Arithmetic C++

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Calculations

• Often when we develop programs calculations are embedded as part of it.

• It could be something as simple as counting number of tries user has enter his or her password.

• Or something complex like simulating path of a meteor that would crash into earth.

• We need to be able to perform calculations!
Arithmetic

- Note: C++ does not directly support Exponent operation.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>Addition</td>
</tr>
<tr>
<td>-</td>
<td>Subtraction</td>
</tr>
<tr>
<td>*</td>
<td>Multiplication</td>
</tr>
<tr>
<td>/</td>
<td>Division</td>
</tr>
<tr>
<td>%</td>
<td>Modulus (remainder)</td>
</tr>
<tr>
<td>( )</td>
<td>Parentheses</td>
</tr>
</tbody>
</table>
# Order of Operation

<table>
<thead>
<tr>
<th>Operation</th>
<th>Name</th>
<th>Precedence</th>
</tr>
</thead>
<tbody>
<tr>
<td>(</td>
<td>Parentheses</td>
<td>Contents of the parentheses has highest precedence should be evaluated first.</td>
</tr>
<tr>
<td>^</td>
<td>Exponent</td>
<td>(Operation does NOT exist in C++)</td>
</tr>
<tr>
<td>*</td>
<td>Multiplication</td>
<td>Equal Precedence</td>
</tr>
<tr>
<td>/</td>
<td>Division</td>
<td>Evaluated from left to right</td>
</tr>
<tr>
<td>%</td>
<td>Modulus</td>
<td></td>
</tr>
<tr>
<td>+</td>
<td>Addition</td>
<td>Equal Precedence</td>
</tr>
<tr>
<td>-</td>
<td>Subtraction</td>
<td>Evaluated from left to right</td>
</tr>
</tbody>
</table>
Examples of Expressions

- Finding the remainder of $5 / 2$
  
  $$5 \% 2 =$$

- Find the remainder of the sum of two numbers divided by 2
  
  A) $\text{number1} + \text{number2} \% 2 =$
  
  B) $2 \% \text{number1} + \text{number2} =$
  
  C) $(\text{number1} + \text{number2}) \% 2 =$

- Is the answer A, B or C?
Integer Division

- Integer division in C++ will truncate any decimal value, for example:
  - $5 \div 2 = 2$ for an integer division
  - $4 \div 2 = 2$ this means $5 \div 2 = 4 \div 2$
  - $10 \div 3 = 3$
  - $11 \div 2 = 5$

- The resulting type is an Integer.
- What makes this an integer division?
  - Both the dividend and divisor are integers (not decimal).
Double (decimal) Division

• Double division in C++ will retain the appropriate decimal value, for example:
  – 5 / 2.0 = 2.5
  – 4 / 2.0 = 2
  – 10/ 3.0 = 3.333333...
  – 11 / 2.0 = 5.5

• The resulting type is a **Double**.

• What makes this an decimal division?
  – Either the dividend or divisor must be a decimal.
All Other Operations

- Same rule apply to Addition, Subtraction and Multiplication.

- If both of the values are of type int, result will be int.

- If either one of the type is double, result will be double.
Data Types and Order of Operation

• Look at the example below:
  • $5.0 + 5 / 2$
    – What is the resulting data type of the first operation?
      • int
    – What is the resulting data type of the second operation?
      • double
  • $5 + 5 / 2.0$
    – What is the resulting data type of the first operation?
      • double
    – What is the resulting data type of the second operation?
      • double
Type Casting

- If we want to convert from a **int** to a **double** for a more precise result we can do so with type casting.
- Type casting is a temporary change from one type to another.
- To type cast from int to double we can do the following:
  ```java
double value = (double) 5 / 2;
//value = 2.5
```
Type Casting (cont.)

• We can also type cast from double to an int, this will truncate the decimal value.

• Example:
  
  double total = 100.5;
  int value = (int) total;
  //value = 100
Lab Exercise

• Write a program to convert Temperature from Fahrenheit to Celsius:
  
  Note: $C = (F - 32) \times \frac{5}{9}$
#include <iostream>
using namespace std;
int main()
{
    int f;
    cout << "Enter a temperature in degrees Fahrenheit :" ;
    cin >> f;
    double c;
    c = (f - 32) * 5 / (double) 9; // makes 9 to 9.0
    cout << "In Celsius that is: " << c << endl;
    return 0;
}