then r = 27 % 7?
- 27 / 7 = (3*7 + 6)/7 = 3 + **6**/7 = 3.85714285714
  - 3 = Integer division part
    - Means we have maximum 3 multiples of 7 (3*7 = 21)
  - 0.85714285714 = fractional part
  - 6 (remainder) of division = 27 - 21

Modulus %2 and %10

- 100 % 2 = (50*2 + 0) ⇒ 0
- 101 % 2 = (50*2 + 1) ⇒ 1
- 108 % 2 = (54*2 + 0) ⇒ 0
-
- 1000 % 10 = (100*10 + 0) ⇒ 0
- 1001 % 10 = (100*10 + 1) ⇒ 1
- 1008 % 10 = (100*10 + 8) ⇒ 8
- 1000 % 100 = (10*100 + 0) ⇒ 0
- 1234 % 100 = (100*12 + 34) ⇒ 34
- 1234 % 1000 = (1000*1 + 234) ⇒ 234
- 1234 % 10000 = (10000*0 + 1234) ⇒ 1234

- **Observations**
- Number % 2
  - 0 if number is even
    - Even number is divisible by 2
  - 1 for odd
- Number % 10 = last 1 digit
- Number % 100 = last 2 digits
- Number % 1000 = last 3 digits
- Number % 10000 = last 4 digits

Summary

- Num % 2 ⇒ can tell us if number is even or odd
- Num % 10 ⇒ gives us the last digit of num
- Num / 10 ⇒ removes the last digit of num (integer division)
- r = n%k [r ust be < k]
- We can convert double and char to integer

Homework 1

- Given a number. Using only %2 how to know if the number is even or odd?
- Given a number. Using only %10 how to know if the number is even or odd?
- Given a number. Using only /2 how to know if the number is even or odd?

Homework 2

- Write a program that reads 5 numbers and print the following:
  - A) Their average
  - B) The sum of the first 3 numbers divided by the sum of the last 2 numbers
  - C) The average of the first 3 numbers divided by the average of the last 2 numbers.
  - What is the math relation between B and C?
  - Any relation between A and C?
- Input 1 2 3 4 5
  - 3
  - 0.666666667
  - 0.444444444

Homework 3

- Write a program that reads an integer and print the sum of its last 3 digits.
- Inputs
    - 15 => 6
    - 125 => 8
    - 1000 => 0
    - 1001 => 1
    - 1234 => 9
    - 99999 => 27

Homework 4

- Write a program that reads an integer and print the 4th from the right side. If no such digit, print 0
- Inputs
  - 15 => 0
  - 125 => 0
  - 1000 => 1
  - 5001 => 5
  - 1234 => 1
  - 654321 => 4
  - 99999 => 9

Homework 5

- Write a program that reads 2 numbers a, b and divide them (a/b), but prints only the fraction part
- E.g. for inputs 201 and 25, print 0.04
  - Notice: 201 / 25 = 8.04
  - We only want the fraction part: 0.04

Homework 6

- We know N % M computes the remainder of division
- Write a program that reads 2 integers and print such reminder without using the modulus operator %
- E.g. for inputs 27 and 12 ⇒ output 3
  - Remember in math: 27 % 12 = 3

Homework 7

- Write a program that reads an integer and print 100 if number is even or 7 if number is odd
  - E.g. for input 8 ⇒ 100
  - E.g. for input 133 ⇒ 7
- Note: if you know if conditions, don't use them.

Homework 8

- Assume a year has 12 months, but each month is 30 days
  - That is a year has 12 * 30= 360 days
- Read an integer: whole number of days of someone age. Print 3 numbers
  - Total years   total months   days
- Inputs ⇒ Outputs
  - 360   1 0 0   each 360 days a year
  - 30   0 1 0   each 30 days a month
  - 10   0 0 10   just days infant!
  - 391   1 1 1   391 = 360 + 30 + 1 = 1 year, 1 month, 1 day
  - 61   0 2 1   61 = 2*30 + 1
  - 200   0 6 20   200 = 30*6 + 20
  - 1000   2 9 10   1000 = 2*360 + 9*30 + 10
  - 5000   13 10 20

تم بحمد الله

علمكم الله ما ينفعكم

ونفعكم بما تعلمتم

وزادكم علماً