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Introducción a C++

Historia

- Creado en 1979 como una extensión de C por:

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- Hecho para ser rápido *y* escalable, ofrenciendo constructores de alto y bajo nivel.

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- Creado en 1979 como una extensión de C por:

Figure: Bjarne Stroustrup, creador de C++.

- Hecho para ser rápido *y* escalable, ofrenciendo constructores de alto y bajo nivel.
- Mejora contínua a lo largo de los años, las últimas fueron en Sep. 2011 (conocido como C++11).

Hola Mundo!

El comienzo

```
// My first C++ program

#include <iostream>

int main()
{
  std::cout << "Hello world!";
  return 0;
}
```

Output: `Hello World!`

Hola Mundo

```
// My first C++ program
```

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#include <iostrea
m>
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int main()
{



}
```

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int main()
{
       cout << "Hello World!";

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Generando un ejecutable

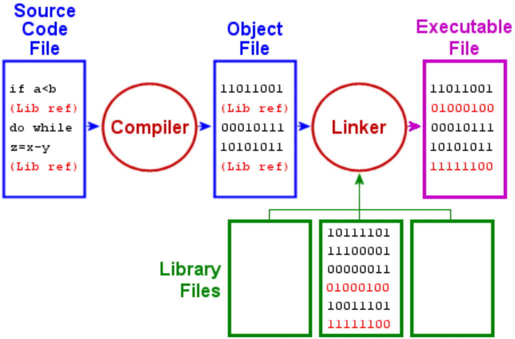

Figure: Compilando C++ [1].

[1] https://stackoverflow.com/questions/23615282/object-files-vs-library-files-and-why

Espacios en Blanco

Definition

whitespace spaces, tabs, and (sometimes) new lines.

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Completely equivalent as far as compiler is concerned:

```
#include <iostream>
int main(){std::cout<<"Hello world!";return 0;}
```

```
#include <iostream>
int main()
{
std::cout
<<
"Hello world!"
;
return
0
;
}
```

Mayúsculas

C++ es sensible a las mayúsculas! Esto quiere decir que:

```
int main()
```

is different from

```
INT MAIN ()
```

which is different from

```
int Main()
```

and only the first version is correct.

Comentarios

Hay dos tipos de comentarios:

```
// This is a line comment.
// It ends at the end of the line.
```

```
/* This is a C-style comment.
   It ends when the closing star-slash is reached. */
```

Use comments liberally - they are enormously useful!

Do

Avoid stating the obvious. A good comment will not say *what* is happening but rather *why*.

Definiendo una variable

Definition

variable Una entidad que es posible almacenar y efectuar operaciones sobre ellas.

Ejemplos:

```
int anInteger;
double aDouble;
unsigned short i;
float x, y, z;
```

Format: `variable_type variable_name, variable_name2;`

Nombres de variables

A variable name is an example of an identifier.

Definition

identifier Un identificador es una secuencia de caracteres que sirve para nombrar variables

[2] Ver `http://en.cppreference.com/w/cpp/keyword`.

Nombres de variables

A variable name is an example of an identifier.

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Los identificadores pueden ser cualquier sequencia de caracteres, dígitos o guión bajo pero no deben

- comenzar con un dígito,
- ser una palabra reservada [2].

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- comenzar con un dígito,
- ser una palabra reservada [2].

Definition

palabra reservada una palabra que tiene un significado especial en C++.

[2] Ver `http://en.cppreference.com/w/cpp/keyword`.

Nombres de variables

Do

- Nombrar variables con significado, aunque signifique aumentar el código!
  Malo: `data, dRange, a, ccn, value, one`
  Bueno: `daysOfWeek, sumSq, isEnabled, unitCell`

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  Malo: `data, dRange, a, ccn, value, one`
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- Por ejemplo:

```
double rootMeanSquare; // .. go on to
    calculate rms
```

  El nombre de la variable hace obvio que se usa para almacenar el valor cuadrático medio

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  El nombre de la variable hace obvio que se usa para almacenar el valor cuadrático medio

Don't

Evitar usar abreviaciones, a menos que sean muy comunes.

Tipos de Variables

Fundamental data types:

Type	Size	Values
`bool`	1 byte	true or false
`char`	1 byte	256 character values
`unsigned short int`	2 bytes	0 to 65,353
`short int`	2 bytes	-32,768 to 32,767
`unsigned int`	4 bytes	0 to 4,294,967,295
`int`	4 bytes	-2,147,483,648 to 2,147,483,647
`unsigned long int`	8 bytes	0 to 18,446,744,073,709,551,615
`long int`	8 bytes	-9,223,372,036,854,775,807 to 9,223,372,036,854,775,807
`float`	4 bytes	1.2e-38 to 3.4e38
`double`	8 bytes	2.2e-308 to 1.8e308

Usando variables

```cpp
#include <iostream>

int main()
{
  double G = 6.6738e-11;
  double massOfEarth = 5.9722e24;
  double massOfMoon = 7.3477e22;
  double r = 384400e3;
  double force;

  force = G * massOfEarth * massOfMoon / (r * r);

  std::cout << "Force between Earth and Moon is: "
            << force << "\n";

  return 0;
}
```

Constantes

```cpp
#include <iostream>

int main()
{
  const double G = 6.6738e-11;
  const double massOfEarth = 5.9722e24;
  const double massOfMoon = 7.3477e22;
  const double r = 384400e3;
  double force;

  force = G * massOfEarth * massOfMoon / (r * r);

  std::cout << "Force between Earth and Moon is: " << force << "\n";

  G = 7e-11; // WON’T COMPILE. WHAT KIND OF A UNIVERSE WOULD WE BE LIVING IN
             // IF G COULD VARY??

  return 0;
}
```

Constantes

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  G = 7e-11; // WON'T COMPILE. WHAT KIND OF A UNIVERSE WOULD WE BE LIVING IN
             // IF G COULD VARY??

  return 0;
}
```

Do

Usar la palabra reservada `const` para asegurar que una variable no cambia. En C++ es distinto a `mutable`

Constantes

```
// http://en.cppreference.com/w/cpp/language/cv

#include <iostream>

int main()
{
    int n1 = 0;           // non-const object
    const int n2 = 0;     // const object
    int const n3 = 0;     // const object (same as n2)
    volatile int n4 = 0;  // volatile object
    const struct
    {
        int n1;
        mutable int n2;
    } x = {0, 0};      // const object with mutable member

    n1 = 1; // ok, modifiable object
//  n2 = 2; // error: non-modifiable object
    n4 = 3; // ok, treated as a side-effect
//  x.n1 = 4; // error: member of a const object is const
    x.n2 = 4; // ok, mutable member of a const object isn't const

    const int& r1 = n1; // reference to const bound to non-const object
//  r1 = 2; // error: attempt to modify through reference to const
    const_cast<int&>(r1) = 2; // ok, modifies non-const object n1

    const int& r2 = n2; // reference to const bound to const object
//  r2 = 2; // error: attempt to modify through reference to const
//  const_cast<int&>(r2) = 2; // undefined behavior: attempt to modify const object n2
}
```

Alcance

Definition

alcance define la región del programa donde es posible usar la variable.

El alcance de una variable se define por el bloque, formado por los paréntesis {}, dentro del cual se declara.

[3] Source: `http://www.cplusplus.com/doc/tutorial/variables/`.

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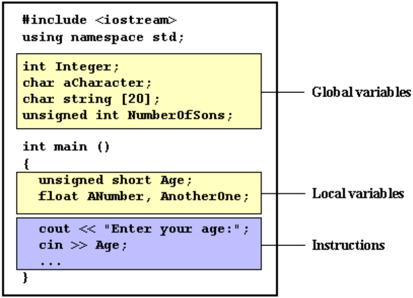

```
#include <iostream>
using namespace std;

int Integer;
char aCharacter;
char string [20];
unsigned int NumberOfSons;

int main ()
{
  unsigned short Age;
  float ANumber, AnotherOne;

  cout << "Enter your age:";
  cin >> Age;
  ...
}
```

Figure: Alcance de variables[3].

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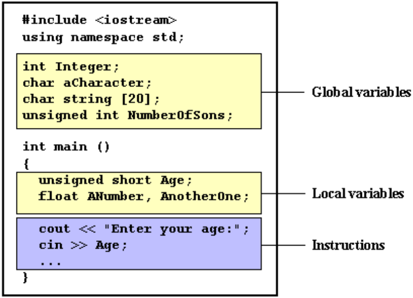

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  ...
}
```

Figure: Alcance de variables[3].

Don't

Evitar declarar variables con alcance global. Las constantes globales están OK.

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Operadores Simples

Asignación: =

```
a = 5; a = b; a = b = c;
```

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Operadores Aritmeticos : +, −, ∗, /, %

Todos los obvios, excepto el operador *modulo* (%). Entrega el resto de la división de un número por otro.

```
a = 30 % 10;
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```
a = 30 % 10;
```

Asignación Compuesta: +=, −=, ∗=, /=, %=

Ejecuta la operación sobre el valor actual y después almacena el nuevo valor, por ejemplo:

```
a += 5; a *= b;
```

División de Enteros

Warning!

In C++ integer arithmetic truncates (effectively rounds down):

```
int dividend = 20, divisor = 7;
int someInteger = dividend / divisor; // = 2
```

Storing the result in a double doesn't help as the arithmetic has already been done:

```
double someDouble = dividend / divisor; // = 2
```

What gives?

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double someDouble = dividend / divisor; // = 2
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What gives? Well you have two options:

1.
```
someDouble = static_cast<double>(dividend) /
    static_cast<double>(divisor); // = 2.85714
```

División de Enteros

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1.
   ```
   someDouble = static_cast<double>(dividend) /
     static_cast<double>(divisor); // = 2.85714
   ```

2.
   ```
   someInteger = (dividend + (dividend % divisor)) /
     divisor; // = 3
   ```

Operadores Unarios: `++`, `--`

```
a++;
```

Es equivalente a:

```
a += 1;
```

Operadores Unarios: `++, --`

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```

Es equivalente a:

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Operadores Relacionales: `==, !=, >, <, >=, <=`

```
bool areNotEqual = (a != b);
```

Operadores Unarios: `++`, `--`

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```
a += 1;
```

Operadores Relacionales: `==`, `!=`, `>`, `<`, `>=`, `<=`

```
bool areNotEqual = (a != b);
```

Don't

Mix up = and == this will cause endless headaches! Consider:

```
a = 5; b = 6; areEqual = (a = b);
```

This is a problem because C++ considers any number other than 0 be true!

Operadores Lógicos: !, &&, ||

NOT

a	!a
true	false
false	true

AND

a	b	a && b
true	true	true
true	false	false
false	true	false
false	false	false

OR

a	b	a || b
true	true	true
true	false	true
false	true	true
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<table>
<tr><th>a</th><th>b</th><th>a || b</th></tr>
<tr><td>true</td><td>true</td><td>true</td></tr>
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<tr><td>false</td><td>true</td><td>true</td></tr>
<tr><td>false</td><td>false</td><td>false</td></tr>
</table>

Do

Keep it simple: don't try and do too much in a single line. While this:

```
    result = (i < 10) && (++i < n);
```

is a valid expression, deciphering what it does is a lot of work. Instead use:

```
    result = i < 10;
    ++i;
    result = result && i < n;
```

Precedencia de Operadores

Precedence	Op.	Associativity
1	`++ -- !`	Right
2	`* / %`	Left
3	`+ -`	
4	`< <= > >=`	
5	`== !=`	
6	`&&`	
7	`||`	
8	`=`	Right

Operator precedence tells you the order that an expression will be evaluated in. Some are obvious but consider:

```
a = 21 + 7 % 2;
```

which could be interpreted as

```
a = 21 + (7 % 2); // this
a = (21 + 7) % 2; // or this.
```

In fact the first version is correct.

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which could be interpreted as

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In fact the first version is correct.

Do

Use parentheses to make an expressions more clear even if they are not necessary.

Precedencia de Operadores

Precedence	Op.	Associativity
1	++ -- !	Right
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3	+ -	
4	< <= > >=	
5	== !=	
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Operators that have the same precedence are evaluated according to their *associativity* e.g.:

```
a = b = c;    //
    evaluates as
a = (b = c);
```

because = is right associative.

[4] http://en.cppreference.com/w/cpp/language/operator_precedence

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    evaluates as
a = (b = c);
```

because = is right associative.While:

```
a * b / c;    //
    evaluates as
(a * b) / c;
```

because * and / are left associative. See[4] for a full list of operators and their precedence.

[4] http://en.cppreference.com/w/cpp/language/operator_precedence

Salida Estándar (cout)

You've already met `cout`, it uses the *indirection operator* (<<) to print to the screen e.g.:

```
std::cout << "Have some pi: ";
std::cout << 3.1415926;
std::cout << a;
```

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```

We can use << more than once in the same statement:

```
double t0 = 1.5, t1 = 2.5;
cout << "t0: " << t0 << ", t1: " << t1
     << ", delta: " << t1 - t0;
```

Output: `t0:  1.5, t1:  2.5, delta:  1`

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     << ", delta: " << t1 - t0;
```

Output: `t0:  1.5, t1:  2.5, delta:  1`

If you want a new line you have to use `\n`:

```
double t0 = 1.5, t1 = 2.5;
cout << "t0: " << t0 << "\nt1: " << t1 << "\n";
```

Output:

```
t0:  1.5
t1:  2.5
```

Standard input (cin)

Extracting information out of the user

To get input from the user, use the extraction operator (>>) of the cin object (pronounced *see-in*) e.g.:

```
  double radius;
  std::cin >> radius;
```

at this point the program will stop and wait for the user to enter a number and push RETURN.

Standard input (`cin`)

Extracting information out of the user

To get input from the user, use the extraction operator (>>) of the `cin` object (pronounced *see-in*) e.g.:

```
double radius;
std::cin >> radius;
```

at this point the program will stop and wait for the user to enter a number and push RETURN. As with output we can use >> more than once in a statement e.g.:

```
std::cin >> width >> height;
```

in this case the program will wait for two sets of numbers to be entered. They can be separated by a space, tab or a newline.

Ejemplo Completo

```
#include <iostream>

int main()
{
  unsigned int width, height;
  std::cout << "Please enter a width and height: ";
  std::cin >> width >> height;
  std::cout << "Area is: " << width * height << "\n";

  const double ratio = static_cast<double>(height) /
    static_cast<double>(width);
  std::cout << "Ratio is: 1:" << ratio
            << " (width:height)" << "\n";

  const bool isSquare = (width == height);
  std::cout << "Is it a square? " << isSquare << "\n";

  return 0;
}
```