
Logical Operators and if/else statement

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Floating Point and Relational Operators

- Floating point math may not work out as you expect because of round off errors.
- In Math
 - $6 * 2/3 = 4$
- In C++, where 0.66666 is equivalent to $2/3$
 - $6.0 * 0.66666 =$
 - $6.0 * 0.66667 =$
 - $6.0 * 0.666666 =$
 - $6.0 * (2.0 / 3.0) =$

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11.1 Example (page 180)

```
double result;

result = 6.0 * 0.666666;

if ( result == 4.0 )
{
    cout << "result == 4.0" << endl;
}

cout << setprecision(6) << fixed;
cout << result << endl;
cout << setprecision(2) << result;
cout << endl;
```

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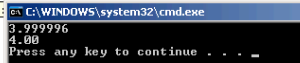
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Example

```
#include "stdafx.h"
#include <iostream>
#include <iomanip>
using namespace std;

int _tmain(int argc, _TCHAR* argv[])
{
    double result;
    result = 6.0 * 0.666666;
    if( result == 4.0 )
    {
        cout << " TRUE, result does equal 4.0" << endl;
    }
    cout << setprecision(6) << fixed << result << endl;
    cout << setprecision(2) << fixed << result << endl;
    return 0;
}
```



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If Statement

- We may want to execute some code if an expression is **true**, and execute *some other code* when the expression is **false**.
- This can be done with two if statements...

```
if( value >= LIMIT )
{
    // do something
}
if( value < LIMIT )
{
    // do something else
}
```

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If/Else (4.3)

- C++ provides a shortcut to combine two **if** statements:
 - The statements in the else clause are executed only when the expression is false.
- ```
if(expression)
{
 // do stuff
}
else
{
 // do other stuff
}
```

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## 11.2 Example

```
int number;
cout << "Enter a number, I'll tell you";
cout << " if it is odd: ";
cin >> number;

// use an if/else statement here
```

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## If/Else: Syntax and Formatting

```
if(expression)
{
 // do stuff
}
else
{
 // do other stuff
}
```

- Note the braces with the `else` keyword and the alignment of the `else` under the `if` on its own line

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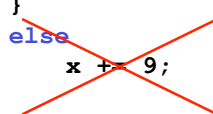
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## If/Else: Braces

```
if(expression)
{
 // do stuff
}
else
 x += 9;
```



- Always use braces with the `else`!

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## If/Else: Commenting

```
// the expression I'm using here
// checks for . . .
if(expression)
{
 // if the expression is true
 // I need to ...
}
else
{
 // if the expression is false
 // I need to ...
}
```

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## 11.3 Practice

- Turn this code into an if/else statement:

```
int x, y;
if (x > y)
{
 x += y;
}
if (y <= x)
{
 y += x;
}
```

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## 11.4 Practice

- Are these two code snippets equivalent?

|                                                                                     |                                                                           |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| <pre>int x, y; if ( x &gt; y ) {     x += y; } if ( y &lt; x) {     y += x; }</pre> | <pre>int x, y; if ( x &gt; y ) {     x += y; } else {     y += x; }</pre> |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------|

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## Logical Operators (4.7)

- If we want to check for more than one condition then we need to use logical operators
- These combine logical expressions (i.e. expressions that have a true/false value)
- There are three logical operators
  - `&&` and
  - `||` or
  - `!` Not

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## 11.5 Examples of Logical Operators

- `if( ( x > 7 ) && ( x < 20 ) )`
- `if( ( temp > 90.0 ) && ( humidity > 0.9 ) )`
- `if( ( salary < minSalary ) || ( dependents > 5 ) )`

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## Evaluating Expressions: And &&

- `(expr1) && (expr2)`
- For the complete expression to be true, both `expr1` and `expr2` have to be true
- Example:
  - `(temp > 90.0) && (humidity > 0.9)`
    - These are unbearable heat and humidity conditions
    - Both must be true for the entire expression to be true

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## Evaluating Expressions: Or ||

- `(expr1 || expr2)`
- The complete expression is true if either `expr1` or `expr2` is true
- Examples:
  - `(salary < minSalary) || (dependents > 5)`
  - To qualify for financial aid, salary has to be less than some minimum salary or the number of dependents is greater than 5
  - Only one condition has to be true

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## Evaluating Expressions: Not !

- `!expr`
- Unary operator
- Examples:
  - `!((salary < minSalary) && (dependents > 5))`
  - What makes this true? False?

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## 11.6 Example

- Your local bookstore has asked you to write a program to help them determine the cost of shipping of customers orders. If the order is \$30 or less then shipping will cost \$5, if the order is over \$30 then shipping will be \$3

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## 11.7 Problem

- The bookstore has now changed it's shipping policy so that
  - If the order is \$30 or less, shipping is \$5
  - If the order is over \$30 but less than \$50, shipping is \$3
  - If the order is over \$50 then shipping is \$2

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## Operator Precedence

- We have now added relational, equality and logical operators to the mathematical operators that were introduced last week
- Where do the new operators fit in the precedence table?

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## Precedence (page 1125)

| Precedence Operators (Highest to Lowest) |                      |
|------------------------------------------|----------------------|
| - (unary negation), ! (Logical NOT)      |                      |
| * / %<br>- +                             | Arithmetic Operators |
| <= > > <<br>== !=                        | Relational Operators |
| && (Logical AND)<br>   (Logical OR)      |                      |
| = += -= *= /= %=                         | Assignment Operators |

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## 11.8 Expression Evaluation

- According to the operator precedence and associativity rules given on the previous slide, how will the following expressions be evaluated?
  - `x < min + max`
  - `min <= x && x <= max`
  - `!x == y + 2`
  - `x = a + b % 7 * 2`

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## `exit()`

- To terminate a program we can use the `exit(int status)` function
  - This is a *function*, not part of the language
    - `#include <stdlib.h>`
  - The `status` is returned to the operating system to denote program success or failure
    - Success: 0
    - Failure: non-zero

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## 11.9 Practice

- Write a program that will ask the user for two integers. Display both integers to the screen if they are each greater than 1000 and terminate the program with `exit()` otherwise. Use exactly one `if/else`

```
#include <iostream>

using namespace std;

int main()
{
```

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