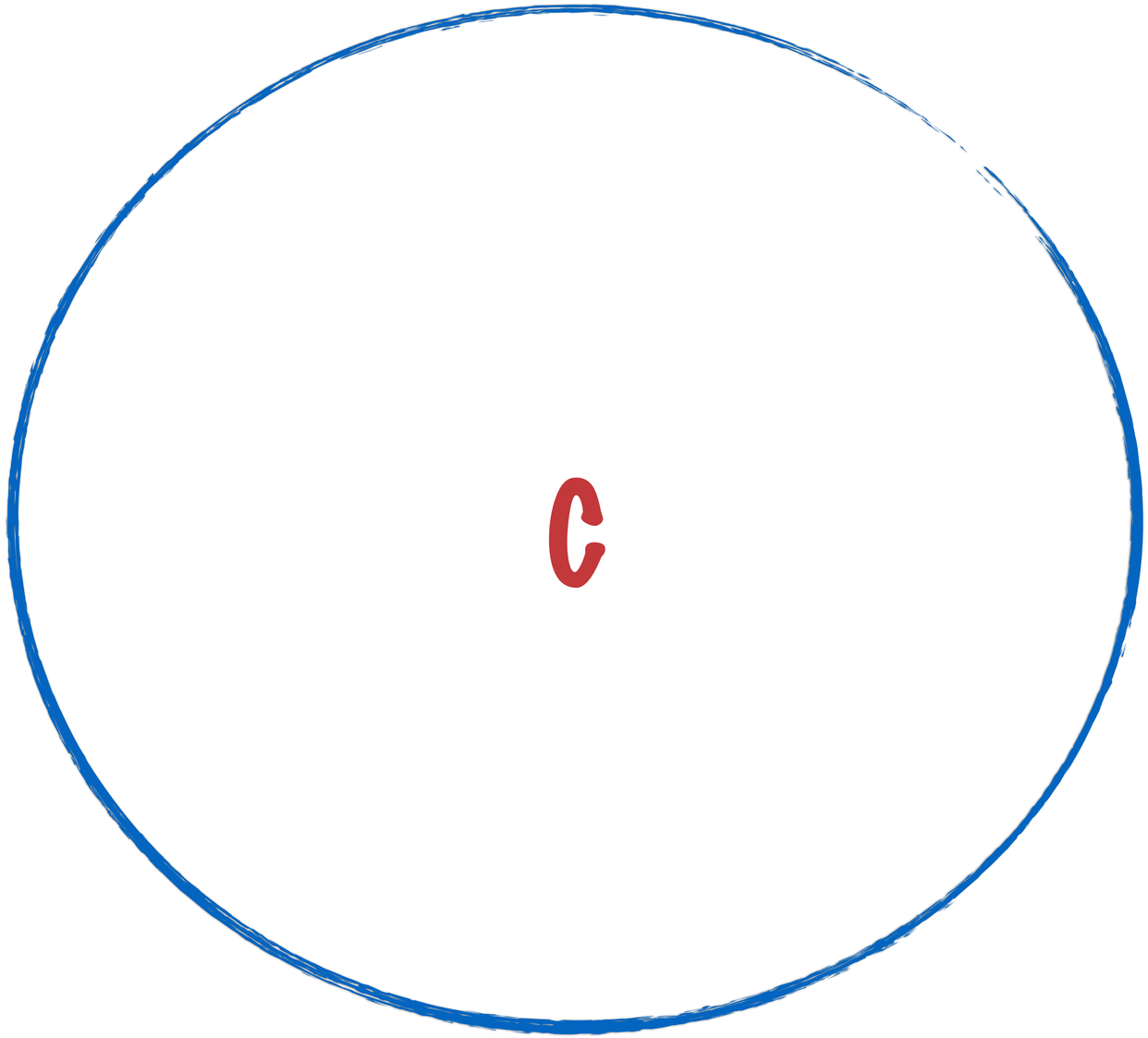
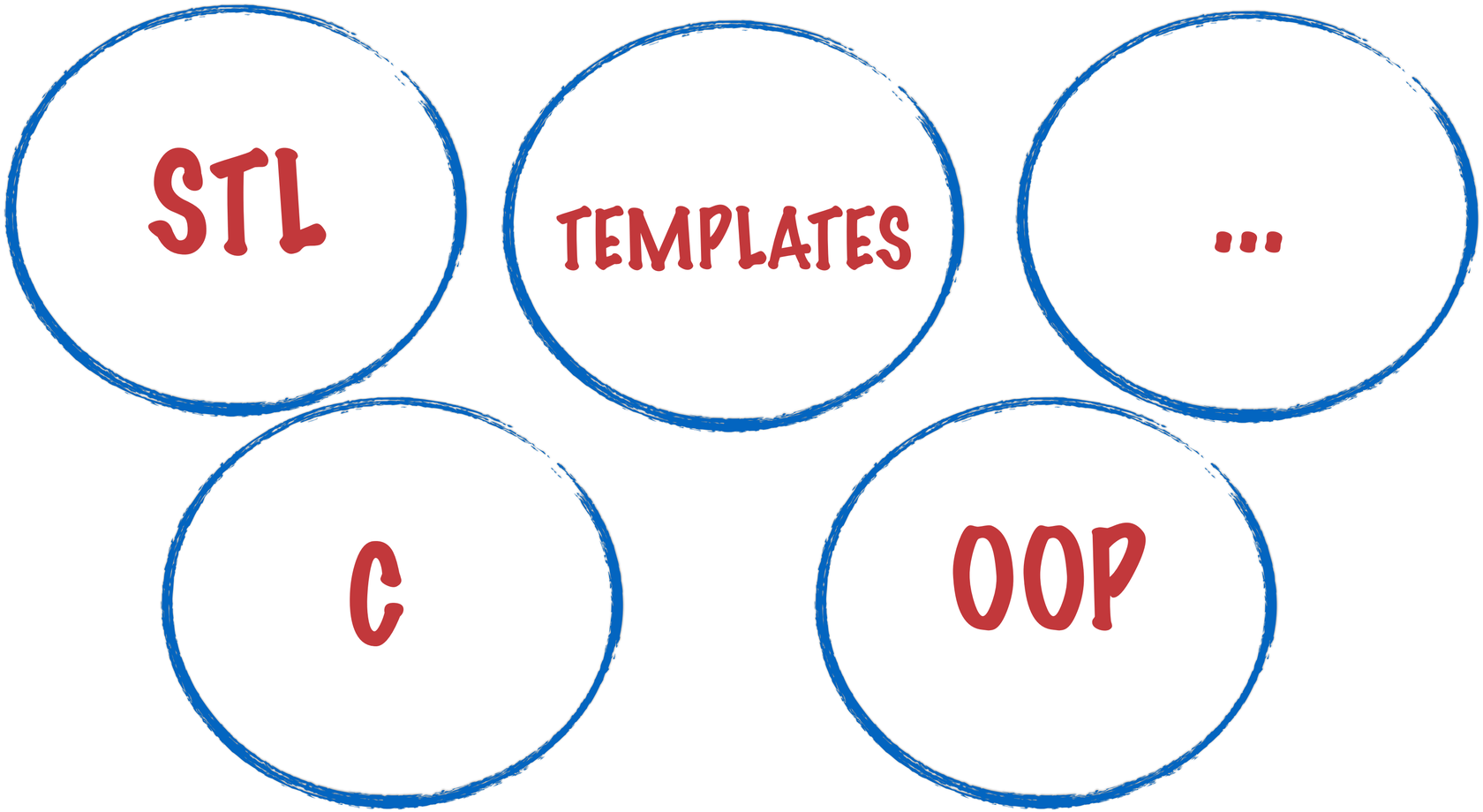
C++ AND C

C++ AND C

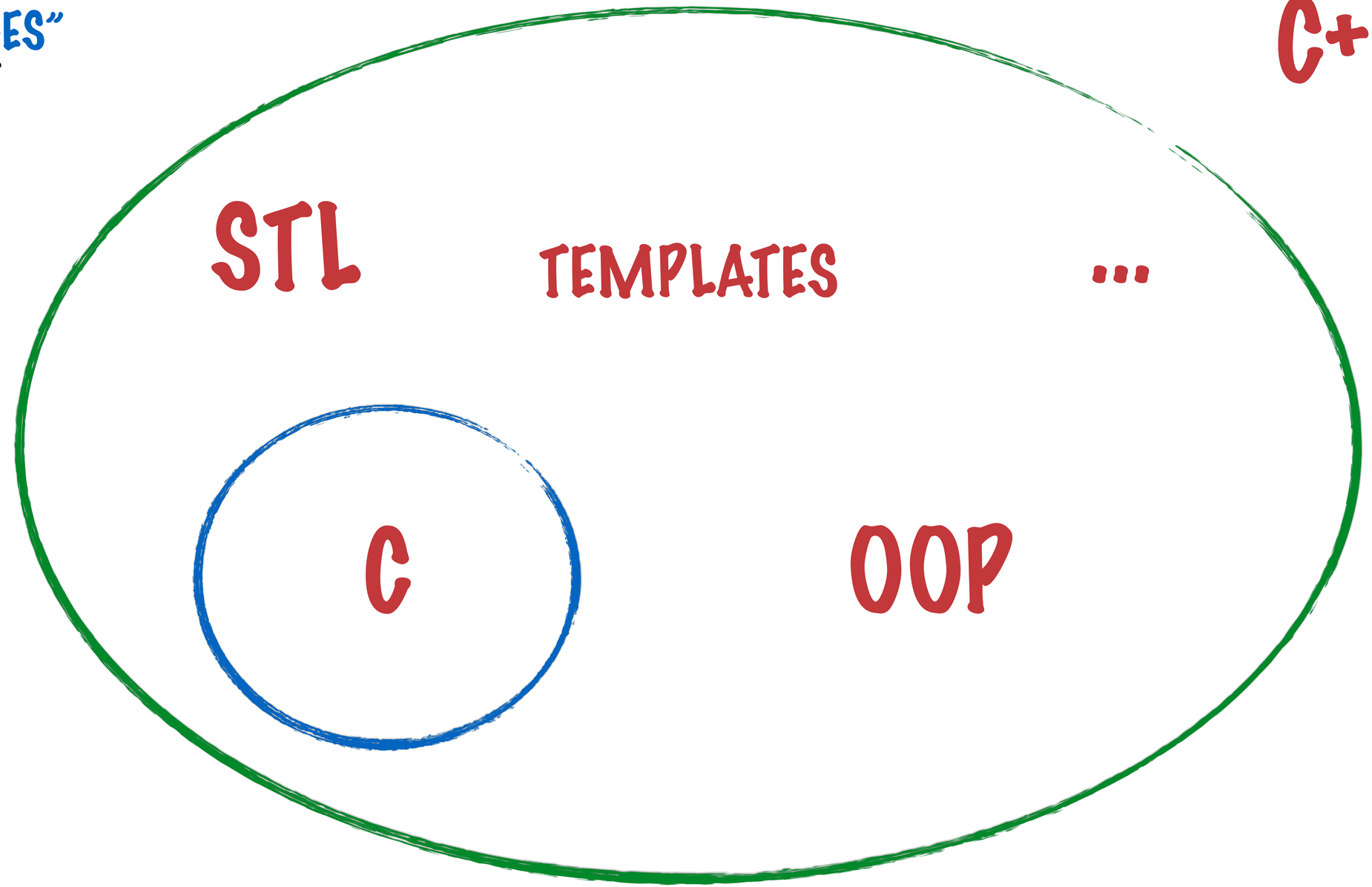


C++ AND C



C++ AND C

"VIEW C++ AS A FEDERATION OF LANGUAGES"
— SCOTT MYERS



"VIEW C++ AS A FEDERATION OF LANGUAGES"
— SCOTT MYERS

C++ AND C

C++ IS A SUPERSET OF C

BUT SOME PARTS OF C ARE BASICALLY RENDERED REDUNDANT BY NEW C++ FEATURES

C++ IS A SUPERSET OF C

LET'S WRITE A REALLY SIMPLE C++ PROGRAM

- SAY HELLO TO THE USER
- PROMPT HER FOR A NUMBER
- THEN PRINT THAT NUMBER TO SCREEN.

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#include <iostream>
using namespace std;

int main()
{
    cout << "Hi there! This is a C++ world" << endl;
    int someNumber;  //hold user input in this variable
    cout << "Please enter some number: ";
    cin >> someNumber;
    cout << "The number you entered was:" << someNumber << endl;
    return 0;
}
```

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

int main()
{ // C Translation: printf("Hi there! This is a C++ world.\n");
   cout << "Hi there! This is a C++ world" << endl;
   int someNumber;  //hold user input in this variable
   cout << "Please enter some number: ";
   cin >> someNumber;
   cout << "The number you entered was:" << someNumber << endl;
   return 0;
}
```

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

int main()
{
    // C Translation: Standard output stream
    cout << "Hi there! This is a C++ world" << endl;
    int someNumber;  //hold user input in this variable
    cout << "Please enter some number: ";
    cin >> someNumber;
    cout << "The number you entered was:" << someNumber << endl;
    return 0;
}
```

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    cin >> someNumber;
    cout << "The number you entered was:" << someNumber << endl;
    return 0;
}
```

// C Translation: send-to

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

int main()
{
    cout << "Hi there! This is a C++ world" << endl;   // C Translation:"\n"
    int someNumber;  //hold user input in this variable
    cout << "Please enter some number: ";
    cin >> someNumber;
    cout << "The number you entered was:" << someNumber << endl;
    return 0;
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    cin >> someNumber;
    cout << "The number you entered was:" << someNumber << endl;
    return 0;
}
```

// C Translation: /*hold user input in this variable*/

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

int main()
{
    cout << "Hi there! This is a C++ world" << endl;
    int someNumber;  //hold user input in this variable
    cout << "Please enter some number: ";
    cin >> someNumber; // C Translation: scanf("%d", &someNumber);
    cout << "The number you entered was:" << someNumber << endl;
    return 0;
}
```

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using namespace std;

int main()
{
    cout << "Hi there! This is a C++ world" << endl;
    int someNumber;  //hold user input in this variable
    cout << "Please enter some number: ";
    cin >> someNumber;  // C Translation: standard input stream
    cout << "The number you entered was:" << someNumber << endl;
    return 0;
}
```

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

int main()
{
    cout << "Hi there! This is a C++ world" << endl;
    int someNumber;  //hold user input in this variable
    cout << "Please enter some number: ";
    cin >> someNumber;  // C Translation: get-from
    cout << "The number you entered was:" << someNumber << endl;
    return 0;
}
```

LET'S WRITE A REALLY SIMPLE C++ PROGRAM

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- THEN PRINT THAT NUMBER TO SCREEN.

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

int main()  // C Translation (note the extra.h!): #include <stdio.h>
{
    cout << "Hi there! This is a C++ world" << endl;
    int someNumber;  //hold user input in this variable
    cout << "Please enter some number: ";
    cin >> someNumber;
    cout << "The number you entered was:" << someNumber << endl;
    return 0;
}
```

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using namespace std;

int main()
{
    cout << "Hi there! This is a C++ world" << endl;
    int someNumber;  //hold user input in this variable
    cout << "Please enter some number: ";
    cin >> someNumber;
    cout << "The number you entered was:" << someNumber << endl;
    return 0;
}
```

// C Translation: none!

EVEN THIS VERY SIMPLE PROGRAM
WOULD HAVE GIVEN YOU A FLAVOUR OF
SOME DIFFERENCES BETWEEN C AND C++

SCREEN IO

COMMENTS

NAMESPACES

COMMENTS

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

int main()
{
    cout << “Hi there! This is a C++ world” << endl;
    int someNumber;
    cout << “Please enter some number: “;
    cin >> someNumber;
    cout << “The number you entered was:“ << someNumber << endl;
    return 0;
}
```

// C Translation: /*hold user input in this variable*/

//hold user input in this variable

COMMENTS

// C-style comments :

```
/*hold user input in this variable*/
```

C comments are block comments, with start and end delimiters

// C++-style comments :

```
//hold user input in this variable
```

C++ comments are single line comments, end-delimiter is simply the end of line (carriage return)

You can also use C-style comments in C++

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WOULD HAVE GIVEN YOU A FLAVOUR OF
SOME DIFFERENCES BETWEEN C AND C++

SCREEN IO

COMMENTS

NAMESPACES

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C HAS TWO TYPES OF DATA (VARIABLES)

GLOBAL

Defined outside all functions, and accessible to all functions

LOCAL

Defined inside a function (or a scope) and only visible inside that function (or scope)

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As the size and complexity of a program grows, global variables lead to naming conflicts

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C++ MITIGATES THIS BY DIVIDING THE WORLD INTO: NAMESPACES

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#include <iostream>
using namespace std;

int main()
{
    cout << “Hi there! This is a C++ world” << endl;
    int someNumber;  //hold user input in this variable
    cout << “Please enter some number: “;
    cin >> someNumber;
    cout << “The number you entered was:“ << someNumber << endl;
    return 0;
}
```

This line indicates that we want to use functions and variables from the namespace std

By default, code is written inside a namespace called ‘std’, but programmers can and should define and stay within their own namespaces

C++ MITIGATES THIS BY DIVIDING THE WORLD INTO: NAMESPACES

```
namespace client_code {
  int someVariable = 100;

  int doSomething() {
  }
}
```

```
namespace utilities {
  char someVariable = 'a';

  int doSomethingElse() {
  }
}
```

C++ MITIGATES THIS BY DIVIDING THE WORLD INTO: NAMESPACES

By default, code is written inside a namespace called 'std', but programmers can and should define and stay within their own namespaces

how do you refer to a variable in another, different, namespace?

THE SCOPE RESOLUTION OPERATOR

THE SCOPE RESOLUTION OPERATOR

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

int a = 10; // This is a 'global' (within namespace std) variable

namespace private_space {
  int a = -10; // This is the version of a defined inside namespace 'private_space'
}

int main()
{
   cout << "Hi there! This is a C++ world" << endl;
   int a = 20;  //this is a local (inside main) variable, within namespace 'std'
   cout << "Please enter some number: ";
   cout << "Variable a (local) = " << a << endl; //prints 20
   cout << "Variable a (global) = " << ::a << endl; // prints 10
   cout << "Variable a (private_space) = " << private_space::a << endl; // prints -10
   return 0;
}
```

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int main()
{
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   cout << "Please enter some number: ";
   cout << "Variable a (local) = " << a << endl; //prints 20
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   cout << "Variable a (private_space) = " << private_space::a << endl; // prints -10
   return 0;
}
```

the same variable, with three different scopes..

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using namespace std;

int a = 10; // This is a 'global' (within namespace std) variable

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int main()
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If no scope resolution operator (::) is used, the local version will be used only if it exists

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namespace private_space {
int a = -10; // This is the version of a defined inside namespace 'private space'
}

int main()
{
   cout << "Hi there! This is a C++ world" << endl;

   cout << "Please enter some number: ";
   cout << "Variable a (no local so global) = " << a << endl; //prints 10
   cout << "Variable a (global) = " << ::a << endl; // prints 10
   cout << "Variable a (private_space) = " << private_space::a << endl; // prints -10
   return 0;
}
```

If there is no local version then the global one in the **std** namespace (**::**) is used

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If the scope resolution operator (`::`) is used with a blank namespace, **std** is the default namespace, it's the global namespace

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   return 0;
}
```

C++ searches first in the global namespace, then in any other namespaces which have been included - more on the inclusion later

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If the scope resolution operator (`::`) is used with an explicit namespace (here `private_space`) that version is used

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If the scope resolution operator (`::`) is used with an explicit namespace (here `private_space`) that version is used

EVEN THIS VERY SIMPLE PROGRAM
WOULD HAVE GIVEN YOU A FLAVOUR OF
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SCREEN IO

COMMENTS

NAMESPACES

SCREEN IO

`cout` `clog` `cerr` `cin`

STANDARD OUTPUT STREAM - WRITE TO THIS STREAM TO WRITE TO SCREEN

use the `<<` operator

STANDARD INPUT STREAM - READ FROM HERE TO READ FROM KEYBOARD

use the `>>` operator

ERRM..ARE N'T THESE THE BITWISE SHIFT OPERATORS?

use the `<<` operator

use the `>>` operator

ERRM..ARE N'T THESE THE BITWISE SHIFT OPERATORS?

EXACTLY! BUT C++ ALLOWS SOMETHING MIND BENDING

OPERATOR OVERLOADING

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THE SAME OPERATOR CAN DO DIFFERENT THINGS, DEPENDING ON THE CONTEXT

AND A PROGRAMMER CAN REDEFINE OPERATORS AT WILL

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OPERATOR OVERLOADING

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```
struct ComplexNumber
{
   int realPart;
   int imaginaryPart;
};
struct ComplexNumber p1 = {3,4};
struct ComplexNumber p2 = {4,0};
struct ComplexNumber p2 = p1 + p2;
```

THE SAME OPERATOR CAN DO DIFFERENT THINGS, DEPENDING ON THE CONTEXT

OPERATOR OVERLOADING

AND A PROGRAMMER CAN REDEFINE OPERATORS AT WILL

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   int realPart;
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OPERATOR OVERLOADING

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SCREEN IO

OPERATOR OVERLOADING

COMMENTS

FUNCTION OVERLOADING ETC

NAMESPACES

FUNCTION OVERLOADING

PROGRAMMERS CAN DEFINE MULTIPLE FUNCTIONS WITH THE SAME NAME

EACH OVERLOADED VERSION HAS A DIFFERENT SIGNATURE: NUMBER, ORDER AND TYPE OF FUNCTION PARAMETERS

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FUNCTION OVERLOADING

EACH OVERLOADED VERSION HAS A DIFFERENT SIGNATURE: NUMBER, ORDER AND TYPE OF FUNCTION PARAMETERS

```
double getArea(double radius)
{
   return 3.14 * radius * radius;
}
double getArea(double length, double breadth)
{
   return length * breadth;
}
```

SAME NAME, OVERLOADED FUNCTION

PROGRAMMERS CAN DEFINE MULTIPLE FUNCTIONS WITH THE SAME NAME

FUNCTION OVERLOADING

EACH OVERLOADED VERSION HAS A DIFFERENT SIGNATURE: NUMBER, ORDER AND TYPE OF FUNCTION PARAMETERS

```
double getArea(double radius)
{
   return 3.14 * radius * radius;
}
double getArea(double length, double breadth)
{
   return length * breadth;
}
```

NUMBER, TYPE AND ORDER OF ARGUMENTS DIFFERENT!

PROGRAMMERS CAN DEFINE MULTIPLE FUNCTIONS WITH THE SAME NAME

FUNCTION OVERLOADING

EACH OVERLOADED VERSION HAS A DIFFERENT SIGNATURE: NUMBER, ORDER AND TYPE OF FUNCTION PARAMETERS

```
double getArea(double radius)
{
  return 3.14 * radius * radius;
}
double getArea(double length, double breadth)
{
  return length * breadth;
}
double radius r = 5;
double squareSide = 3;

cout <<“Area of a circle of radius “<< radius << ” = “ << getArea(radius) << endl;
cout <<“Area of a square of length “<< squareSide <<“ =“
     <<getArea(squareSide,squareSide)<<endl;
```

PROGRAMMERS CAN DEFINE MULTIPLE FUNCTIONS WITH THE SAME NAME

FUNCTION OVERLOADING

EACH OVERLOADED VERSION HAS A DIFFERENT SIGNATURE: NUMBER, ORDER AND TYPE OF FUNCTION PARAMETERS

FUNCTION #1

```
double getArea(double radius)
{
  return 3.14 * radius * radius;
}
```

FUNCTION #2

```
double getArea(double length, double breadth)
{
  return length * breadth;
}
```

```
double radius r = 5;
double squareSide = 3;

cout <<"Area of a circle of radius "<< radius << " = " << getArea(radius) << endl;
cout <<"Area of a square of length "<< squareSide <<" ="
     <<getArea(squareSide,squareSide)<<endl;
```

CALL #1

CALL #2

PROGRAMMERS CAN DEFINE MULTIPLE FUNCTIONS WITH THE SAME NAME

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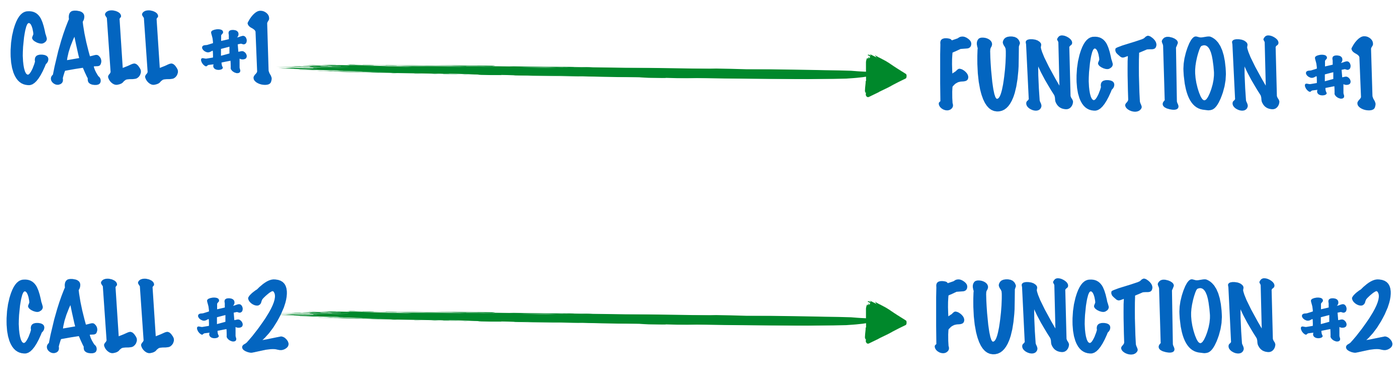

THE C++ COMPILER FIGURES OUT WHICH VERSION TO CALL FROM THE PARAMETERS PASSED IN

PROGRAMMERS CAN DEFINE MULTIPLE FUNCTIONS WITH THE SAME NAME

FUNCTION OVERLOADING

EACH OVERLOADED VERSION HAS A DIFFERENT SIGNATURE: NUMBER, ORDER AND TYPE OF FUNCTION PARAMETERS

IN C++, FUNCTIONS CAN'T BE OVERLOADED ON THE RETURN TYPE!

FUNCTIONS
(OVERLOADING ETC)

PROGRAMMERS CAN ALSO SPECIFY **DEFAULT VALUES** FOR FUNCTION PARAMETERS

IF THE CALLING CODE OMITS THOSE PARAMETERS, THE DEFAULT VALUE WILL BE USED

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IF THE CALLING CODE OMITS THOSE PARAMETERS, THE DEFAULT VALUE WILL BE USED

```
double print_3D_Coordinates(double x=0,double y=0,double z = 0)
{
  cout<<“A point in 3-D space: x=“<<x<<“,y=“<<y<<“,z=“<<z<<endl;
}

print_3D_Coordinates(); // prints “x=0,y=0,z=0”
print_3D_Coordinates(10); // prints “x=10,y=0,z=0”
print_3D_Coordinates(10,20); // prints “x=10,y=20,z=0”
print_3D_Coordinates(10,20,30); // prints “x=10,y=20,z=30”
```

PROGRAMMERS CAN ALSO SPECIFY **DEFAULT VALUES** FOR FUNCTION PARAMETERS

IF THE CALLING CODE OMITS THOSE PARAMETERS, THE DEFAULT VALUE WILL BE USED

```
double print_3D_Coordinates(double x=0,double y=0,double z = 0)
{
  cout<<"A point in 3-D space: x="<<x<<",y="<<y<<",z="<<z<<endl;
}
```

NO PARAMETERS SPECIFIED AT ALL - ALL DEFAULTS USED!

```
print_3D_Coordinates(); // prints "x=0,y=0,z=0"
print_3D_Coordinates(10); // prints "x=10,y=0,z=0"
print_3D_Coordinates(10,20); // prints "x=10,y=20,z=0"
print_3D_Coordinates(10,20,30); // prints "x=10,y=20,z=30"
```

PROGRAMMERS CAN ALSO SPECIFY **DEFAULT VALUES** FOR FUNCTION PARAMETERS

IF THE CALLING CODE OMITS THOSE PARAMETERS, THE DEFAULT VALUE WILL BE USED

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double print_3D_Coordinates(double x=0,double y=0,double z = 0)
{
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}
```

X = 0, Y = 0 , Z = 0

NO PARAMETERS SPECIFIED AT ALL - ALL DEFAULTS USED!

```
print_3D_Coordinates(); // prints "x=0,y=0,z=0"
print_3D_Coordinates(10); // prints "x=10,y=0,z=0"
print_3D_Coordinates(10,20); // prints "x=10,y=20,z=0"
print_3D_Coordinates(10,20,30); // prints "x=10,y=20,z=30"
```

PROGRAMMERS CAN ALSO SPECIFY **DEFAULT VALUES** FOR FUNCTION PARAMETERS

IF THE CALLING CODE OMITS THOSE PARAMETERS, THE DEFAULT VALUE WILL BE USED

```
double print_3D_Coordinates(double x=0,double y=0,double z = 0)
{
  cout<<"A point in 3-D space: x="<<x<<",y="<<y<<",z="<<z<<endl;
}

print_3D_Coordinates(); // prints "x=0,y=0,z=0"
print_3D_Coordinates(10); // prints "x=10,y=0,z=0"
print_3D_Coordinates(10,20); // prints "x=10,y=20,z=0"
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THIS GETS INTERESTING - ONE VALUE SPECIFIED..

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  cout<<"A point in 3-D space: x="<<x<<",y="<<y<<",z="<<z<<endl;
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ARGUMENT VALUES ARE FILLED IN FROM LEFT TO RIGHT..

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double print_3D_Coordinates(double x=0,double y=0,double z = 0)
{
  cout<<"A point in 3-D space: x="<<x<<",y="<<y<<",z="<<z<<endl;
}
print_3D_Coordinates(); // prints "x=0,y=0,z=0"
print_3D_Coordinates(10); // prints "x=10,y=0,z=0"
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print_3D_Coordinates(10,20,30); // prints "x=10,y=20,z=30"
```

X = 10

THIS GETS INTERESTING - ONE VALUE SPECIFIED..

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```
double print_3D_Coordinates(double x=0,double y=0,double z = 0)
{
  cout<<"A point in 3-D space: x="<<x<<",y="<<y<<",z="<<z<<endl;
}
```

X = 10 Y = 0, Z = 0

THIS GETS INTERESTING - ONE VALUE SPECIFIED..

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print_3D_Coordinates(); // prints "x=0,y=0,z=0"
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print_3D_Coordinates(10,20); // prints "x=10,y=20,z=0"
print_3D_Coordinates(10,20,30); // prints "x=10,y=20,z=30"
```

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DEFAULTS USED FOR MISSING VALUES

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double print_3D_Coordinates(double x=0,double y=0,double z = 0)
{
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}

print_3D_Coordinates(); // prints "x=0,y=0,z=0"
print_3D_Coordinates(10); // prints "x=10,y=0,z=0"
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print_3D_Coordinates(10,20,30); // prints "x=10,y=20,z=30"
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SAME DEAL - TWO VALUES SPECIFIED..

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}
print_3D_Coordinates(); // prints "x=0,y=0,z=0"
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print_3D_Coordinates(10,20,30); // prints "x=10,y=20,z=30"
```

X = 10, Y = 20

SAME DEAL - TWO VALUES SPECIFIED..

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double print_3D_Coordinates(double x=0,double y=0,double z = 0)
{
  cout<<"A point in 3-D space: x="<<x<<",y="<<y<<",z="<<z<<endl;
}
```

X = 10, Y = 20 Z = 0

SAME DEAL - TWO VALUES SPECIFIED..

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print_3D_Coordinates(); // prints "x=0,y=0,z=0"
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DEFAULTS USED FOR MISSING VALUES

FUNCTION OVERLOADING AND DEFAULT VALUES CAN GET COMPLICATED

THE C++ COMPILER WILL FLAG ERRORS IF ANY AMBIGUITY CREEPS IN

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```
double getPerimeter(double radius,double PI = 3.1415)
{
  return 2 * PI * radius;
}
double getPerimeter(double side1, double side2, double side3)
{
  return side1 + side2 + side3;
}
```

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  return side1 + side2 + side3;
}
```

THIS IS ALLOWED, WE CAN SPECIFY DEFAULT VALUES IN OVERLOADED METHODS

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double getPerimeter(double radius,double PI = 3.1415)
{
  return 2 * PI * radius;
}
double getPerimeter(double side1, double side2, double side3)
{
  return side1 + side2 + side3;
}

double radius r = 5;
double triangleSide = 3;

cout <<"Perimeter of a circle of radius "<< radius << " = " << getPerimeter(radius) << endl;
cout <<"Perimeter of a triangle of sides"<< triangleSide <<" , "
     <<getPerimeter(triangleSide, triangleSide, triangleSide)<<endl;
```

THIS WORKS, NO AMBIGUITY ABOUT WHICH METHOD WILL BE CALLED

FUNCTION OVERLOADING AND DEFAULT VALUES CAN GET COMPLICATED

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```
double getPerimeter(double radius,double PI = 3.1415)
{
  return 2 * PI * radius;
}
double getPerimeter(double side1, double side2, doubl
{
  return side1 + side2 + side3;
}
double getPerimeter(double length, double breadth)
{
  return 2 * (length + breadth);
}

double squareSide = 3;

cout <<"Perimeter of a square of sides"<< squareSide <<" ="
     <<getPerimeter(squareSide, squareSide)<<endl;
```

WHICH METHOD DOES THIS REFER TO?

AMBIGUOUS! COMPILE ERROR!

EVEN THIS VERY SIMPLE PROGRAM WOULD HAVE GIVEN YOU A FLAVOUR OF

SOME DIFFERENCES BETWEEN C AND C++

REFERENCES

OPERATOR OVERLOADING

SCREEN IO

COMMENTS

FUNCTION OVERLOADING AND DEFAULT VALUES

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HOW WOULD WE WRITE, IN C, A FUNCTION THAT SWAPS THE VALUES OF 2 VARIABLES?

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```
// writing the function
double swap(int *a,int *b)
{
   int temp = *a;
   a = b;
   *b = temp;
}

// calling the function
int a = 5;
int b = 10;
printf("a = %d, b = %d\n",a,b);
swap(&a,&b);
printf("a = %d, b = %d\n",a,b);
```

INCREDIBLY COMPLICATED CODE, FOR A REALLY SIMPLE OPERATION!

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THE FUNCTION BODY MUST TAKE IN AND DEREFERENCE POINTERS

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```

THE CALLING CODE MUST USE THIS DIFFICULT '&' TO PASS IN THE ADDRESS OF THE UNDERLYING MEMORY LOCATION OF THE VARIABLE

REFERENCES

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TO MAKE SUCH COMMON USE-CASES SIMPLE, C++ INTRODUCED THE IDEA OF

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// writing the function
double swap(int& a,int& b)
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  int temp = a;
  a = b;
  b = temp;
}

// calling the function
int a = 5;
int b = 10;
printf("a = %d, b = %d\n",a,b);
swap(a,b);
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INCREDIBLY SIMPLE, EXCEPT FOR ONE TINY LITTLE BIT!

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// writing the function
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   a = b;
   b = temp;
}

// calling the function
int a = 5;
int b = 10;
printf("a = %d, b = %d\n",a,b);
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printf("a = %d, b = %d\n",a,b);
```

A VARIABLE OF TYPE `int&` IS SAID TO BE AN 'INT REFERENCE' OR 'A REFERENCE TO AN INT'

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USE AN `int&` EXACTLY AS YOU WOULD AN `int`

REFERENCES

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int a = 5;
int b = 10;
printf("a = %d, b = %d\n",a,b);
swap(a,b);
printf("a = %d, b = %d\n",a,b);
```

```
a = 5, b = 10
```

USE AN `int&` EXACTLY AS YOU WOULD AN `int`

BUT BE AWARE THAT IT IS PASSED-BY-REFERENCE (LIKE A POINTER)

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int a = 5;
int b = 10;
printf("a = %d, b = %d\n",a,b);
swap(a,b);
printf("a = %d, b = %d\n",a,b);
```

```
a = 10, b = 5
```

USE AN `int&` EXACTLY AS YOU WOULD AN `int`

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HOW WOULD WE WRITE, IN C++, A FUNCTION THAT SWAPS THE VALUES OF 2 VARIABLES?

USE AN `int&` EXACTLY AS YOU WOULD AN `int`

BUT BE AWARE THAT IT IS PASSED-BY-REFERENCE (LIKE A POINTER)

REFERENCES ARE IN FACT, POINTERS - C++ JUST MAKES THEIR SYNTAX FAR EASIER TO USE

REFERENCES

REFERENCES ARE IN FACT, POINTERS - C++ JUST MAKES THEIR SYNTAX FAR EASIER TO USE

NO MEMORY ALLOCATION, MEMORY LEAKS, OR EVEN NULLS (A REFERENCE CAN NEVER BE NULL!)

REFERENCES

RULE #1: A REFERENCE MUST ALWAYS BE INITIALISED

```
int& x = 3;
```

X

```
int& x;
x = 3;
```

REFERENCES

RULE #2: A REFERENCE CAN NEVER BE RE-ASSIGNED

X

~~int& x = 4;~~

~~x = 3;~~

REFERENCES

RULE #3: MULTIPLE REFERENCES TO THE SAME VALUE CAN EXIST - IF ONE IS MODIFIED, ALL GET MODIFIED

REFERENCES

RULE #4: REFERENCES CAN NEVER BE NULL

REFERENCES

RULE #5: REFERENCES CAN EXIST TO ANY TYPE (INCLUDING POINTERS)

REFERENCES

RULE #6:

C++ Standard 8.3.2/4:

> There shall be no references to references, **no arrays of references**, and no pointers to references.

EVEN THIS VERY SIMPLE PROGRAM WOULD HAVE GIVEN YOU A FLAVOUR OF SOME DIFFERENCES BETWEEN C AND C++

REFERENCES

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CONST

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FUNCTION OVERLOADING AND DEFAULT VALUES

NAMESPACES

CONST

WITH REFERENCES, IT IS VERY EASY TO INADVERTENTLY CHANGE THE VALUE OF A VARIABLE WITHOUT MEANING TO

CONST

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// writing the function
double swap(int& a,int& b)
{
   int temp = a;
   a = b;
   b = temp;
}

// calling the function
int a = 5;
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printf("a = %d, b = %d\n",a,b);
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```

WITH REFERENCES, IT IS VERY EASY TO INADVERTENTLY CHANGE THE VALUE OF A VARIABLE WITHOUT MEANING TO

IN OUR EXAMPLE OF SWAPPING 2 VALUES, THERE IS NOTHING TO EXPLICITLY WARN THE CALLING CODE THAT THE VALUES OF A AND B ARE CHANGED BY THE FUNCTION SWAP

IN ORDER TO PREVENT UNWANTED OR INADVERTENT MODIFICATIONS, C++ INTRODUCED A NEW KEYWORD

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IN ORDER TO PREVENT UNWANTED OR INADVERTENT MODIFICATIONS, C++ INTRODUCED A NEW KEYWORD

CONST

ANY VARIABLE CAN BE MARKED AS CONST, AND ANY MODIFICATION TO ITS VALUE WILL YIELD AN ERROR

```
const double PI = 3.1415;
```

CONST

IN C++, YOU SHOULD ENTIRELY AVOID USING `#DEFINE` TO DEFINE CONSTANTS - IT LACKS THE SCOPE GRANULARITY OF `const`

```
const double PI = 3.1415;
```

X ~~`#DEFINE PI 3.1415;`~~

CONST

BACK TO OUR SWAP EXAMPLE - WOULD THIS WORK?

```
// writing the function
double swap(const int& a,const int& b)
{
   int temp = a;
   a = b;
   b = temp;
}

// calling the function
int a = 5;
int b = 10;
printf("a = %d, b = %d\n",a,b);
swap(a,b);
printf("a = %d, b = %d\n",a,b);
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BACK TO OUR SWAP EXAMPLE - WOULD THIS WORK?

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// writing the function
double swap(const int& a,const int& b)
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   int temp = a;
   a = b;
   b = temp;
}

// calling the function
int a = 5;
int b = 10;
printf("a = %d, b = %d\n",a,b);
swap(a,b);
printf("a = %d, b = %d\n",a,b);
```

X

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bool

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bool

IN C, THERE WAS NO EXPLICIT BOOLEAN TYPE

0 EVALUATED TO **FALSE**, AND ANY NON-ZERO VALUE EVALUATED TO **TRUE**

C++ HAS AN EXPLICIT `bool` TYPE, WITH VALUES `true` AND `false`

bool

IN C, THERE WAS NO EXPLICIT BOOLEAN TYPE

0 EVALUATED TO `FALSE`, AND ANY NON-ZERO VALUE EVALUATED TO `TRUE`

C++ HAS AN EXPLICIT `bool` TYPE, WITH VALUES `true` AND `false`

DON'T MIX `bool` VALUES `true` AND `false` WITH THE C `TRUE` AND `FALSE`. ONLY USE THE C++ `bool`

EVEN THIS VERY SIMPLE PROGRAM WOULD HAVE GIVEN YOU A FLAVOUR OF SOME DIFFERENCES BETWEEN C AND C++

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EVEN THIS VERY SIMPLE PROGRAM WOULD HAVE GIVEN YOU A FLAVOUR OF SOME DIFFERENCES BETWEEN C AND C++

THIS LIST DOES NOT EVEN START WITH THE MOST IMPORTANT DIFFERENCE OF THEM ALL -

OBJECT-ORIENTED PROGRAMMING

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C++ IS A FUNDAMENTALLY OBJECT-ORIENTED LANGUAGE, C IS NOT.

OBJECTS VERSUS STRUCTS

NEW/DELETE VERSUS MALLOC/FREE

STRING VERSUS CHAR*

OBJECT-ORIENTED PROGRAMMING

C++ IS A FUNDAMENTALLY OBJECT-ORIENTED LANGUAGE, C IS NOT.

BUT WE WILL GET TO THAT IN GOOD TIME :-)